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Physical Rehabilitation of Children with Cerebral Palsy by Bobath-Therapy Method

Vitalii Kashuba[1], Borys Dolynskyi[2], Valentyna Todorova[3], Bozhena Bukhovets[4], Olena Andrieieva[5], Andrii Shankovskyi[6], Ivan Salatenko[7], Vasyl Lutskyi[8] and Lidia Kovalchuk[9]

[1,5]National University of Ukraine on Physical Education and Sport, Kyiv, Ukraine
[2,3,4]The state institution «South Ukrainian National Pedagogical University named after K. D. Ushynsky», Odesa, Ukraine
[6]Department of Physical Education and Sports. Ivano-Frankivsk National Technical University of Oil and Gas, Ivano-Frankivsk, Ukraine
[7]Sumy National Agrarian University Gerasim Kondratiev str, Sumy, Ukraine
[8,9]Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, Ukraine.

Abstract

The article presents the structure and content of a physical rehabilitation program incorporating Bobath therapy for 4-year-old children with spastic diplegia cerebral palsy in a specialized rehabilitation center. The objective of the study was to justify theoretically and to develop physical rehabilitation program incorporating Bobath therapy for 4-year-old children with spastic diplegia cerebral palsy in a specialized rehabilitation center. Material & methods: theoretical analysis and generalization of special scientific and methodological literature; pedagogical observation, interview, and experiment (ascertaining and formative); motor abilities testing (with the Motor abilities assessment chart by Karel and Berta Bobath); clinical study (neurological examination to determine the severity of motor impairment according to the Gross Motor Function Classification System (GMFCS)); statistical data analysis. Statistical analysis of the motor impairment assessment data after the completion of the physical rehabilitation program revealed an increase in the number of children with GMFCS level I (the mildest form), which was statistically significantly higher ($p < 0.05$) compared to the subjects participated in the standard physical rehabilitation program; the analysis of the relationship between the motor function and the severity of motor impairment in children with cerebral palsy after the completion of the physical rehabilitation program shows the tendency for reduced motor function associated with a low level of motor impairment. The developed physical rehabilitation program incorporating Bobath therapy for 4-year-old children with spastic diplegia cerebral palsy in a specialized rehabilitation center was evaluated in the course of the formative experiment. The practical effectiveness of the proposed program was proved by the quantitative changes (at the level of $p < 0.05$) of the studied parameters. The results of the study confirm the effectiveness of the proposed program of physical rehabilitation focused on the development of motor function and correction of motor impairments.

Keywords: cerebral palsy, physical rehabilitation, program, Bobath therapy.

1. Introduction

The problem of the incidence of infantile cerebral palsy (CP), which is the main cause of childhood disability, remains an urgent issue in pediatric neurology, as the incidence rate does not tend to decrease both worldwide and in Ukraine [1].

In most children with cerebral palsy, organic lesions of the central nervous system cause motor impairments associated with sensory and mental disorders. Furthermore, somatic health, physical development, and regulatory mechanisms of the body are also affected [2].

The issue of physical rehabilitation of children with cerebral palsy is being actively studied by modern scientists all over the world. According to the researchers, physical rehabilitation is the main part of the complex of rehabilitation measures, which is realized through the use of physical culture, which utilizes movements as the main biological function of the body and provides stimulation of growth and development and maintenance of homeostasis (Bobath, 1966). The main task of physical rehabilitation for cerebral palsy in children is to develop motor abilities and motor function through the integrated application of physical rehabilitation methods [3].

2. Literature Review

l of the above and the diversity of the clinical picture of cerebral palsy form the basis for the creation of modern programs combining different methods of physical rehabilitation, the primary means of which is physical exercise, that is confirmed by a large amount of scientific research [4].

It is appropriate to underline that, according to the results of modern scientific researches, application of the Bobath approach in physical rehabilitation of children with cerebral palsy promotes formation of motor skills and free movement in space, both independently and with the additional equipment. Despite the proven positive effects of Bobath therapy techniques (exercise, positional treatment, teaching self-care and child-care skills) on physical rehabilitation of children with cerebral palsy, the issue of their use in many aspects is still unresolved, and there is no differentiation of the means according to the severity of motor impairments [5].

The objective of the study was to justify theoretically and to develop physical rehabilitation program incorporating Bobath therapy for 4-year-old children with spastic diplegia cerebral palsy in a specialized rehabilitation center [6].

3. Method

3.1. Participants

The ascertaining and formative experiments involved 36 children aged 4 years with spastic diplegia cerebral palsy. The pedagogical experiment application was justified by the process of identifying the benefits of the proposed physical rehabilitation program incorporating Bobath therapy for 4-year-old children with spastic diplegia cerebral palsy in a specialized rehabilitation center.

3.2. Materials

Theoretical analysis and generalization of special scientific and methodological literature; pedagogical observation, interview, and experiment (ascertaining and formative); motor abilities testing (with the Motor abilities assessment chart by Karel and Berta Bobath); clinical study (neurological examination to determine the severity of motor impairment according to the Gross Motor Function Classification System (GMFCS)); statistical data analysis [6].

The analysis of special scientific and methodological literature involved modern domestic and foreign scientific literature devoted to the issues of etiology and pathogenesis of cerebral palsy, symptoms, early intervention, features of application and differentiation of physical rehabilitation methods. Particular attention was paid to the study of the benefits of utilizing the approach of Bobath therapy in the physical rehabilitation of children with cerebral palsy [7].

3.3. Procedure

The testing was conducted to assess the children's motor function with the Motor Abilities Assessment Chart by Karel and Berta Bobath. In each of the tests a grading system with values from 0 to 5 were used as follows: 0 – cannot be placed in test posture; 1 – passive movement with the help of physical rehabilitation therapist; 2 – can assume and sustain test posture unaided; 3 – can perform movement unaided, but in abnormal manner; 4 – can perform movement unaided, but imperfect; 5 – can perform normal movement. Using this test, the formation of motor skills was evaluated as follows: rolling to the side and to the prone position, squatting from standing position, etc. [8].

Pedagogical and visual observation with processing and analysis of the data obtained was implemented during each stage of physical rehabilitation. The pedagogical observation consisted of a step-by-step control to evaluate the effectiveness of a 6-month physical rehabilitation course. For this purpose, children were examined at the beginning and at the end of the rehabilitation course, in addition, ongoing assessment was conducted to check the child's response to physical exercise during physical rehabilitation [9].

Visual observation of the impact of physical activity was carried out through direct observing of the child during the class. Discipline, interest in, emotionality, external symptoms of fatigue (sweating, coloring of the skin, coordination of movements, attention, etc.) were separately observed. The interview was used to evaluate the general well-being of the subjects during and after the classes [10].

The ascertaining experiment was used to determine the characteristics of the state of the children who participated in the study and to obtain the baseline data to determine the strategy of implementation of physical rehabilitation program for children with cerebral palsy and to conduct the further formative experiment. The formative experiment was conducted to determine the effectiveness of the proposed physical rehabilitation program incorporating Bobath therapy for preschool 4-year-old children with spastic diplegia cerebral palsy in a specialized rehabilitation center [11].

The clinical method included a neurological examination by a neurologist, which determined the severity of motor impairment according to a standardized system for assessing the degree of motor development retardation on the basis of the functional abilities and needs for technical aids and mobility devices of children with cerebral palsy, the Gross Motor Functional Classification System (GMFCS) [12].

For example, GMFCS Level I refers to children, who are able unaided to sit down, to sit on the floor, and to manipulate an object, as well as walks unaided in all settings. Children with Level II GMFCS also are able to sit on the floor unaided, but experience difficulty with balance when manipulating an object, as well as are able to walk only with aids [13].

GMFCS Level III children are able to sit on the floor unaided too, but mostly need the assistance. Children with GMFCS Level III are able to walk a short distance in indoor settings using a hand-held mobility device with supervision or assistance to choose the direction of movement and turns. GMFCS Level IV patients generally require additional devices for sitting or standing and can travel the short distances (within the room) by rolling over, creeping and crawling. GMFCS Level V children are physical disabled and limited in all motor functions. These children are unable to move unaided and are transported in a manual wheelchair in all settings [14].

The analysis and mathematical processing of the data were performed on a personal computer using Biostat, Statistics 6.0, and MS Excel 2013 software packages [14].

4. Results

Assessment of motor function in 4-year-old children with spastic diplegia cerebral palsy using the Motor Abilities Assessment Chart showed that 53.33% of children obtained high scores in test exercises in a prone starting position. Only 36.51% of children were able to make rolling to the side.

Before the study, 22.46% of children were able to assume a test position and held it independently. A small number of children (22.3%) were able to take a kneeling position, to held it, and to crawl freely.

As with the other tests, the proportion of children who were able to freely held the body in a squat sitting position was not significantly different ($p > 0.05$). Only a small number of children (11.27%) had the advanced ability to stand independently.

According to the Gross Motor Function Classification System, only 8.96% of children had GMFCS level I and were able to move freely; 29.85% had GMFCS level II and were able to move using mobility devices; and 61.19% of children had GMFCS level III, were significantly restricted in independent mobility, and could not even use additional equipment.

Comparison of children's parameters of motor function depending on the level of GMFCS showed that the children with GMFCS level I had reduced motor function in all tests before the rehabilitation course. Furthermore, children with GMFCS level III had lower motor abilities than children with GMFCS level II in all test exercises except for those in a supine position (table 1).

Table 1. *Analysis of relationship between the motor function and the severity of motor impairment of children before physical rehabilitation course (n = 36)*

Parameter	GMFCS level								
	I, n = 3			II, n = 14			III, n = 19		
	Me	25 %	75 %	Me	25 %	75 %	Me	25 %	75 %
Supine	5.0	5.0	5.0	4.5	4.0	5.0	4.0	4.0	4.0
Prone	5.0	5.0	5.0	4.0	4.0	5.0	4.0	4.0	4.0

Rolling to the side	5.0	4.0	5.0	4.0	4.0	5.0	4.0	3.0	4.0
Rolling to prone position	5.0	4.0	5.0	4.0	4.0	4.0	3.0	3.0	4.0
Sitting	5.0	4.0	5.0	4.0	4.0	4.0	3.0	3.0	4.0
Kneeling	5.0	4.0	5.0	4.0	3.0	5.0	3.0	3.0	3.0
Squatting	5.0	3.0	5.0	4.0	3.0	4.0	3.0	3.0	3.0
Standing	4.0	3.0	5.0	4.0	3.0	4.0	3.0	2.0	3.0

The objective of the developed program was to improve motor function and to correct the symptoms of motor impairments, to implement the prevention of secondary complications, thereby improving the quality of life for ensuring maximum social adaptation of 4-year-old children with spastic diplegia cerebral palsy. The proposed program of physical rehabilitation differed from the standard programs by integrative approach to addressing the problem of physical rehabilitation of children with cerebral palsy through the use of Bobath therapy.

The program of physical rehabilitation in the settings of a specialized rehabilitation center was developed for 4-year-old children with spastic diplegia cerebral palsy, had a total duration of 6 months and included 3 in-patient courses of 10 days duration and two modes of physical activity (normal training and light training). The program was used for physical rehabilitation of 36 children aged 4 years with spastic diplegia cerebral palsy.

In the first course of physical rehabilitation, light training mode of physical activity was used for children with GMFCS levels I, II, and III. In subsequent physical rehabilitation courses normal training mode was used for children with GMFCS levels I and II, whereas light training mode was used for GMFCS level III children.

The objective of the light training mode was to promote gradually increasing overall adaptation of children with cerebral palsy to the environment and regimen of rehabilitation center and to increase the level of physical fitness, familiarity with rehabilitation procedures, preparation for a gradual increase in the number, intensity, and duration of physical rehabilitation procedures, normalization of muscle tone, reduction of pathological reflexes, prevention of further complications, such as contractures and deformities, etc. [14].

Normal training mode was used to reduce pathological reflexes impact on the musculoskeletal system, correction of contractures and deformities, teaching self care skills and skills of caring for a child with special needs, development of motor skills, strengthening the trunk muscles, practicing motor skills, and development of physical skills [14].

The physical rehabilitation program included two components: the basic and the variable ones. In the basic component, the following methods of physical rehabilitation were used: instrumental physiotherapy, sensory integration therapy, and kinesio taping). In the variable component, Bobath techniques were used such as: physical exercise, teaching self-care and child care skills, and positional treatment [18].

Depending on the individual physical abilities of patients, including the GMFCS level, physical exercise sets were designed on the basis of differentiated use of Bobath techniques incorporated in therapeutic gymnastics procedure). In the proposed program of physical rehabilitation, the therapeutic gymnastics procedure included Bobath exercises with gradually increased complexity of the tasks combined with active games and breathing exercises depending on the GMFCS level [15].

The children with GMFCS level III were treated with Bobath exercises, which were grouped into the sets that included breathing exercises and active games depending on functional abilities of the child's musculoskeletal system. Children with GMFCS level II performed more complex Bobath exercises combined with breathing exercises and active games, which were also grouped into sets. The program for GMFCS level I children included the most complex exercises grouped into appropriate sets [15].

A typical design was chosen for Bobath therapy sessions which consisted of introductory, main, and final parts. The introductory part included low-load preventive and general exercises for small and medium

muscle groups in a supine initial position, breathing exercises, positional treatment, and active games, as well as was focused on the gradual adaptation of the child to increasing load [15].

The main part combined general and specific exercises. The objectives of the program were achieved through the use of corrective exercises in the following starting positions: prone, lying on the side, sitting, kneeling, and standing; as well as with breathing exercises; teaching self-care skills and caring for a child with special needs; and active games. In the first half of the main part, patients performed physical exercises familiar to them, while the second half included new exercises [15].

In the final part, physical load was decreased due to including breathing exercises and exercises in the sitting and kneeling positions performed at a slow pace and with a small number of repetitions [15].

The results of assessment of children after the course of physical rehabilitation showed that the distribution of children according to the level of motor function development had no statistically significant differences ($p > 0.05$) compared with the baseline data (Table 2). After the course of physical rehabilitation, the differences between the studied parameters were more pronounced and statistically significant ($p < 0.05$).

Indicators of motor function improved by 8.70% in a supine position, by 9.51% in a prone position, by 10.10% in a sitting position, by 12.73% in a kneeling position, by 13.22% in a squatting position, and by 15.95% in a standing position, whereas the abilities to roll to the side improved by 6.38% and to roll to the prone position improved by 7.14%.

Table 2. *Measures of motor function of children before and after physical rehabilitation course (n = 36)*

Parameter		Average values, points				
		n = 36				
		$\bar{x}$	Me	25 %	75 %	SE
Supine	Before	38.89	55.56	2.78	-	-
	After	75.0*	25.0*	-	-	-
Prone	Before	30.56	61.11	5.56	-	-
	After	72.2*	27.78*	-	-	-
Rolling to the side	Before	30.56	61.11	5.56	-	-
	After	55.56*	38.89	5.56	-	-
Rolling to prone position	Before	16.67	52.78	30.56	-	-
	After	55.56*	38.89*	5.56	-	-
Sitting	Before	13.89	38.89	47.22	-	-
	After	33.33	58.33	8.33*	-	-
Kneeling	Before	19.44	22.22	58.33	-	-
	After	36.11	52.78	11.11	-	-
Squatting	Before	8.33	25.0	58.33	8.33	-
	After	33.33	44.44	22.22	-	-
Standing	Before	5.56	27.78	50.0	13.89	2.78
	After	13.89	50.0	36.11	-	-

Note: * – difference is statistically significant, $p < 0.05$.

After the course of physical rehabilitation, the positive changes were observed in the severity of motor impairment, as evidenced by an increase of 47.22% in the number of children with GMFCS level I due to a decrease of 38.89% and 8.57% in the number of children with GMFCS level II and III, respectively. Furthermore, 38,89% of GMFCS level III children improved their motor function to the GMFCS level II (table 3).

Table 3. *Analysis of relationship between the motor function and the severity of motor impairment in children after the course of physical rehabilitation (n = 36)*

Parameter	GMFCS level								
	I, n = 20			II, n = 14			III, n = 2		
	Me	25 %	75 %	Me	25 %	75 %	Me	25 %	75 %
Supine	5.0	5.0	5.0	5.0	4.0	5.0	4.0	4.0	4.0
Prone	5.0	5.0	5.0	5.0	4.0	5.0	4.0	4.0	4.0
Rolling to the side	5.0	4.0	5.0	4.0	4.0	5.0	3.5	3.0	4.0
Rolling to prone position	5.0	4.5	5.0	4.0	4.0	5.0	3.5	3.0	4.0
Sitting	4.5	4.0	5.0	4.0	4.0	4.0	3.0	3.0	3.0
Kneeling	5.0	4.0	5.0	4.0	4.0	4.0	3.0	3.0	3.0
Squatting	5.0	4.0	5.0	4.0	3.0	4.0	3.0	3.0	3.0
Standing	4.0	4.0	4.5	3.0	3.0	3.0	3.0	3.0	3.0

After the course of physical rehabilitation, the relationship was revealed between the decreased motor function of the children and the severity of motor impairment.

On the basis of the data obtained, we assume the low level of motor function is due to a correspondingly low GMFCS level in 4-year-old children with spastic diplegia cerebral palsy.

5. Discussion and Conclusion

The analysis of the specialized literature has showed that the issue of physical rehabilitation of children with cerebral palsy is still being actively investigated. Experts believe that physical rehabilitation, which is based on the use of physical education approaches, takes a major place in the system of rehabilitation measures [16].

Despite the great interest of scientists and active discussions, the problem of physical rehabilitation of children with cerebral palsy so far is still a relevant field of research [16].

According to modern research, Bobath therapy, which is recognized as an effective approach by scientists around the world, stands out among traditional approaches to physical rehabilitation of children with cerebral palsy. The scientists believe that the Bobath techniques are used in the physical rehabilitation of children with cerebral palsy just due to their influence on the development of motor function at the neurophysiological level [17].

Experimental data have shown that the use of Bobath therapy in physical rehabilitation of children with cerebral palsy promotes development of motor skills and independent mobility. However, despite the positive experience of using Bobath techniques in physical rehabilitation of children with cerebral palsy, the issues of their independent and combined use remain to be addressed.

Therefore, the diversity of the clinical picture of CP and discussions about the effectiveness of the modern approaches to physical rehabilitation for children with CP form the basis for the creation of technologies and programs combining various methods of physical rehabilitation, the leading means of which is physical exercise [18].

The developed physical rehabilitation program incorporating Bobath therapy for 4-year-old children with spastic diplegia cerebral palsy in a specialized rehabilitation center was implemented taking into consideration the principles of physical rehabilitation and pedagogics [19].

The involvement of the means of physical rehabilitation and the forms of their use in the developed program was realized taking into account not only the etiopathogenesis of cerebral palsy and the state of the nervous system, but also the results of the assessment of physical development, motor function, and motor disorders that characterize motor development [20; 21].

The results of the scientific study confirmed the effectiveness of the developed physical rehabilitation program incorporating Bobath therapy for 4-year-old children with spastic diplegia cerebral palsy in a specialized rehabilitation center.

The developed physical rehabilitation program for 4-year-old children with spastic diplegia cerebral palsy in a specialized rehabilitation center was successfully evaluated in the course of the formative experiment: its effectiveness was evidenced by statistically significant changes in the studied parameters ($p<0.05$).

After the course of physical rehabilitation, the 4-year-old children with spastic diplegia cerebral palsy had more developed motor functions in all studied starting positions compared to the baseline level.

After the course of physical rehabilitation, the proportion of children with the GMFCS level I (the mildest form) was statistically significantly higher ($p <0.05$) than before the study.

In summary, the study supported the efficiency of implementation and the practical focus of the implemented program, that is evidenced from the positive changes in motor function and outcomes of correction for motor impairment in 4-year-old children with spastic diplegia cerebral palsy.

This study provides grounds to recommend the proposed program of physical rehabilitation for 4-year-old children with spastic diplegia cerebral palsy in a specialized rehabilitation center for use in the rehabilitation centers for disabled children, other relevant rehabilitation centers, and specialized preschool educational institutions.

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Examination of the Relationship between Dominant & Non-dominant Isokinetic Knee Strength and the Body Composition in Basketball Players

Hacı Ahmet Pekel[1] and Çağdaş Özgür Cengizel[2]
[1,2]Department of Trainer Education, Faculty of Sport Sciences, Gazi University, Turkey.

Abstract

The objectives of this study are (a) the comparison of dominant and non-dominant knee strength (b) the determination of body composition and comparison of dominant vs. non-dominant leg composition and (c) the determination of the relationship between isokinetic strength and the body composition in basketball. 21 male basketball players from the senior category voluntarily participated in the study. Isokinetic knee strength of the subjects was performed at three different angular speeds (60˚/sec 5 rep, 180˚/sec 10 rep, 300˚/sec 20 rep) in knee flexion (Hamstring: H) and extension (Quadriceps: Q). The body composition was determined using a bioimpedance analyzer. A significant difference was found in the dominant and non-dominant knee strength of the subjects and the power parameters at 60˚/sec & 180˚/sec angular speed ($p<0.05$). The most significant bilateral force difference is found at an angular speed of 60˚/sec, while isokinetic knee strength parameters at 300˚/sec angular speed are not different for the dominant and non-dominant sides. Dominant vs. non-dominant leg composition (fat percentage, fat mass, fat-free mass, predicted muscle mass) was not significantly different. However, a significant positive correlation was determined between the subjects' body weight, fat-free muscle mass, fat-free leg muscle mass and predicted leg muscle mass and isokinetic knee strength. As a result, although there is no difference in dominant vs. non-dominant leg composition in elite male basketball players, there is a difference in isokinetic knee strength. Especially in less repetitive and explosive exercises (such as jumping), this difference is greater. Besides, it is predicted that when fat-free body&leg mass and muscle mass are increased, isokinetic knee strength will also increase. Therefore, to prevent injuries, it is recommended to include exercises that will increase leg muscle mass to minimize or eliminate the difference in bilateral isokinetic knee strength and to increase the jump height.

Keywords: Basketball, Isokinetic strength, Body composition, Strength asymmetry, Dominant leg.

1. Introduction

As in many other sport branches, body composition and strength are undoubtedly important characteristics for a good performance in basketball. The question here is that what is the relationship between body composition, which can be distinguished even between player positions, and strength which is one of the motoric functions? While it may be misleading to attribute basketball performance to only one factor, determining the variables that affect this performance separately and in comparison to each other are very informative and guiding details for trainers and conditioners.

Basketball, which requires high physical and technical-tactical preparation, includes fast and well-coordinated preparatory work in different directions, especially considering the rapid response of the movements on the court [1]. These inadequate preparatory activities affect performance negatively while causing sports injuries. The periodic evaluation of muscle strength plays a very important role in planning the training process and preventing injuries [2,3]. With the isokinetic dynamometers which allow objective measurement of muscle strength, power and endurance, high-efficiency muscle functions measurements and muscle strength training can be performed. When the speed of movement is controlled and kept constant, isokinetic assessments provide information on maximum dynamic muscle contraction [4]. At the same time, muscle strength imbalance between dominant and non-dominant muscle groups can be detected [5]. Investigating the strength and relations according to the technical characteristics of isokinetic strength in different sports branches (e.g. wrist, knee, elbow, shoulder strength training in an isokinetic device for shooting in basketball), and doing isokinetic strength training at a branch-specific angle and speed, can have positive results in terms of sportive performance and technical development [6].

Since every sport has its requirements, every athlete needs a specific body composition for their sports discipline. Understanding body composition is essential for designing and managing training programs [7]. To be successful in basketball, appropriate anthropometric characteristics are needed and every player must

have a high level of technical and tactical skills. Body composition parameters such as body fat percentage, fat-free mass and somatotype components are often used to evaluate physical abilities [8].

Elite athletes are required to be faster, stronger, and more explosive [9]. In this case, the question suggests "what are the factors that limit athletes?" One of the first answers is body weight and height. Considering that athletes often perform speed and jump in a competition, a high-fat percentage will negatively affect movement speed and jumping and will play a key role in winning or losing [10]. Therefore, the need for less fat tissue and more muscle mass is inevitable [7]. Studies show that body composition affects strength and agility [11], while the body weight affects speed, endurance and strength [12].

Basketball is characterized by anaerobic leg strength and rapid movement performance. For a successful basketball performance, fitness with high muscle strength such as sprinting, jumping, agility is required [13]. According to the time-motion analysis data made in basketball, athletes perform an average of 1000 moves in a match, and the average duration of each movement takes less than three seconds [14]. The most relevant muscle group to meet these requirements are the leg muscles, and the leg muscle strength is very decisive for this performance [15–17].

In particular, due to the nature of sport branches (basketball, volleyball, etc.), patellar tendinopathy is encountered as an overuse injury that requires many and repeated jumping action during a match. Therefore, it should be ensured that the athletes at risk for these injuries are determined by isokinetic evaluation of the knee and the training process is designed accordingly before each season [18,19].

In the literature, it is possible to find studies investigating the relationship between body composition and basketball performance [20–22], body composition and strength in basketball [4], body composition and vertical jump [10], isokinetic strength and other motoric functions [23]. Studies that investigate the relationship between isokinetic knee strength and motoric functions have also been found [24,25]. However, in these studies, there are differences in method and age groups. There is also a limited number of studies which examined the relationship between body composition and leg strength in different branches [26,27]. The question here is, "is there a relationship between body and leg composition and isokinetic knee strength in basketball?". Therefore, the objectives of this study are (a) the comparison of dominant and non-dominant knee strength (b) the determination of body composition and comparison of dominant vs. non-dominant leg composition and (c) the determination of the relationship between isokinetic strength and the body composition in basketball.

2. Method

2.1. Participants

In this research, 21 male basketball players who trained regularly for a minimum of seven years participated voluntarily (Table 1). This research was approved by the Gazi University Ethics Committee (Research code 2020-228). The subjects were informed about the test protocol, the purpose of the test, and the possible risks before the test was conducted. Besides, signed permits were collected from all participating athletes. Athletes who had lower extremity injury and/or surgery in the last six months were not included in the study. Only basketball players from the male and senior categories were included in the study.

Table 1. *Characteristics of the subjects*

	Mean ± SD	Min	Max
Age (year)	21.8 ± 2.2	19	26
Years of experience (year)	11.0 ± 2.4	7	15
Body height (cm)	188.7 ± 6.8	176.9	199.8
Body weight (kg)	86.1 ± 9.4	73.1	106
BMI (kg/m^2)	24.2 ± 1.7	21.4	27.6
Fat percentage (%)	11.6 ± 4.0	4.6	17.3
Fat Mass (kg)	10.2 ± 4.3	3.7	17.9
Fat-free mass (kg)	75.9 ± 6.8	64.1	88.1

2.2. Research design

Isokinetic strength

The test protocol was completed at Gazi University Faculty of Sport Sciences Biomechanics Laboratory. On the same day, the isokinetic strength values and body composition of the subjects were determined. The dominant legs of the subjects (the dominant leg of all subjects was the right leg) were determined before the subjects reported their volunteer participation and the isokinetic strength test began. They were subjected to the study after approximately 20 minutes of general and special warm-up. To determine the isokinetic knee strength performance of the subjects, knee flexion and extension (H/Q) test was applied at three different angular speeds using the ISOMED 2000 isokinetic strength dynamometer instrument (D&R Ferstl GmbH, Hemau, Germany). 3 trials & 5 test repeats at 60˚/sec, 3 trials & 10 test repeats at 180˚/sec, and 3 trials & 20 test repeats at 300˚/sec were separately performed on concentric/concentric dominant and non-dominant leg. Full rest was applied to the subjects between the measurements. During the test, verbal motivational support was provided for the subjects. The subjects were stabilized on the shoulders, hips and legs in a sitting position on the dynamometer. As a result of the isokinetic strength test, dominant and non-dominant leg peak torque values were determined for different angular speeds. The following variables were used to evaluate the isokinetic knee strength (separately for the dominant and non-dominant sides):

PT: It is the peak torque value produced and its unit is Nm.

PT/BW: It states the ratio of peak torque to body weight. It can also be expressed as the relative strength. Its unit is Nm/kg.

Flex/Ex Ratio (H/Q): It is the ratio of the hamstring muscle strength to the quadriceps muscle strength. The value is given as %.

Angle of peak torque: It is the angle from which the peak torque is obtained. Its unit is degrees.

Work: It is the work achieved in knee flexion and extension. Its unit is Joule.

Power: It is the power produced in knee flexion and extension. Its unit is Watt.

Work/Weight: It is the amount of work produced per body weight (kg). It is also referred to as relative work.

Flexion values are accepted as variables belonging to the hamstring muscle group (H) and extension values as variables belonging to the quadriceps muscle group (Q).

Body Composition

A Seca brand stadiometer was used to measure the height of the subjects and to determine the body composition of the subjects a TANITA (BC-418MA) brand bio-impedance analyzer was used. As a result of these analyzes;

BW: Body weight
BMI: Body Mass Index
Fat %: Body fat percentage
FM: Whole-body fat weight
FFM: Fat-free mass
RL Fat %: Right leg fat percentage
RLFM: Right leg fat mass
RLFFM: Right leg fat-free mass
RLPMM: Right leg predicted muscle mass
LL Fat %: Left leg fat percentage
LLFM: Left leg fat mass
LLFFM: Left leg Fat-free mass
LLPMM: Left leg predicted muscle mass

2.3. Data analysis

Descriptive statistics were used in the analysis of the data and paired t-test (Wilcoxon) was used to compare dominant and non-dominant legs (both isokinetic knee strength and bioimpedance data). Spearman correlation test was applied to determine the relationship between the body composition and the isokinetic strength which were applied at different angular speeds. Sigma Plot 11.0 (Systat Software, Inc)

software was used for statistical analysis of the data and the significance level was taken as p <0.05.

3. Results

Body Composition

In this study, in the bioimpedance analysis of the subjects, the leg Fat%, FM, FFM and the PMM were not significantly different between the right and left legs (Table 2).

Table 2. *Comparison of the subjects' dominant and non-dominant leg composition*

	Dominant leg			Non-Dominant leg			p
	Mean ± SD	Min	Max	Mean ± SD	Min	Max	
Fat %	12 ± 2.8	6.7	16.7	12.2 ± 2.9	5.7	17.1	.146
Fat Mass (kg)	1.8 ± 0.6	0.8	2.9	1.8 ± 0.6	0.7	2.9	.999
FFM (kg)	12.7 ± 1	10.8	14.8	12.6 ± 1.1	10.7	15.1	.125
PMM (kg)	12 ± 1	10.2	14	12 ± 1	10.1	14.2	.155

FFM: Fat-free mass, PMM: Predicted muscle mass

Isokinetic Strength

The highest PT, PT/BW and work values of the subjects were obtained at 60˚/sec angular speed on the dominant and non-dominant sides (Table 3), followed by angular speed of 180˚/sec and 300˚/sec, respectively (Table 4, Table 5). Flex/Ex Ratio value was obtained at the highest angular speed of 300˚/sec for both sides, followed by angular speed of 180˚/sec and 60˚/sec, respectively.

Subjects at an angular speed of 60˚/sec; when the dominant & non-dominant knee isokinetic strength were compared, a significant difference was found in PT Ex, PT/BW Ex, Flex/Ex ratio, Angle of PT Ex, Work Flex, Power Flex and Power Ex (p <0.05). There was no significant difference between dominant and non-dominant knee in all other variables at 60˚/sec angular speed (Table 3).

Table 3. *Comparison of dominant vs. non-dominant isokinetic knee strength of the subjects at 60˚/sec angular speed*

	Dominant	Non-dominant	p
PT flex (Nm)	134.8 ± 24.2	136.1 ± 23.3	.466
PT ex (Nm)	240.4 ± 39.7	229.4 ± 38.8	.016*
PT/BW flex (Nm/kg)	1.4 ± 0.3	1.5 ± 0.2	.524
PT/BW ex (Nm/kg)	2.6 ± 0.4	2.5 ± 0.4	.049*
Flex/Ex ratio (H/Q)	54.9 ± 8.2	59.3 ± 10	.004*
Angle of PT flex (degree)	41.1 ± 8.7	42.5 ± 9.9	.321
Angle of PT ex (degree)	66.3 ± 3.5	64 ± 4.7	.011*
Work flex (Joule)	118.1 ± 26.2	125.2 ± 23	.008*
Work ex (Joule)	189.4 ± 40.9	185.8 ± 35.7	.428
Power flex (Watt)	89.2 ± 19.5	94.9 ± 20.1	.011*
Power ex (Watt)	151.9 ± 31.4	140.1 ± 41.7	.044*
Work/Weight Flex	0.5 ± 0.3	0.5 ± 0.3	.706
Work/Weight Ex	0.5 ± 0.3	0.6 ± 0.2	.123

**: p<0.05, PT: Peak torque, BW: Body weight, flex: flexion, ex: extension, H: Hamstring, Q: Quadriceps Femoris*

Subjects at an angular speed of 180˚/sec; when dominant & non-dominant knee isokinetic strength were compared, a significant difference was found in PT/BW Ex, Flex/Ex ratio and Power Ex (p <0.05). There was no significant difference found between dominant and non-dominant knee in all variables applied at the remaining 180˚/sec angular speed (Table 4).

Table 4. *Comparison of dominant vs. non-dominant isokinetic knee strength of the subjects at 180˚/sec angular speed*

	Dominant	Non-dominant	p
PT flex (Nm)	120.8 ± 21.4	122.2 ± 21.2	.602
PT ex (Nm)	179.3 ± 24.9	173.3 ± 25.2	.114
PT/BW flex (Nm/kg)	1.2 ± 0.2	1.2 ± 0.2	.877
PT/BW ex (Nm/kg)	1.9 ± 0.2	1.8 ± 0.2	.026*

Flex/Ex ratio (H/Q)	66.9 ± 9.3	71.3 ± 9.1	.028*
Angle of PT flex (degree)	39.4 ± 7.8	40.9 ± 8.8	.276
Angle of PT ex (degree)	63.6 ± 5.4	61.8 ± 3.7	.150
Work flex (Joule)	92.3 ± 13.2	96.3 ± 18.1	.163
Work ex (Joule)	133.8 ± 17.1	130.1 ± 20.4	.403
Power flex (Watt)	167 ± 30.8	172.5 ± 38	.701
Power ex (Watt)	256.1 ± 36.8	240.4 ± 40.8	<.001*
Work/Weight Flex	0.7 ± 0.3	0.6 ± 0.3	.472
Work/Weight Ex	0.4 ± 0.2	0.5 ± 0.2	.118

**: p<0.05, PT: Peak torque, BW: Body weight, flex: flexion, ex: extension, H: Hamstring, Q: Quadriceps Femoris*

Subjects at an angular speed of 300˚/sec; when the dominant & non-dominant knee isokinetic strength were compared in the applied variables, no significant difference was found between the dominant and non-dominant knee (Table 5).

Table 5. *Comparison of dominant vs. non-dominant isokinetic knee strength of the subjects at 300˚/sec angular speed*

	Dominant	Non-dominant	p
PT flex (Nm)	109 ± 26.6	108.5 ± 22.6	.912
PT ex (Nm)	147.2 ± 24.5	150.6 ± 20.8	.285
PT/BW flex (Nm/kg)	1.0 ± 0.2	1 ± 0.2	.999
PT/BW ex (Nm/kg)	1.4 ± 0.2	1.4 ± 0.2	.776
Flex/Ex ratio (H/Q)	74.0 ± 17.9	72.1 ± 11.4	.581
Angle of PT flex (degree)	46.7 ± 7.8	47.8 ± 7.1	.443
Angle of PT ex (degree)	59.8 ± 1.1	59 ± 3.5	.464
Work flex (Joule)	66.7 ± 12.5	67.9 ± 12.1	.632
Work ex (Joule)	87.8 ± 15.3	88.5 ± 11.7	.685
Power flex (Watt)	156.8 ± 36.1	163.7 ± 36.7	.339
Power ex (Watt)	230.8 ± 51.9	224.1 ± 37.7	.394
Work/Weight Flex	0.8 ± 0.2	0.8 ± 0.1	.651
Work/Weight Ex	0.7 ± 0.2	0.7 ± 0.2	.520

**: p<0.05, PT: Peak torque, BW: Body weight, flex: flexion, ex: extension, H: Hamstring, Q: Quadriceps Femoris*

Body composition and isokinetic knee strength relationship

At 60˚/sec angular speed, a significantly positive correlation was found between PT of dominant & non-dominant knee extension and BW, FFM, RLFFM, RLPMM, LLFFM and LLPMM (p <0.05). Besides, a significant positive correlation was found between the PT of the dominant knee flexion and BW, FFM and RLFFM, while a significant positive relationship was found only with FFM in non-dominant knee flexion PT (Table 6, p <0.05).

Table 6. *The relationship between the isokinetic knee strength of the subjects at different angular speed and body composition*

	Dominant											
	60˚/sn				180˚/sn				300˚/sn			
	Q		H		Q		H		Q		H	
	r	p	r	p	r	p	r	p	r	p	r	p
BW	.571	.007*	.438	.047*	.651	.001*	.421	.057	.645	.002*	.223	.325
BMI	.292	.195	.198	.386	.270	.232	.122	.593	.229	.311	-.062	.784
FAT%	.232	.306	-.051	.819	.144	.527	.023	.917	.140	.539	-.110	.629
FAT MASS	.313	.164	.031	.890	.246	.276	.143	.531	.239	.292	-.035	.877
FFM	.595	.005*	.572	.007*	.759	<.001*	.504	.019*	.707	<.001*	.328	.143
RL FAT %	.263	.246	.155	.494	.175	.442	.155	.498	.103	.653	-.051	.824
RL FAT MASS	.370	.097	.249	.274	.383	.085	.274	.225	.319	.157	.053	.819
RL FFM	.614	.003*	.434	.049*	.752	<.001*	.432	.049*	.737	<.001*	.257	.256

RL PMM	.625	.003*	.421	.056	.762	<.001*	.433	.049*	.740	<.001*	.259	.254
	Non-dominant											
	60˚/sn				180˚/sn				300˚/sn			
	Q		H		Q		H		Q		H	
	r	p	r	p	r	p	r	p	r	p	r	p
BW	.491	.024*	.392	.077	.632	.002*	.576	.006*	.612	.003*	.303	.179
BMI	.139	.543	.085	.711	.362	.105	.328	.145	.348	.120	.099	.665
FAT%	.153	.502	-.026	.908	.225	.320	.182	.425	.027	.903	.096	.674
FAT MASS	.242	.284	.064	.776	.335	.135	.284	.210	.134	.558	.156	.494
FFM	.514	.017*	.509	.018*	.677	<.001*	.625	.003*	.718	<.001*	.322	.152
LL FAT %	.148	.516	.125	.581	.263	.244	.347	.121	.196	.389	.165	.469
LL FAT MASS	.233	.306	.175	.442	.413	.062	.409	.065	.290	.199	.199	.382
LL FFM	.530	.014*	.357	.110	.757	<.001*	.542	.011*	.627	.002*	.318	.157
LL PMM	.542	.011*	.342	.127	.785	<.001*	.533	.012*	.652	.001*	.320	.155

**: p<0.05, BW: Body weight, BMI: Body mass index, FFM: Fat-free mass,RL: Right leg, LL: Left leg, PMM: Predicted muscle mass*

At 180˚/sec angular speed, a significant positive correlation was found between the knee extension & flexion PT of dominant & non-dominant leg and BW, FFM, RLFFM, RLPMM, LLFFM, LLPMM (p <0.05). Besides, a significant positive correlation was found between the knee extension PT of dominant & non-dominant leg and BW, while a significant positive correlation was found only between knee flexion PT non-dominant leg and BW (Table 6, p <0.05).

At 300˚/sec angular speed, a significant positive correlation was found between the knee extension PT of dominant & non-dominant leg and BW, FFM, RLFFM, RLPMM, LLFFM and LLPMM (Table 6, p <0.05).

No significant relationship was found between isokinetic knee strength obtained at different angular speeds and BMI, FAT%, FM, leg FAT%, and leg FM in terms of both dominant and non-dominant legs.

4. Discussion and Conclusion

In this study, it was aimed to determine the relationship between isokinetic knee strength and body composition in senior male basketball players. In addition, isokinetic knee strength & body composition were compared between dominant and non-dominant legs. A significant difference was found in the dominant and non-dominant knee strength of the subjects and the power parameters at 60˚/sec & 180˚/sec angular speed (p <0.05). The most significant bilateral strength difference is found at an angular speed of 60˚/sec, while isokinetic knee strength parameters at 300˚/sec angular speed are not different for the dominant and non-dominant sides. Dominant vs. non-dominant leg composition (FAT%, FM, FFM, PMM) was not significantly different. However, a significant positive correlation was determined between the subjects' BW, FFM, leg FFM and leg PMM and isokinetic knee strength.

Isokinetic Strength: Comparison of dominant vs non-dominant leg

Muscle strength is generally defined as the maximum strength or torque that develops during maximal voluntary contraction of a particular muscle group under a certain set of conditions [28]. In our study, the most significant bilateral strength difference was found at 60˚/sec angular speed, while isokinetic knee strength parameters at an angular speed of 300˚/sec were not different for the dominant and non-dominant sides. It can be said that the 60˚/sec angular speed is similar to the maximal strength in terms of difficulty and application intensity of the movement.

A significant relationship was found between peak power and quadriceps muscle strength produced at different angular speeds in basketball players [24]. A significantly strong relationship was found between isokinetic knee extensor strength and vertical jump in basketball players [25]. In the review study of Dervišević & Hadžić'in (2012) in which they researched the isokinetic strength in team sports, they stated that the strength and strength ratios of Q and H could play an important role in the competence of basketball players. In this review, some of the research has shown that compared to non-elite basketball players, elite basketball players achieve significantly higher peak extension torque.

The difference in relative strength between the extremities is expressed as muscle strength asymmetry

[29]. When this difference is ≥ 10-15 %, it is considered to be asymmetry and this situation is considered a predictor of sports injuries [30]. A significant strength asymmetry between the dominant and non-dominant sides was determined according to the result of knee flexion and extension isokinetic strength test at 60˚/sec angular speed applied in young male basketball players ($p<0.05$; d=0.40-0.98, Thomas, Comfort, Dos'Santos, & Jones, 2017). Since basketball is a contact sport, the risk of injury is higher compared to non-contact sports. Schiltz et al. (2009) reported that male basketball players with a history of knee injury have bilateral isokinetic and functional asymmetry, and the strength asymmetry was higher than 10% in all isokinetic tests. Besides, it was found that the absolute and relative force of elite basketball players differs between dominant and non-dominant sides. In our study, a significant difference was found in the subjects' dominant and non-dominant knee strength and power parameters at 60˚/sec & 180˚/sec angular velocities ($p<0.05$). The most significant bilateral strength difference is found at an angular speed of 60˚/sec, while isokinetic knee strength parameters at 300˚/sec angular speed are not different for the dominant and non-dominant sides. This finding, which is similar to the findings in the literature, can be related to the consequence of more frequently jumping on one leg in basketball.

In healthy subjects, concentric H/Q ratios typically range from 0.5 to 0.8. Higher rates are seen during isokinetic testing at faster angular speed. In our study, this value ranges from 54-74 % (0.5-0.7). At a lower angular speed (60˚/sec, dominant vs. non-dominant) 54.9 % and 59.3 % (.54-.59) and at a higher angular speed (300˚/sec, dominant vs. non-dominant) 74 % and 72.1 % (.74-.72) were determined. Although there is a low consensus on some normative values, the value between 50-69 % for 60˚/sec angular speed and about 70-80 % for 300˚/sec speed seems to have gained general acceptance [33,34]. In another study in which isokinetic knee strength of male basketball players was examined at 60˚/sec and 180˚/sec angular speed [35], H/Q ratio in dominant and non-dominant legs were found to be 58 % and 56 %, 65 % and 69 %, respectively.

Body Composition: Comparison of dominant vs non-dominant leg

In this study, no significant difference was found between dominant and non-dominant leg body composition in senior male basketball players. In a basketball game performance, subcutaneous adipose tissue appears as a factor that disrupts the performance of athletes in a competitive environment [36]. According to the results of the studies applied in other sports branches that may be related to our research, it was determined that good athletes have a lower fat percentage and higher muscle mass. It is seen that the effect of body composition on sportive success is quite high [37–39]. Although body composition in basketball varies between positions, the relationship between body composition and match performance was also investigated [20]. According to the findings of the research, it was determined that competitive and more successful forwards have a lower body fat percentage and higher muscle mass.

In our study, BMI of male basketball players was determined as 24.2±1.7, FAT% as 11.6% ±4.0, FM as 10.2±4.3 kg, and FFM as 75.9±6.8 kg. This finding is consistent with previous studies [10,40,41]. It was determined that basketball players with a low-fat percentage and a high-fat-free mass have better vertical jumping performance and therefore body composition is an indirect determinant for performance [10].

The Relationship between Body Composition and Strength

In this study, a significantly positive correlation was determined between the subjects' BW, FFM, leg FFM, leg PMM and the isokinetic knee strength.

Basketball is characterized by rapid directional changes that involve complex and multi-plane movements from running to sprinting and jumping which require multiple transitions, acceleration and deceleration. The strength is very important as one of the basic motoric functions in this dynamic game structure. Xie et al. (2020) It investigated the volumes of lower extremity muscles and the relationship between these muscle volumes and jumping and speed with the MRI (magnetic resonance imaging) method in male basketball players. The striking finding is that there is a high correlation between vastus medialis and semimembranosus muscle and jumping, adductor longus and vastus medialis muscle volume and sprinting performance. However, a strong relationship was found between quadriceps muscle group volume and knee extension isokinetic strength in sedentary adults, [43] and as a result of this finding, it was suggested to focus on this muscle group to increase performance in lower extremity training programs. Besides, Soslu et al. (2016) it was emphasized that the maximal leg extension strength of the basketball players (quadriceps femoris muscle group) in particular is an important component in test performance of anaerobic and sprinting ability.

In a study examining the relationship between body composition and anaerobic power in wrestlers [26], a significant positive correlation was found between absolute peak power and BW ($r=0.807$; $p<0.01$), left leg muscle mass ($r=0.823$; $p<0.01$), right leg muscle mass ($r=0.824$; $p<0.01$). Considering this finding, it was reported that the muscle mass of athletes is an important determinant for anaerobic performance. According to an interesting finding, higher body mass index and strong hip abduction strength predict non-contact anterior cruciate ligament injury in basketball players [44]. Considering this point, it would not be wrong to state that high-fat percentage and fat weight prepares the ground for future sports injuries.

A significant positive relationship was determined between leg strength and BW & FFM in male basketball players aged 15-19 [21]. Although the leg strength is measured with isometrically in the method of this research and differs from our study, its findings are similar to our research.

As a result, research shows that a higher muscle mass and a lower FAT% is desirable for better anaerobic performance. In this study, although there is no difference in dominant vs non-dominant leg composition in elite male basketball players, there is a difference in isokinetic knee strength. Especially in less repetitive and explosive exercises (such as jumping), this difference is greater. The reason for this difference is thought to be because jumping & shooting on one leg is done more frequently in basketball. It is assumed that jumping and landing on one leg may affect the difference between the dominant and non-dominant sides. Besides, it is predicted that when fat-free body&leg mass and muscle mass are increased, isokinetic knee strength will also increase. Therefore, to prevent injuries, it is recommended to include exercises that will increase leg muscle mass to minimize or eliminate the difference in bilateral isokinetic knee strength and to increase the jump height.

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Conflicts of Interests

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Dynamics of the Functional State of Students in the Process of Powerlifting in Higher Education

Valeriy Zhamardiy[1], Olena Shkola[2], Olena Otravenko[3], Olena Momot[4], Mariia Andreieva[5], Olena Andrieieva[6], Vasyl Mudryk[7], Viktor Slusarev[8], Halyna Broslavska[9] and Galina Putiatina[10]

[1]Ph.D. in Pedagogics, Associate Professor of the Department of Physical Education and Health, Physical Therapy, Ergotherapy with Sports Medicine and Physical Rehabilitation, Ukrainian Medical Stomatological Academy, Poltava, Ukraine.

[2]Ph.D. in Pedagogics, Associate Professor, Head of the Department of Physical Education, Municipal Establishment «Kharkiv Humanitarian Pedagogical Academy» of Kharkiv Regional Council, Kharkiv, Ukraine.

[3]Ph.D. in Pedagogics, Associate Professor, Associate Professor of the Department of Theory and Methodology of Physical Education, Luhansk Taras Shevchenko National University, Starobilsk, Ukraine.

[4]Doctor of Pedagogical Sciences, Associate Professor of the Department of Theoretical and Methodological Foundamentals of Teaching Sports Disciplines, Poltava V. G. Korolenko National Pedagogical University, Poltava, Ukraine.

[5]Ph.D. in Pedagogics, Professor of the Department of Social Work, Municipal Establishment «Kharkiv Humanitarian Pedagogical Academy» of Kharkiv Regional Council, Kharkiv, Ukraine.

[6]Associate Professor of the Department of Clinical Pharmacology and Clinical Pharmacy, National Univeristy of Pharmacy, Kharkiv, Ukraine.

[7]Ph.D. in Pedagogics, Professor, Professor of the Department of Theory and Methods of Physical Education, Municipal Establishment «Kharkiv Humanitarian Pedagogical Academy» of Kharkiv Regional Council, Kharkiv, Ukraine.

[8]Ph.D. in Biological Sciences, Associate Professor, Associate Professor of Theory and Methods of Physical Education, Municipal Establishment «Kharkiv Humanitarian Pedagogical Academy» of Kharkiv Regional Council, Kharkiv, Ukraine.

[9]PhD in Pedagogics, Senior Lecturer at the Department of Mathematics and Physics, Municipal Establishment «Kharkiv Humanitarian Pedagogical Academy» of Kharkiv Regional Council, Kharkiv, Ukraine.

[10]PhD in Physical Education and Sport, Associate Professor, Vice-Rector for Scientific and Pedagogical Work, Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine.

Abstract

The article defines the dynamics of the functional state of students after implementation of methods of special skills and abilities formation during powerlifting classes. It was found that one of the most important tasks of physical education in higher education is the creation of the most favorable, optimal conditions for the harmonious and spiritual development of each student, preservation of student's health, development of necessary theoretical knowledge, formation of special skills and abilities, maintenance and development of functional capabilities of the organism. We have studied that the formation of a responsible attitude of students to their health is associated with many aspects of the educational process. We have identified that one of the main ways is to cultivate positive, sustainable and effective cognitive interests and students' understanding of the importance of a healthy lifestyle provided in powerlifting classes.

Keywords: methods, powerlifting, students, physical fitness, physical education.

1. Introduction

Today, society needs from future specialists in physical education not only strong theoretical knowledge, but also practical skills and special abilities, a high level of psychophysical training and professional ability to work, increased physical reserve and functional capabilities of the body, the desire to achieve the goal, harmonious and spiritual development. They are necessary for timely adaptation to rapidly changing conditions of the working and external environment. Based on the requirements of legal documents relating to the training of future professionals, the educational process of physical education should be aimed at improving health, improvement of motor skills, as well as increase in the level of physical fitness of student youth.

Physical education and physical activity in daily activities are carried out on the basis of individual characteristics and needs of each student. The formation of beliefs in the need to involve students in regular physical education and mass sports is of paramount importance. The content and scope of relevant classes is

determined by the curriculum, scientifically sound guidelines, taking into account the nature of physical activity in professional activities and education. Powerlifting is one of the top priority types of physical activity within the framework of physical education classes. Powerlifting classes promote good health, increase efficiency, display and develop students' strength skills. The arsenal of tools and many years of accumulated experience of coaches and outstanding athletes in powerlifting are not used in the educational process of physical education.

2. Materials and Methods

The aim of the study is to determine the dynamics of students' body functional state after the introduction of methods of forming special skills and abilities in the process of powerlifting.

General scientific and special research methods were used to achieve the set goal and solve the problems, interconnected and consistently applied throughout the study: *theoretical (for the formation of theoretical and methodological foundations of the study):* analysis and generalization of philosophical, sociological, psychological, pedagogical, valeological literature; study of educational programs; regulatory and legislative documents; methodical recommendations and textbooks on psychological and pedagogical disciplines; study of the experience of physical education departments in the development of powerlifting in higher education institutions; *empirical* (*to determine the general health of students):* methods of collecting information (questionnaires, surveys, pedagogical testing and observation of students' educational and training activities), analysis of learning outcomes, interviews, methods of expert assessments, self-assessment, generalization of independent characteristics; *experimental (for the analysis of the basic ways of research of complex indicators):* ascertaining, formative, control stages of pedagogical experiment using the Diary of physical self-improvement in powerlifting, visual aids; *statistical (to assess the statistical significance of differences in the status and dynamics of changes in health indices):* descriptive statistics, determination of statistical significance of differences between groups by the Student's method and correlation analysis by the Pearson method.

The pedagogical experiment was carried out on the basis of Poltava National Pedagogical University named after V. G. Korolenko, which was attended by twelve study groups of students (a total of 294 people, including 161 - boys and 133 - girls) from historical, natural, psychological-pedagogical, physical-mathematical and philological faculties. All students were divided into control and experimental groups by the method of even distribution of groups. According to the schedule, physical education classes in all groups were held once or twice a week in the morning. Students of control groups were engaged in the curriculum for higher education institutions [12]. Students of experimental groups were engaged in the developed author's technique of formation of special abilities and skills in powerlifting. Training sessions, as part of compulsory and independent classes, were held three times a week in powerlifting and two classes, which included running and swimming. The duration of training sessions in groups was 90 minutes. The effectiveness of the proposed method was evaluated by the results of control tests. At the beginning of the school year (September), physical training tests were conducted and the level of special physical training in powerlifting in control and experimental groups was assessed. Control tests were conducted at the end of the school year (May-June). Students who dropped out of the experimental and control groups during their studies were not included in the statistical processing and were not replaced by others.

3. Results and Discussion

One of the most important aspects of management of long-term training in powerlifting is the system of complex control, which allows the coach-teacher to assess the level of physical and functional readiness of students, the correctness of the chosen direction of training, the dynamics of training and timely adjustments to the training process [1; 5; 6; 8; 10; 11; 20].

The methodological basis of comprehensive control consists from following: the correct choice of tests and their compliance with statistical reliability criteria, objectivity and informativeness; determining the optimal amount of indicators to assess the functional status and level of preparedness of students, its sufficiency, standardization of conditions and sources of information; compliance of control methods with testing tasks [12; 15; 16; 17; 18; 19; 21].

Important in the educational process of physical education is the accounting system, which characterizes its effectiveness. Accounting makes it possible to monitor the state of health, level of preparation of students, physical development, the dynamics of their sports results. Analysis of accounting

for quantitative and qualitative indicators allows the teacher not only to control the educational process of physical education, but also to actively intervene in it, adjust and improve it [2; 3; 4; 7; 9; 13; 14].

Training and extracurricular powerlifting classes with students of experimental groups E1, E2, E3 also contributed to the improvement of functional indicators (А что это за группы не понятно. In boys of the experimental group E1 there was a decrease in heart rate (HR) by 5,82 beats per minute (beats/min), and in the control group K1 by 3.38 beats/min, systolic blood pressure (sBP) decreased by 2.61 mm Hg, and in the control group K1 by 2.1 mm Hg, diastolic blood pressure (dBP) decreased by 2.66 mm Hg, and in the control group K1 by 1.99 mm Hg, hand muscle strength increased by 4.2 kg and 3.1 kg, respectively. Vital lung capacity (VLC) in boys of experimental group E1 improved by 189.9 ml, and in control group K1 by 132.78 ml, respectively. The changes in functional parameters of boys from the experimental E1 and control K1 groups were statistically significant at p<0.01–0.05 (Tab. 1).

Table 1. *Dynamics of the functional state of the body of boys with a high level of physical fitness during the period of pedagogical experiment (E1 – n=13; K1 – n=11)*

Parameters	Group	Before the experiment	After the experiment	Changes for the year	Statistical significance	
		$\overline{X} \pm Sx$	$\overline{X} \pm Sx$	$\Delta \overline{X}$	t	P
HR, beats/min	E1	73.32±1.34	67.5±1.12	-5.82	1.98	<0.05
	K1	73.68±1.25	70.3±1.1	-3.38	1.63	>0.05
sBP, mm Hg	E1	127.3±1.2	124.69±1.35	-2.61	2.25	<0.05
	K1	128.2±0.78	126.1±0.93	-2.1	1.13	>0.05
dBP, mm Hg	E1	78.56±1.1	75.9±0.83	-2.66	2.31	<0.05
	K1	79.32±0.95	77.33±0.76	-1.99	1.10	>0.05
VLC, ml	E1	3795.4±82	3985.3±87	189.9	2.23	<0.05
	K1	3768.42±75	3901.2±70	132.78	1.69	>0.05
Hand muscle strength, kg	E1	41.5±0.5	45.7±0.6	4.2	2.84	<0.01
	K1	39.8±0.7	42.9±0.4	3.1	1.86	>0.05

Introduction of methods of formation of special abilities and skills of students in the educational process of physical education during powerlifting classes contributed to the improvement of functional indicators of the main body systems of girls in the experimental E1 and control K1 groups, which was statistically significant at p <0.01–0.05. The similar data given in Table 2.

Table 2. *Dynamics of the functional state of the body of girls with a high level of physical fitness during the period of pedagogical experiment (E1 – n=7; K1 – n=8)*

Parameters	Group	Before the experiment	After the experiment	Changes for the year	Statistical significance	
		$\overline{X} \pm Sx$	$\overline{X} \pm Sx$	$\Delta \overline{X}$	t	P
HR, beats/min	E1	73.87±1.3	70.1±1.1	-3.77	2.18	<0.05
	K1	73.11±1.45	70.93±0.9	-2.18	1.79	>0.05
sBP, mm Hg	E1	124.7±1.34	122.12±1.2	-2.58	2.29	<0.05
	K1	125.2±1.5	123.9±1.1	-1.3	1.64	>0.05
dBP, mm Hg	E1	76.15±1.4	74.2±1.15	-1.95	2.43	<0.05
	K1	76.87±1.2	75.6±0.85	-1.27	1.72	>0.05
VLC, ml	E1	2675±68	2797±47.6	122.0	2.19	<0.05
	K1	2603±75.3	2694.1±52.4	91.1	1.67	>0.05
Hand muscle strength, kg	E1	36.1±0.6	38.43±0.72	2.33	2.36	<0.01
	K1	35.87±0.7	37.33±0.8	1.46	1.60	>0.05

In girls of the experimental group E1 there was a decrease in heart rate by 3.77 beats/min, and in the control group K1 by 2.18 beats/min, sBP decreased by 2.58 mm Hg, and in the control group K1 by 1.3 mm Hg, dBP lowered by 1.95 mm Hg, and in the control group K1 by 1.27 mm Hg, hand muscle strength increased by 2.33 kg and 1.46 kg, respectively. VLC in girls of the experimental group E1 improved by 122 ml, and in the control K1 by 91.1 ml, respectively.

Let us consider the dynamics of functional indicators in students of experimental E2 and control K2 groups. Heart rate in boys from the experimental group E2 decreased by 4.75 beats/min, from the control group K2 by 2.6 beats/min, sBP decreased by 3.0 mm Hg, and in the control group K2 by 2.2 mm Hg, dBP lowered by 2.7 mm Hg in group E2, and in the control group K2 by 2.0 mm Hg, VLC in boys from the experimental group E2 increased by 196.2 ml, and from the control group K2 by 133.1 ml, the strength of the muscles of the hand in the boys of the experimental group E2 increased by 4.3 kg, and the control group K2 by 3.2 kg, respectively, which was statistically significant at p <0.01–0.05 (Tab. 3).

Table 3. *Dynamics of the functional state of the body of boys with an average level of physical fitness during the period of pedagogical experiment (E2 – n=25; K2 – n=27)*

Parameters	Group	Before the experiment	After the experiment	Changes for the year	Statistical significance	
		$\overline{X} \pm Sx$	$\overline{X} \pm Sx$	$\Delta \overline{X}$	t	P
HR, beats/min	E2	74.87±1.64	70.12±1.1	-4.75	2.47	<0.05
	K2	75.2±1.42	72.6±1.21	-2.6	1.81	>0.05
sBP, mm Hg	E2	123.7±0.58	120.7±0.3	-3.0	2.20	<0.05
	K2	124.2±0.63	122.0±0.53	-2.2	1.78	>0.05
dBP, mm Hg	E2	75.4±0.45	72.7±0.51	-2.7	2.39	<0.05
	K2	76.21±0.7	74.21±0.62	-2.0	1.99	>0.05
VLC, ml	E2	3711±58	3907.2±61	196.2	2.27	<0.05
	K2	3698±63	3831.1±49	133.1	1.87	>0.05
Hand muscle strength, kg	E2	37.2±0.88	41.5±0.75	4.3	2.43	<0.01
	K2	35.9±1.2	39.1±0.93	3.2	2.07	>0.05

Improvements in functional performance in girls of the experimental E2 and control K2 groups reflect significant changes in improving their functional readiness. Functional heart rate in girls of the experimental group E2 decreased by 3.32 beats/min, control group K2 by 2.25 beats/min, sBP decreased by 2.4 mm Hg, control group K2 by 1.4 mm Hg, dBP dropped by 1.7 mm Hg, control group K2 by 1.3 mm Hg, VLC of girls from the experimental group E2 increased by 132.4 ml, and in the control group K2 by 98.3 ml, the strength of the muscles of the hand in girls of the experimental group E2 increased by 2.65 kg, and in the control group K2 by 1.67 kg, respectively, which was statistically significant at p <0.01–0.05 (Tab. 4).

The dynamics of improvement of functional parameters of students from experimental E3 and control K3 groups with low level of health and physical fitness showed that the boys from the experimental group E3 had a decrease in heart rate by 4.23 beats/min, and in the control group K3 by 2.08 beats/min, sBP decreased by 1.63 mm Hg, and in the control group K3 by 1.13 mm Hg, dBP lowered by 1.8 mm Hg, and in the control group K3 by 1.23 mm Hg, hand muscle strength increased by 3.1 kg and 2.8 kg, respectively. There was a statistically significant (p<0.05) increase in the functional index of VLC in boys of the experimental group E3, in contrast to the control group K3. The VLC value in the boys of the experimental group E3 was 109 ml and the control group K3 79 ml, respectively (Tab. 5).

Table 4. *Dynamics of the functional state of the body of girls with an average level of physical fitness during the period of pedagogical experiment (E2 – n=19; K2 – n=14)*

Parameters	Group	Before the experiment	After the experiment	Changes for the year	Statistical significance	
		$\overline{X} \pm Sx$	$\overline{X} \pm Sx$	$\Delta\overline{X}$	t	P
HR, beats/min	E2	75.56±1.5	72.24±1.3	-3.32	2.33	<0.05
	K2	75.12±1.7	72.87±1.6	-2.25	1.76	>0.05
sBP, mm Hg	E2	123.1±0.91	120.7±1.2	-2.4	2.21	<0.05
	K2	123.4±0.85	122.0±0.76	-1.4	1.73	>0.05
dBP, mm Hg	E2	71.1±0.6	69.4±0.3	-1.7	2.19	<0.05
	K2	72.5±0.47	71.2±0.56	-1.3	1.82	>0.05
VLC, ml	E2	2511±36	2643.4±32	132.4	2.26	<0.05
	K2	2505±40	2603.3±33	98.3	1.73	>0.05
Hand muscle strength, kg	E2	24.2±0.84	26.85±0.6	2.65	2.29	<0.01
	K2	23.93±0.68	25.6±0.53	1.67	1.71	>0.05

The girls in the experimental group E3 had a decrease in heart rate by 2.52 beats/min, and in the control group K3 by 1.22 beats/min, sBP decreased by 1.5 mm Hg, and in the control group K3 by 0.96 mm Hg, dBP decreased by 1.2 mm Hg, and in the control group K3 by 0.94 mm Hg, hand muscle strength increased by 1.9 kg and 1.2 kg, respectively. There was a statistically significant ($p<0,05$) increase in the functional index of VLC in girls of the experimental group E3 (Tab. 6).

Taking into account anthropometric and functional indicators of students, the dynamics of indices of physical development of boys and girls of experimental E1, E2, E3 and control K1, K2, K3 groups was determined. Before the pedagogical experiment, the boys of the experimental group E1 mass-growth index (MGI) was 378.3 g/cm, and in the control group K1 it was 382.38 g/cm, and at the end of pedagogical experiment it was 375.49 g/cm in the boys of the experimental group E1 and 380.54 g/cm of the control group K1 (Tab. 7).

Table 5. *Dynamics of the functional state of the body of boys with a low level of physical fitness during the period of pedagogical experiment (E3 – n=41; K3 – n=44)*

Parameters	Group	Before the experiment	After the experiment	Changes for the year	Statistical significance	
		$\overline{X} \pm Sx$	$\overline{X} \pm Sx$	$\Delta\overline{X}$	t	P
HR, beats/min	E3	76.34±1.63	72.11±0.94	-4.23	2.52	<0.05
	K3	76.78±1.43	74.7±0.65	-2.08	2.01	>0.05
sBP, mm Hg	E3	120.23±0.8	118.6±0.75	-1.63	2.19	<0.05
	K3	119.87±1.3	118.74±0.8	-1.13	1.54	>0.05
dBP, mm Hg	E3	71.5±1.3	69.7±1.04	-1.8	2.33	<0.05
	K3	72.1±1.21	70.87±0.85	-1.23	1.69	>0.05
VLC, ml	E3	3369±39.5	3478±43.2	109	2.25	<0.05
	K3	3343±40.3	3422±37.3	79	1.82	>0.05
Hand muscle strength, kg	E3	31.7±0.72	34.8±0.5	3.1	2.21	<0.01
	K3	30.3±0.68	33.1±0.6	2.8	1.84	>0.05

Table 6. *Dynamics of the functional state of the body of girls with a low level of physical fitness during the period of pedagogical experiment (E3 – n=48; K3 – n=37)*

Parameters	Group	Before the experiment	After the experiment	Changes for the year	Statistical significance	
		$\overline{X} \pm Sx$	$\overline{X} \pm Sx$	$\Delta\overline{X}$	t	P
HR, beats/min	E3	79.12±1.12	76.6±0.85	-2.52	2.27	<0.05
	K3	78.57±1.33	77.35±0.93	-1.22	1.67	>0.05
sBP, mm Hg	E3	121.3±0.74	119.8±0.52	-1.5	2.18	<0.05
	K3	121.87±0.85	120.91±0.7	-0.96	1.54	>0.05
dBP, mm Hg	E3	68.5±0.7	67.3±0.54	-1.2	2.16	<0.05
	K3	67.9±0.85	66.96±0.9	-0.94	1.68	>0.05
VLC, ml	E3	2343±36.8	2443±29.4	100	2.21	<0.05
	K3	2310±40.2	2373±34.5	63	1.49	>0.05
Hand muscle strength, kg	E3	19.9±0.6	21.8±0.3	1.9	2.25	<0.01
	K3	18.2±0.6	19.4±0.4	1.2	1.63	>0.05

The results of the experimental study allow us to state a significant improvement in somatic health, general and special physical fitness of students of experimental E1, E2, E3 and control K1, K2, K3 groups according to the results of the control tests.

One of the most important tasks of physical education in higher education is to create the most favorable, optimal conditions for the harmonious and spiritual development of each student, maintaining his health, developing the necessary theoretical knowledge, formation of special skills and abilities, maintenance and development of functional capabilities of the organism. During the development of methods for the formation of special skills and abilities of students in the process of powerlifting, we focused on strengthening the physical health of students, in order to increase the level of physical and functional capabilities of the organism.

The vital index (VI) at the beginning of the experiment in the boys of the experimental group E1 was 64.01 ml/kg, the control group K1 62.33 ml/kg, and at the end of 67.5 ml / kg in the boys of the experimental group E1 and 63.86 ml / kg of the control group K1. The Robinson index at the beginning of the pedagogical experiment in the boys of the experimental group E1 was 74.03 conventional units (c.u.), while boys from the control group K1 had 76.36 c.u., and at the end of the Robinson index was 69.77 in the boys of the experimental group E1 and 73.71 c.u. in the boys of the control group K1 c.u.

Table 7. *Dynamics of indices of physical development of boys with a high level of physical fitness for the period of pedagogical experiment (E1 – n=13; K1 – n=11)*

Parameters	Group	Before the experiment	After the experiment	Changes for the year	Statistical significance	
		$\overline{X} \pm Sx$	$\overline{X} \pm Sx$	$\Delta\overline{X}$	t	P
MGI, g/cm	E1	378.3±0.55	375.49±0.53	-2.81	3.67	<0.05
	K1	382.38±0.38	380.54±0.48	-1.84	2.09	>0.05
VI, ml/kg	E1	64.01±1.98	67.5±0.76	3.49	3.89	<0.05
	K1	62.33±1.41	63.86±1.17	1.53	1.88	>0.05
The Robinson index, c.u.	E1	74.03±1.33	69.77±0.37	-4.26	3.37	<0.05
	K1	76.36±1.95	73.71±0.63	-2.65	2.00	>0.05
HRRT, min	E1	1.24±1.61	1.0±0.9	-0.24	2.65	<0.05
	K1	1.26±1.33	1.13±1.65	-0.13	1.98	>0.05
PI, %	E1	78.84±1.7	81.17±1.39	2.33	2.21	<0.05
	K1	76.22±1.25	78.0±1.84	1.78	1.66	>0.05

Heart rate recovery time (HRRT) after 20 squats during 30 s in boys of the experimental group E1 was 1.24 minutes, the control group K1 time was 1.26 minutes at the beginning of experiment, and at the end of experiment it was 1.0 min in the boys of the experimental group E1 and 1.13 min in the control group K1. The power index (PI) at the beginning of the experiment in the boys of the experimental group E1 was 78.84%, in the the control group K1 it was 76.22%, and at the end of the experiment it was 81.17% in the boys of the experimental group E1 and 78.0% in the boys of the control group K1, which was statistically significant at $p < 0.05$.

Before the pedagogical experiment, the girls from the experimental group E1 had mass-growth index of 367.7 g/cm, in the control group K1 index was 377.23 g/cm, and at the end of the experiment mass-growth index was 375.48 g/cm in girls from experimental group E1 and 365.08 g/cm in girls from control group K1. The vital index at the beginning of the experiment in the girls of the experimental group E1 was 55.37 ml/kg, the control group K1 had 53.23 ml/kg, and at the end of experiment it was 67.5 ml/kg in girls from experimental group E1 and 54.5 ml/kg in girls from control group K1. The Robinson index at the beginning of the pedagogical experiment in the girls from the experimental group E1 was 76.12 c.u., in control group K1 it was 78.48 c.u., and at the end of experiment it was 72.89 c.u. in girls from the experimental group E1 and 76.74 c.u. in control group K1 (Tab. 8).

Table 8. *Dynamics of indices of physical development of girls with a high level of physical fitness for the period of pedagogical experiment (E1 – n=7; K1 – n=8)*

Parameters	Group	Before the experiment	After the experiment	Changes for the year	Statistical significance	
		$\overline{X} \pm Sx$	$\overline{X} \pm Sx$	$\Delta\overline{X}$	t	P
MPI, g/cm	E1	367.7±1.21	370.32±0.67	-2.62	3.43	<0.05
	K1	377.23±0.45	375.48±1.21	-1.75	1.81	>0.05
VI, ml/kg	E1	55.37±1.7	57.44±1.43	2.07	3.04	<0.05
	K1	53.23±1.4	54.5±0.75	1.27	2.03	>0.05
The Robinson index, c.u.	E1	76.12±0.33	72.89±0.75	-3.23	2.65	<0.05
	K1	78.48±1.15	76.74±0.44	-1.74	1.83	>0.05
HRRT, min	E1	1.26±1.43	1.06±0.5	-0.20	2.54	<0.05
	K1	1.27±1.19	1.15±1.29	-0.12	1.76	>0.05
PI, %	E1	58.47±1.12	60.36±1.33	1.89	2.18	<0.05
	K1	57.2±0.93	58.66±1.11	1.46	1.73	>0.05

The HRRT after 20 squats, for 30 s of girls from experimental group E1 was 1.26 min, girls from control group K1 had HRRT 1.27 min, and at the end of the experiment it was 1.06 min in experimental group E1 and 1.15 min in control group K1. The PI at the beginning of the experiment in experimental group E1 was 58.47%, control group K1 had 57.2%, and at the end of experiment girls from experimental group E1 had 60.36% PI and 58.66% in control group K1, which was statistically significant at $p < 0.05$.

Before the pedagogical experiment boys from the experimental group E2 had mass-growth index of 425.39 g/cm, in the control group K2 index was 434.35 g/cm, and at the end of the experiment mass-growth index was 421.98 g/cm in boys from experimental group E2 and 432.42 g/cm in boys from control group K2. The vital index at the beginning of the experiment in the boys from the experimental group E2 was 57.7 ml/kg, in the control group K2 it was 57.46 ml/kg, and at the end of experiment it was 61.33 ml/kg in the boys from the experimental group E2 and 59.26 ml/kg in control group K2 (Tab. 9).

Table 9. *Dynamics of indices of physical development of boys with an average level of physical fitness for the period of pedagogical experiment (E2 – n=25; K2 – n=27)*

Parameters	Group	Before the experiment	After the experiment	Changes for the year	Statistical significance	
		$\overline{X} \pm Sx$	$\overline{X} \pm Sx$	$\Delta \overline{X}$	t	P
MPI, g/cm	E2	425.39±0.4	421.98±0.35	-3.41	3.93	<0.05
	E2	434.35±0.3	432.42±0.33	-1.93	2.14	>0.05
VI, ml/kg	E2	57.7±1.61	61.33±0.98	3.63	3.32	<0.05
	E2	57.46±1.44	59.26±1.36	1.8	1.78	>0.05
The Robinson index, c.u.	E2	88.37±1.84	83.4±1.2	-4.97	3.08	<0.05
	E2	90.07±1.35	87.28±1.54	-2.79	2.07	>0.05
HRRT, min	E2	1.45±1.23	1.09±0.87	-0.36	2.36	<0.05
	E2	1.5±0.67	1.36±1.12	-0.14	1.82	>0.05
PI, %	E2	68.4±1.93	71.76±1.15	3.36	2.07	<0.05
	E2	67.89±1.72	69.7±1.47	1.81	1.53	>0.05

The Robinson index at the beginning of the pedagogical experiment in the boys of the experimental group E2 was 88.37 c.u., control group K2 had index of 90.07 c.u., and at the end of the experiment it was 83.4 c.u. in the experimental group E2 and 87.28 c.u. in control group K2. Heart rate recovery time after 20 squats for 30 s in boys from experimental group E2 was 1.45 min, in control group K2 it was 1.5 min, and at the end of experiment it was 1.09 min in boys from experimental group E2 and 1.36 min in control group K2. The power index at the beginning of the experiment in boys from the experimental group E2 was 68.4%, in control group K2 it was 67.89%, and at the end of experiment it became 71.76% in the boys from the experimental group E2 and 69.7% in the control group K2, which was statistically significant at $p < 0.05$.

Before the pedagogical experiment, the girls from the experimental group E2 mass-growth index was 384.37 g/cm, in the control group K2 it was K2 387.87 g/cm, and at the end of the experiment it became 381.2 g/cm in the girls from the experimental group E2 and 386.09 g/cm in control group K2. The vital index at the beginning of the experiment in girls from experimental group E2 was 48.38 ml/kg and 46.02 ml/kg in the control group K2, and at the end of the experiment it became 51.0 ml/kg in girls from the experimental group E2 and 47.72 ml/kg in control group K2 (Tab. 10).

Table 10. *Dynamics of indices of physical development of girls with an average level of physical fitness for the period of pedagogical experiment (E2 – n=19; K2 – n=14)*

Parameters	Group	Before the experiment	After the experiment	Changes for the year	Statistical significance	
		$\overline{X} \pm Sx$	$\overline{X} \pm Sx$	$\Delta \overline{X}$	t	P
MGI, g/cm	E2	384.37±0.7	381.2±0.78	-3.17	2.94	<0.05
	E2	387.87±1.2	386.09±1.67	-1.78	1.75	>0.05
VI, ml/kg	E2	48.38±1.27	51.0±0.23	2.62	3.12	<0.05
	E2	46.02±0.23	47.72±1.17	1.7	1.81	>0.05
The Robinson index, c.u.	E2	90.57±1.77	86.34±1.65	-4.23	2.43	<0.05
	E2	92.75±0.65	90.8±1.54	-1.95	2.04	>0.05
HRRT, min	E2	1.48±0.76	1.19±0.63	-0.29	2.23	<0.05
	E2	1.49±0.72	1.37±1.38	-0.12	1.63	>0.05
PI, %	E2	53.13±0.43	55.33±1.17	2.2	2.27	<0.05
	E2	52.1±1.13	53.62±0.33	1.52	1.59	>0.05

The Robinson index at the beginning of the pedagogical experiment in the girls from the experimental group E2 was 90.57 c.u. and 92.75 c.u. in the control group K2, and at the end of the experiment it became 86.34 c.u. in the experimental group E2 and 90.8 c.u. in control group K2. The HRRT after 20 squats for 30 s in girls from experimental group E2 was 1.48 min and 1.49 min in the control group K2. At the end of the experiment it became 1.19 min in girls from experimental group E2 and 1.37 min in control group K2. The power index at the beginning of the experiment in girls from the experimental group E2 was 53.13% and 52.1% in the control group K2, and at the end of the experiment it became 55.33% in the experimental group E2 and 53.62% in the control group K2, which was statistically significant at $p < 0.05$.

Before the pedagogical experiment boys from the experimental group E3 had mass-growth index of 475.9 g/cm, the control group K3 had 480.54 g/cm, and at the end of the experiment it became 473.96 g/cm in the experimental group E3 and 479.42 g/cm in the control group K3. The vital index at the beginning of the experiment in boys from experimental group E3 was 54.57 ml/kg, boys from control group K3 had 52.12 ml/kg, and at the end of the experiment it became 56.13 ml/kg in experimental group E3 and 53.12 ml/kg in the control group K3 (Tab. 11).

Table 11. *Dynamics of indices of physical development of boys with a low level of physical fitness for the period of pedagogical experiment (E3 – n=41; K3 – n=44)*

Parameters	Group	Before the experiment	After the experiment	Changes for the year	Statistical significance	
		$\overline{X} \pm Sx$	$\overline{X} \pm Sx$	$\Delta \overline{X}$	t	P
MGI, g/cm	E3	475.9±0.75	473.96±0.77	-1.94	3.28	<0.05
	K3	480.54±0.58	479.42±0.35	-1.12	2.01	>0.05
VI, ml/kg	E3	54.57±1.21	56.13±0.53	1.56	2.67	<0.05
	K3	52.12±1.39	53.12±1.47	1.0	1.65	>0.05
The Robinson index, c.u.	E3	97.31±1.41	95.1±1.02	-2.21	2.84	<0.05
	K3	100.29±1.61	98.58±1.13	-1.71	1.94	>0.05
HRRT, min	E3	2.62±0.7	2.44±0.8	-0.18	2.49	<0.05
	K3	2.8±1.13	2.7±0.67	-0.10	1.82	>0.05
PI, %	E3	62.23±1.41	63.64±1.19	1.41	2.17	<0.05
	K3	61.89±1.13	62.86±1.5	0.97	1.65	>0.05

The Robinson index at the beginning of the pedagogical experiment in the boys from the experimental group E3 was 97.31 c.u. and 100.29 c.u. in the control group K3, and at the end of the experiment it became 95.1 c.u. in the experimental group E3 and 98.58 c.u. in the control group K3. The HRRT after 20 squats for 30 s in the boys from the experimental group E3 was 2.62 minutes, the boys from control group K3 recovered heart rate in 2.8 minutes, and at the end of the experiment it became 2.44 minutes in the experimental group E3 and 2.7 minutes in the control group K3. The power index at the beginning of the experiment in the boys from the experimental group E3 was 62.23% and 61.89% in the control group K3. At the end of the experiment it became 63.64% in the experimental group E3 and 62.86% in the control group K3, which was statistically significant at $p < 0.05$.

Before the pedagogical experiment the girls from the experimental group E3 had mass-growth index of 414.2 g/cm and it was 427.09 g/cm in the control group K3. At the end of the experiment it became 412.55 g/cm in the experimental group E3 and 425.98 g/cm in the control group K3. The vital index at the beginning of the experiment in girls from experimental group E3 was 43.18 ml/kg and 42.3 ml/kg in the control group K3. At the end of the experiment it became 44.63 ml/kg in the experimental group E3 and 43.23 ml/kg in the control group K3. The Robinson index at the beginning of the pedagogical experiment in the girls from the experimental group E3 was 100.3 c.u and 102.52 c.u. in the control group K3. At the end of the experiment it became 99.34 c.u. in the experimental group E3 and 102.06 c.u. in the control group K3. The HRRT after 20 squats for 30 s in girls from experimental group E3 was 2.64 minutes and 2.67 minutes in the control group K3. After the experiment it became 2.5 minutes in the experimental group E3 and 2.6 minutes

in the control group K3. The power index at the beginning from the experiment in girls of experimental group E3 was 46.43% and 42.7% in the control group K3. At the end of the experiment it became 47.3% in the experimental group E3 and 43.35% in the control group K3, which was statistically significant at $p < 0.05$ (Tab. 12).

During the pedagogical experiment the index of harmonious morphological development was determined (HMDI) of boys and girls from experimental E1, E2, E3 and control K1, K2, K3 groups. It was found that 25% of boys have a normosthenoid body type, 55% have asthenoid and 20% have pycnoid body type. In girls, body type indicators were: normosthenoid - 20%, asthenoid - 15%, pycnoid - 65%. The data of the experimental study showed that most boys and girls have asthenoid and pycnoid body type.

Table 12. *Dynamics of indices of physical development of girls with a low level of physical fitness for the period of pedagogical experiment (E3 – n=48; K3 – n=37)*

Parameters	Group	Before the experiment	After the experiment	Changes for the year	Statistical significance	
		$\overline{X} \pm Sx$	$\overline{X} \pm Sx$	$\Delta\overline{X}$	t	P
MGI, g/cm	E3	414.2±1.54	412.55±1.34	-1.65	3.13	<0.05
	K3	427.09±1.13	425.98±1.75	-1.11	2.10	>0.05
VI, ml/kg	E3	43.18±1.24	44.63±1.63	1.45	2.46	<0.05
	K3	42.3±0.83	43.23±1.29	0.93	1.82	>0.05
The Robinson index, c.u.	E3	100.3±1.67	99.34±1.54	-0.96	2.61	<0.05
	K3	102.52±1.61	102.06±1.13	-0.46	1.92	>0.05
HRRT, min	E3	2.64±0.76	2.5±0.6	-0.14	2.33	<0.05
	K3	2.67±0.89	2.6±0.7	-0.07	1.76	>0.05
PI, %	E3	46.43±1.93	47.3±1.24	0.87	2.27	<0.05
	K3	42.7±0.83	43.35±1.74	0.65	1.79	>0.05

The use of powerlifting in the process of physical education allows students in a short period of time to improve health, general and special physical fitness, functional indicators. In general, exercises with weights have a positive effect on the formation of the physique, improve the efficiency of organs and systems of the body. Powerlifting has a number of advantages: it gives a noticeable effect of training for several months, allows you to have an isolated effect on underdeveloped muscle groups and easy to dose the load. Powerlifting also promotes good health, the formation of special skills, strengthens the musculoskeletal system, promotes general physical development. It also has a positive effect on the female body. Powerlifting classes help to improve the functionality of the entire female body, not just individual muscle groups, increase its resistance to various factors and improve health. The introduction of powerlifting in the process of physical education is justified as one of the ways to improve physical development and functional fitness of students.

Improving the effectiveness of physical education classes in higher education demands following: increasing the amount of time for physical education classes; conducting classes at the most convenient time for students; material and technical equipment of sports and gyms; use of the most popular types of physical culture and health-improving activities; development of author's curricula and methods for the formation of special skills and abilities of students in the process of physical education, which take into account indicators of health, physical development and physical fitness.

4. Conclusions

The analysis of the dynamics of physical development of students gives grounds to claim that the implementation in physical education process of developed methods of forming special skills and abilities of students contributed to the change for the better of all studied indicators. As a result of the study, experimental data were obtained, which expand the idea of the possibility of improving the physical development, physical fitness and health of student youth. Indicators of the level of physical development,

motor fitness and functional state of the body of students did not differ significantly from the results of similar studies by other scientists.

The results of the experimental study confirmed the effectiveness of the developed method of forming special skills and abilities of university students during powerlifting classes. Creating pedagogical conditions for improving the strength abilities of boys and girls contributed to the effective training of powerlifting with the use of physical exercises of strength orientation. The effectiveness of the method of forming special skills and abilities of students in the process of powerlifting classes will increase significantly if the powerlifting classes will take into account the physical capabilities of students and the motivational focus of these classes.

According to the specified components the planning of loadings and algorithm of carrying out of training sessions on powerlifting must be based on: type and nature of strength exercises, the volume and intensity of the load, the number of repetitions and the amount of load, frequency of training sessions and duration of strength work, rest intervals, number and sequence of strength exercises, etc. The built algorithm allows to optimize training difficulties, to differentiate training loading, methods and principles of development of power qualities and to provide use of optimum dynamics of increase of power loadings. Giving students the opportunity to freely choose the type of physical activity, taking into account their motives, needs and interests changes the attitude of students to physical education and their own health, resulting in intensified physical culture and health activities.

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The Relationship between General Competency Belief and Historical Literacy Perception Levels of Faculty of Sports Sciences Students

Abdullah Yavuz Akinci[1]
[1]*Faculty of Sports Science, Süleyman Demirel University, Isparta, Turkey.*

Abstract

The aim of this study is to examine the relationship between the Faculty of Sports Science Students' general competency belief and their historical literacy perception level. In the center of this research, there are 463 students of Physical Education and Sports and Coaching and Sports Sciences Departments that have studied History in Süleyman Demirel University Sports Sciences Faculty; and the sample group consists 173 students who are selected randomly.

While collecting data, the researcher used a personal data form, General Competency Belief Scale developed by Jerusalem and Schwarzer (1992) and adapted into Turkish by Çelikkaleli and Çapri (2008) and Historical Literacy Perception Level Scale of Uluçay (2019). The data obtained is analyzed via a personal computer. While analyzing data; the numbers, percentages, average values and standard valuations are used as descriptive statistical methods. For continuous variables of the work; Pearson correlation analysis is applied.

As a result, while a low level positive relationship was found between the students' general competency beliefs and the perception sub-dimension of history literacy sub-dimension and attitude levels of objectivity sub-dimension, it was observed that there was no significant relationship between the attitude levels in the consistency sub-dimension, and there was a medium-level positive relationship in the total perception level. It is thought that this situation is due to the positive effects on the students by transferring historical information such as the development of sports branches, individuals playing an important role, events and achievements in the relevant curriculum programs, and an examination practice that prioritizes sportive skills and individual competency in the selection of sports sciences faculty students.

Keywords: General competency belief, historical literacy, physical education and sports.

1. Introduction

In the development of societies; it is known that education is very important in raising competent individuals who can think in all areas of life, process information, make their own decisions and aim for perfection.

General competency; that is one of the important notions of Social Cognitive Theory, can be expressed as a person's organizing and concluding abilities' perception to plan to reach his aim. General competency belief is so important for all lessons, but history has a vital importance in terms of students' motivation problems.

Therefore, in order to create an efficient learning environment, it is necessary to eliminate the questions about what history is and why it should be learned.

Bandura (1995; 1986) defines competency belief as not the amount of skills individuals have, but the belief about how much an individual can fulfill any skill he has under different conditions and for different purposes; on the other hand, in another definition, it is handled as a person's belief in his capacities of organizing behaviors to reach his aim and managing it (1997).

General competency belief (Bandura, 1977), fed by basic and indirect experiences, verbal, physical and emotional cases; affects an individual's vital cognitive processes like cognitive and emotional motivation and making choices (Bandura 1997). On the other hand, competency belief that has different dimensions like individuals' making choices, struggling and insisting; thoughts and emotional reactions, affecting productivity level (Bandura, 1986), generalizability and robustness; is a multidimensional psychological factor (Bandura, 1995; 1986). Competency belief concept is related with achievable behaviors and obtainable results by Luszczynska *et al.* (2004); on the other hand, it was defined as demands from wide area or outside that leave the individual in lurch by Luszczynska *et al.* (2005). Individuals with a general competency belief have some basic features to increase their abilities to cope with challenges. In their reactions to stressful cases, a specific stability that provides competency belief's persistence occurred (Schwarzer&Jarusalem,

1995; Schwarzer, 1994). When general competency belief's positive effect on students' success is examined; it can be said that it creates a positive sign on teaching History (Yılmaz, 2009). On the other hand (Tschannen-Moran *et al.*, 1998) suggested that to make the results more meaningful, they should be more included in practice processes and learn by applying and experiencing.

History is a series of written explanation of what happened in the past and how it resulted. History is a field that is internally open to comment and an argument related to the past; and this argument among the historians can be about between the past and present; or the present and future. The main purpose of history teaching is not changing the society or social change. History is taught not because it changes society, but because it changes the perspective of the World. Safran (2019) explained history like 'it is in the past, in our minds, in archives, in historical relic and documents, everywhere history affects today'. Investigating, analyzing and commenting on historical cases from different points of views obviously puts forth that history teaching does not depend on memorization. Starting from here, we can say that historical thinking abilities should be applied in history classes, furthermore students with historical literacy should be grown. Dilek (2007) describes historical literacy as 'qualifications to be improved to understand the history, commenting on and evaluating historical cases and making connections between the past and today. On the other hand, Car (1993) described it as 'a nonstop interaction process between the historian and the phenomenon; a nonstop dialogue between today and the past. Historical information that depends on remembering and memorizing historical cases; not only makes students gain historical literacy, but also informs them about important people that took efficient part in historical cases; and also dates, places, reasons and results of them (Cooper, 1995). Chronological thinking that makes students systematic while building their own historical back ground, is mentioned as a strong bridge helps them build reason-result connections and a device helps them to analyze historical processes (Ravitch, 1989). Carr (2018) presents determinism as a belief that each case has a reason and if they do not change, a different result doesn't occur; says that everything changes for a reason. And again, during this process, the difference between the reality and hypothesis', proof and claim, specific proof end general claim must be differentiated (Reed, 1989).

According to Literature review done by researcher, there are works examining general competency belief (Dere Çiftçi, 2015, Capri, Güler 2018, Demir, Köstereliоğlu 2015, Koç *et al.* 2018, Çelikkaleli & Akbay 2013) and literacy level (Dikmenli 2015, Uluçay 2019, Karaman 2016); but, there is no study on the relationship between the general competency beliefs of sports sciences students and their historical literacy perception levels. University students create their own system of values, make personal and occupational plans and decide according to their ethic values; that's why it is a vital process. This study aims examining the relation between students' general competency beliefs and historical literacy perception levels.

2. Method

2.1. Model of the study

This study is done by descriptive and relational scanning model. These scanning models can be described as 'models aiming at determining the level of coexistence of Exchange between two or more factors' (Karasar, 2007).

2.2. Creating Volunteer Groups

In the population of this research there are 463 students of Physical Education and Sports, Coaching and Sports Sciences Departments that have studied History in Süleyman Demirel University Sports Sciences Faculty; and the sample group consists 173 who are selected randomly.

Table 1: *Participants' demographic features*

	Variables	**N**	**%**
Age	18-20	84	48.6
	21-23	66	38.2
	24+	23	13.3
	Total	**173**	**100**
Gender	Female	102	59
	Male	71	41
	Total	**173**	**100**
Department	Physical Education and Sports	56	32.4

	Coaching	24	13.9
	Sports Sciences	93	53.8
	Total	**173**	**100**
Class	1	60	34.7
	2	46	26.6
	3	24	13.9
	4	43	24.9
	Total	**173**	**100**

When Table 1 is examined, 48.6% of the participants are between the ages of 18 and 20, 38.2% are between the ages of 21 and 23, and 13.3% are between the ages of 24 and over. It is seen that 59% of the participants are female and 41% are male. It is observed that 32.4% of the participants are in the Physical Education and Sports Teaching department, 13.9% in the Coaching department and 53.8% in the Sports Sciences department. It is observed that 34.7% of the participants are in the first grade, 26.6% in the second grade, 13.9% in the third grade and 24.9% in the fourth grade.

2.3. Data Collection Techniques

Personal information form, general competency belief and historical literacy perception scales are used to collect data in the study.

2.4. Personal Information Form

It contains four questions in order to obtain information about the age, gender, department and grade of the participants.

2.5. General Competency Belief Scale (GCBS):

The adaptation studies of the General Competency Belief Scale developed by Jerusalem and Schwarzer (1992), into Turkish were carried out by Çelikkaleli and Çapri (2008). The scale, which consists of 10 items and is a Likert-type measurement tool, is scored as 1-Not Correct, 2-Somewhat Correct, 3-More Accurate and 4-Totally Correct. In the validity and reliability studies conducted by Çelikkaleli and Çapri (2008), they stated that the measuring tool consists of one dimension. In addition, in the reliability studies of the scale, the internal consistency coefficient was calculated as .87 and the test-retest correlation coefficient was calculated as .92. The high scores obtained from the measurement tool are considered to be high in general competency beliefs. The internal consistency coefficient of the measuring tool is calculated as .87 from the data collected in this study.

2.6. Historical Literacy Perception Scale (HLPS):

It was developed by Uluçay (2019) in order to determine the students' Perception of Historical Literacy. The scale, which consists of 12 items and is a Likert type, is scored as 1-Strongly Disagree 2-Disagree 3-Rarely 4-Agree and 5-Strongly Agree. It is stated that the scale includes 3 sub-dimensions: Perception, Objectivity and Consistency. The original scale was developed by applying it to 298 pre-service teachers studying in the 3rd grade of different undergraduate programs, and the Cronbach Alpha value of the scale was determined as 0.66.

2.7. Statistical Analysis

Application of the Kolmogorov-Smirnov test is only one of the methods used to examine the state of normality. The skewness and kurtosis distributions according to the statistics of the data obtained in the study are given in Table 2.

Table 2. *Skewness-Kurtosis and Kolmogorow-Smirnov Test Significance Level Results of Participants' Scale Scores*

	N	**Skewness**	**Kurtosis**	**p**
General Competency Belief	173	-.659	-.182	.000
Perception towards the Perception Level of Historical Literacy	173	.100	.200	.000

Objectivity towards the Perception Level of Historical Literacy	173	-.778	.155	.000
Consistency towards the Perception Level of Historical Literacy	173	.374	.580	.000
Total Attitude towards the Perception Level of Historical Literacy	173	-.171	.727	.003

Considering the results of the Kolmogorov-Smirnov test, it is observed that the scores of the participants in the general competency beliefs and historical literacy perception scales and deviations from normality are at significant levels (Table 2). When the normal distribution curves are examined, it is seen that there are no excessive deviations from the normality. In the literature, George and Mallery (2016) explained that the values of skewness and kurtosis are ideally within ± 1, while Demir *et al.* (2016) explained that these values are in the range of ± 2 as a suitable condition for normality. In the light of this information, it was decided to use parametric statistical analysis tests. The data obtained in the study were analyzed in computer environment. Number, percentage, mean and standard deviation were used as descriptive statistical methods in the evaluation of the data. Pearson's correlation analysis was applied between the continuous variables of the study.

3. Findings

Table 3: *Descriptive Statistics of Scores Obtained from Scales*

	N	Min.	Max.	X±Sd
General Competency Belief	173	19.00	40.00	32.289±5.371
Perception Towards the Perception Level of Historical Literacy	173	3.00	15.00	10.069±2.340
Objectivity towards the Perception Level of Historical Literacy	173	13.00	30.00	24.884±3.775
Consistency towards the Perception Level of Historical Literacy	173	3.00	15.00	8.590±2.308
Total Attitude towards the Perception Level of Historical Literacy	173	28.00	59.00	43.543±5.672

When Table 3 is examined, it is understood that the General Competency Beliefs of the Faculty of Sports Sciences students are 32.289 ± 5.371. Among the subtitles of historical literacy perception level, it is seen that perception is 10.069 ± 2.340, objectivity was 24.884 ± 3.775, consistency was 8.590 ± 2.308 and the total score of perception level of history literacy is 43.543 ± 5.672.

Table 4: *The Relationship Level between Participants' General Competency Beliefs and Perception Levels of Historical Literacy*

		1.	2.	3.	4.	5.
1. General Competency Belief	**r**	1				
	p					
	n	173				
2. Perception towards	**r**	,241**	1			

the Perception Level of Historical Literacy	**p**	,001				
	n	173	173			
3. Objectivity towards the Perception Level of Historical Literacy	**r**	,284**	,383**	1		
	p	,000	,000			
	n	173	173	173		
4. Consistency towards the Perception Level of Historical Literacy	**r**	,131	,003	,019	1	
	p	,087	,967	,809		
	n	173	173	173	173	
5. Total Attitude towards the Perception Level of Historical Literacy	**r**	,341**	,668**	,831**	,420**	1
	p	,000	,000	,000	,000	
	n	173	173	173	173	173

When Table 4 is examined, the general competency belief levels and historical literacy perception levels of the participants are low between the subtitles perception (r = .241, p = .001) and objectivity (r = .284, p = .000), a moderately positive correlation is found between the total attitude towards historical literacy perception level (r = .341 **, p = .000). However, there is no significant relationship between the general competency belief levels of the participants and the Consistency sub-dimension of the historical literacy perception level (r = .131, p = .087).

4. Discussion and Conclusion

In this study, the relationship between general competency beliefs and historical literacy perception levels of the students who study in the departments of physical education and sports teaching, coaching and sports sciences within the Faculty of Sport Sciences at Süleyman Demirel University and who have taken history courses according to age, gender, department and grade levels have been examined.

It is thought that the process of university education, which is one of the most important stages that will affect the academic life of individuals today, can affect the academic achievements of individuals and their general and academic competencies throughout their lives in transferring these achievements to their lives and history lessons in the curriculum of university education, historical characters and events can affect the knowledge and skills of today's individuals in the future.

It is determined that the subtitles of general competency beliefs, historical literacy perception levels and total scores of the students of the Faculty of Sports Sciences are above the average (Table 3). In the literature review conducted by the researcher, Koç *et al.* (2018), they found in their study that the general competency beliefs of the candidates who took physical education and sports sciences special talent exam were above the average. In another study, Yılmaz (2009) found that, in his study with social studies teacher candidates, perceptions of general competency in history teaching were generally high. On the other hand, Çelikkaleli and Akbay (2013) reported in their study that university students' general competency beliefs were moderate. Again, in the studies examining the perception levels of history literacy in the literature, Ulusoy (2009) reported that high school students liked history lessons. In another study, Keçe (2013) stated that the Classroom Historical Roman Usage Techniques Used in Social Studies Teaching improved the students' history literacy levels. On the other hand, Dervişoğlu *et al.* (2015) revealed that students' perceptions of historical knowledge were low, and stated that students who thought they had sufficient historical knowledge compared themselves with their peers and expressed their passing grades in exams was not a conscious approach. In this study, it is thought that the reason why the scores of the students of the faculty of sports sciences are above average in their general competency beliefs and perception levels of historical literacy is that they consist of people with high sportive skills in terms of their department and that these individuals are influenced by the career development of the athletes whom they take as role models when choosing sports branches.

The general competency belief levels and historical literacy perception levels of the students of the Faculty of Sports Sciences are low between the subtitles perception (r = .241, p = .001) and objectivity (r = .284, p = .000), a moderately positive correlation has been found between the total attitude towards historical literacy perception level (r = .341 **, p = .000). However, there is no significant relationship between the

general competency belief levels of the participants and the Consistency sub-dimension of the historical literacy perception level (r = .131, p = .087).

When we look at the academic studies in the literature, it is seen that general competency belief is related to various variables such as individual achievement motive (Koç, Terzioğlu, & Kayalar 2018), job satisfaction (Çapri & Güler 2018), and professional competency (Yaman *et al.* 2013). Since historical thinking is an ability to understand history, to make comments about the past, to build a bridge between the past and the present and to develop historical consciousness, it is a way of thinking in determining the difference between historical fact and reality (Aslan *et al.* 2015), and since this idea can be understood properly, a study on this issue has arisen.

General competency level; academic success of an individual is the most important determinant of his / her future professional status, income and wealth levels. While (Spinath, 2012). Desivilya and Eisen (2005) show that general competency is related to individual motivation level, Schunk (1995) stated that general competency predicted in accordance with motivation and success, and found positive significant relationships between general competency and performance.

In addition, while solving the problems that individuals may encounter today and in the future; by evaluating beliefs, views, values, thoughts, goals of people who lived in the past and what they tried to achieve (Lee and Ashby, 2001); It is thought that events can be effective in understanding the cause and effect relationship in the historical process (Taylor and Young, 2003).

A positive relationship has been found between the attitude towards sports history lesson Akıncı (2020a) and the Turkish Education History course (Akıncı 2020b) and academic competency in the literature. He states that this situation stems from the academic development of university students who are in the transition to their professional lives, and their point of view regarding the importance of transferring these developments towards the development of new generations in their professional life processes. Whereas; Altunay-Şam (2007) stated that when the attitudes of pre-service teachers studying at different departments of education faculties towards history course were examined, the majority of students were aware of the importance of history and accepted its necessity. However, he also stated that another group consisted of memorizing names and dates, that the lessons taught in this field were also for memorization, they found history boring and monotonous, and that they did not like to study history. Based on this information, it can be interpreted that students with similar characteristics may change their perception of history depending on the faculties they study at.

As a result, a positive correlation has been found between the general competency and historical literacy perception levels of the students studying at the sports science faculty. It is thought that this situation is due to the positive effects on the students by transferring historical information such as the development of sports branches, individuals playing an important role, events and achievements in the relevant curriculum programs, and an examination practice that prioritizes sportive skills and individual competency in the selection of sports sciences faculty students.

5. Recommendations

1.Examination of the same research topic in different regions, different institution types, with different participants and with different research patterns will help to collect systematic information on the perception of history and contribute to the literature.

2.Research should be conducted on the different components that determine individuals' perception of history, such as popular culture, media, family, cultural and belief structure.

3.It is their material and spiritual culture that enables individuals to socialize as part of the culture they belong to. They learn about the culture of the society they belong to, establish a connection between the past and the present, and have an awareness of history. The way to do this is through history teaching. In order for students to create a positive and accurate perception of history, written history based on documents should be processed interactively with oral history resources.

4.Students studying at the Faculty of Sport Sciences, besides history; Studies should be carried out to determine the characteristics such as health, media, information, environmental literacy.

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Evaluation of the Effects of Menstrual Cycle on Postural Stability in Active Young Women

Özkan Güler[1], Azize Diedhiou Bingöl[2], Neşe Şahin F.[3] and Gülfem Ersöz[4]
[1,3,4]Ankara University Faculty of Sports Science Ankara Turkey.
[2]Sirnak University School of Physical Education and Sport Sirnak Turkey.

Abstract

Menstruation is considered as the primary biological factor between men and women. Many studies indicate that the prevalence of injury is higher in female athletes than in male athletes. In the previous studies, an association between postural stability and injury rate has been reported. The purpose of this study is to evaluate the stability of physically active women during different phases of the menstrual cycle. Young women who exercised regularly and had a regular menstrual cycle (n = 19, age: 20.4±1.2 years; height: 164.78±4.66 cm; body weight: 54.63±3.41; BMI: 20.11±0.97 menstruation: 28.47±1.26) participated in the study. The Menstrual cycle is divided into three different phases. The stability was measured in the early menstrual phase, the follicular phase, and the middle of the luteal phase. Postural stability index (PSI) and Limit of stability (LOS), tests were performed with the Biodex SD System (Biodex, Shirley, NY)..During the ovulation phase, according to LOS test results (p=0.016), a statistical difference was found between the three phases. According to this result, LOS values decreased in the ovulation phase compared to other phases. No difference was determined between anterior-posterior oscillation, mediolateral oscillation, and postural stability index scores and menstrual phases (p=0.34). It is observed that stability in women who perform active sports is affected by different menstrual phases. It can be said that the deterioration in stability is caused by the increase in sex hormones muscle and joint laxity during the ovulation phase.

Keywords: Balance, Mensturation, postural sway.

Introduction

The participation of women in sports activities is increasing every day. However, athletes and physically active individuals often experience lower limb injuries [1]. The number of knee and ankle injuries that occur in women during sports activities is increasing, and the main underlying factor of these injuries is defined by increased instability and postural sway [2, 3]. Studies indicate that female athletes are 2-8 times more likely to experience a non-contact ACL injury than male athletes at the same competition level [1, 4-7]. In various studies, the prevalence of lower extremity injuries in female athletes than in male athletes has been associated with anatomical differences, body composition, muscle strength, muscle activation pattern, and hormonal changes in the menstrual phase [8-11]. It has also been stated that menstrual disorders in female athletes also affect the musculoskeletal system and are closely related to the increase in injury risk[12]. Also, it is emphasized by researchers that hormonal changes during menstruation have effects on tendons and ligaments[13-17]. Estrogen and progesterone receptors are located in skeletal muscles, bones ligaments and nervous system.

For this reason, sex hormones affect the structure and function of these tissues [18]). Alpha and beta receptors found in tendons, ligaments, and skeletal muscles have been reported to affect neuromuscular coordination during menstruation [19-21]. In another study, it was observed that estrogen could affect the female neuromuscular system either directly or indirectly through these receptors [22]. In a study, it was reported that estrogen causes laxity in the tendon ligaments and joints as a result of peak concentration during the ovulation phase of the menstrual phase (Lee et al. 2014). Besides, due to the effects of the hormone estrogen on the tendon and ligament laxity, female athletes have been reported to have a higher risk of injury [23, 24]. In another study, it was stated that the sportive performance of laxity in muscle tone, tendons and ligaments negatively affects balance and stability [25-27].

Postural stability is defined as being able to hold the body centre of gravity within the centre of support to prevent falls and complete desired movements [28]. To maintain balance, feedback comes to the brain from various systems such as visual, vestibular, and somatosensory systems [29]. Within these systems, the somatosensory system is considered to perform the most crucial task [30]. The somatosensory system supports the maintenance of stability by providing feedback from ligaments in joint capsules, nerves in the

skin, and muscle tissue. Thanks to the inputs it receives continuously, this feedback system enables difficult and complicated movements to be performed smoothly [31]. Fluctuations in sex hormones during the menstrual cycle cause laxity in tendons and ligaments. Laxity in the tendons and ligaments affects the stability of the joints.

On the other hand, instability of the joints causes postural stability to deteriorate. The deterioration of postural stability increases the risk of falls and injury in individuals. In this direction, the purpose of the study is to examine the effects of the menstrual cycle on balance in active young women.

Method

The study involved 19 women who are actively exercising (age: 20., 47±1.07 height: 164.78±4.66; body weight: 54.63±3.41 BMI: 20.11±0.97 menstruation:28.47±1.26) and had not suffered any knee and wrist injuries in the past six months. The Menstrual cycle is divided into three different phases. Participants were asked to report their menstrual cycle history in the last three months, and the menstrual cycle phases of each participant were determined according to the information received. Women with irregular menstrual cycles were not included in the study. Participants were provided to come to the laboratory on three different days of their menstrual cycles. The day of menstruation was accepted as the first day, and the menstrual cycle was assessed as 28 days. The first test tests of the participants were conducted on the second or third day of the menstrual cycle when estrogen and progesterone hormones were at low levels. The second measurement was performed on the fourteenth day of ovulation, and the last stability test was performed on the twenty-first day at the luteal phase. For the learning effect of being minimum, three measurements were performed on each test day.

Postural stability index (PSI) and Limit of patience tests were measured with Biodex SD (Biodex Shirley NewYork) stability system to determine the stability of the participants. Biodex system allows slope up to 20 degrees and calculates three measurements OSI, MLI, API). OSI test is performed on a dynamic platform with eyes open on double feet. The stability of the platform ranges from 1 to 12. While 12 represents stability, 1 represents instability. The stability level is set to 6. The PSI test consisted of 20 seconds of standing, 10 seconds of rest, and three repetitions. During the trial, participants were asked to keep their hands on their waists. A high score in the OSI test indicates a low stability level.

In the Limit of Stability test, the platform is set to be static. In the Limit of stability test, participants were asked to swing at eight different direction targets shown on the screen most accurately as soon as possible. The participant held his hands at his waist, swinging according to the directions on the screen without bending knees.

Table 1. *Descriptive information of the participants*

	Age	Height	Body Weight	BMI	MensAvg
Mean(SD)	20,47±1,07	164,78±4,66	54,63±3,41	20,11±0,97	28,47±1,26

SD: Standard Deviation; BMI: Body Mass Index; MensAvg: Average number of days of menstrual phase

Statistics

A within-subjects, repeated-measures analysis of variance was used to determine of significant differences in stability values throughout the subject's menstrual cycle. Differences were considered statistically significant at a level of 0.05 or less. All statistical analyses were performed using a personal computer and SPSS version 20 for Windows software(SPSS Inc., Chicago, IL).

Results

According to the LOS test results, a statistically significant difference was determined between menstruation, ovulation, and luteal phases (p=0.016). While the LOS score was 66,52 in the menstrual phase, it was 57,42 in the ovulation phase and 60,78 in the luteal phase. When the intra-group difference was evaluated, a statistical difference was observed between the menstrual phase and the ovulation phase.

Table 2. *Results of the postural stability and Limit of stability balance tests of the participants in three different menstrual phases (Menstrual, ovulation, luteal).*

	Menstruation	Ovulation	Late Luteal	*f*	*P*	
OSI	0,674±,039	0,795±,047	,779±,044	3,755	0,34	None
APSI	0,463±,146	0,521±,154	0,505±,14	1,278	0,289	None
MLSI	0,426±,14	0,478±,178	0,489±,166	1,270	0,291	None
LOS	66,52±10,32	57,42±12,13	60,78±8,67	5,508	0,016*	1>3>2**

OSI: Overall Stability Index; API: Anterior-posterior stability index; MLI: medio-lateral stability index; LOS: Limit of Stability

* There is a significant difference between menstruation, ovulation and luteal phase according to LOS balance test results.

** The difference according to LOS test results is due to the ovulation phase.

Discussion and Conclusion

The menstrual cycle causes psychological and physiological changes in women, and as a result, their physical activity and performance can be affected positively or negatively[32]. In the current study, stability measurements were carried out in three different phases of the menstrual cycle of physically active women. The main finding of the study was that the Limit of postural stability values of female athletes during the ovulation phase of menstruation (14th day) was negatively affected statistically ($p<0,016$). Stability skills include integrated and coordinated operation of sensory systems (proprioceptive, visual and vestibular organ) nervous system (information processing) and motor system (movement control). Change in any of these systems can affect stability. Estrogen and progesterone hormones in bones, skeletal muscles, ligaments, and nervous system can affect these systems structurally and functionally. As a result of the current study, it was found that the stability performances of female athletes in the ovulation phase were affected negatively.

When the literature is reviewed, conflicting results are reported in studies in which the menstrual cycle affects stability. The menstrual phase is a physiological condition that repeats itself in 28-day intervals. The menstrual phase is divided into three main phases. These phases are follicular, ovulation, and luteal. In the ovulation phase, estrogen and progesterone hormones peak. This is associated with ligament laxity of sex hormones [33]. In a well-controlled study involving eight women with regular menstrual cycles, it was reported during the ovulation phase that there was a low-tension reflex response in the hip muscles [34]. Also, it was found in a study specifically investigating the effects of estrogen that female runners had more laxity in knee ligaments during the ovulation phase than during the menstruation phase [35]. Knee and ankle stability are structures that make significant contributions to maintaining balance. Therefore, it can be thought that the physiological and mechanical changes that take place in these structures can negatively affect the balance system. In a study conducted in active young women, it was reported that plantar fascia laxity increased in the ovulation phase compared to other phases when other phases were compared. In the same study, increased plantar fascia activity and serum estrogen levels were found to cause impairment in stability ([26]. In a study in which the effects of menstrual cycle on the performance of female tennis players were examined, it has been reported that postural oscillations increase, stability performance, and hip muscle strength deteriorate in the seventh and fourteenth days of the menstrual cycle [36]. Especially with increasing sex hormones in increasing plantar fascia laxity during ovulation, it is observed that it causes deterioration in the knee and joint stability, and as a result, impaired balance performance.

However, contrary to these studies, it is reported in some studies that there is no change in postural stability during the entire menstrual cycle [37]. In a study conducted on healthy women, it is stated that the menstrual cycle does not affect ankle stability and balance ability [38]. In this study, however, balance skill was measured five days before and after ovulation. No measurement was performed during the ovulation phase when estrogen peaked. The reason why there is no difference during menstruation can be explained that it is due to the dates when the phases are evaluated. In a study that examined women with and without premenstrual symptoms, it was found that the menstrual cycle affects balance and kinesthesis in women

with premenstrual symptoms. In the same study, it was found that it has no effect on women without symptoms [39].

Similarly, it was found in the study examining the effects of oral contraceptives on balance ability that the group using oral contraceptives demonstrated better stability performance in the menstrual cycle than the control group [40]. In the literature, different studies have reported that aerobic exercises and oral contraceptives reduce menstrual symptoms[41] As a result, there are mixed results in the literature regarding the effects of different menstrual cycles. Methods of measurement may have caused this difference, purposes of determining the menstrual cycle, premenstrual syndrome, or the participants' level of exercise.

The main limitation of this study is the determination of menstrual cycle phases according to the participants' notifications. In future studies, estrogen, progesterone, or testosterone from sex hormones can be detected by blood or saliva, and hormone changes in the menstrual cycle can be monitored. As a result, women need to be aware of changes in their muscles and tendons and take measures against the deterioration in their stability. In particular, impaired balance skills are associated with lower extremity injuries and risk of falls. For this reason, it is recommended that exercises that improve balance performance be included in activities performed throughout the day.

Acknowledgments:

This study was conducted in Ankara University Faculty of Sports Science performance laboratories.

Conflict of Interest

There is no conflict of interest

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COVID-19 Fear in Sports Sciences Students and Its Effect on Academic Procrastination Behavior

Yunus Sinan Biricik[1] and Mehmet Haluk Sivrikaya[2]
[1,2]Asist. Prof, Faculty of Sport Sciences, Atatürk University, Erzurum, Turkey.

Abstract

This study aims to examine the COVID-19 fear levels of the students of the faculty of sports sciences and their academic procrastination behavior in terms of various variables and to determine the correlation between them. With a total of 342 participants, the sample of the study consists of 129 female and 213 male students studying at the Faculty of Sports Sciences. Data collection tools used in the study are Fear of COVID-19 Scale (FCV-19S) and Academic Procrastination Scale (APS). The research was conducted following the relational screening model which is a subgroup of the general survey model. The normal distribution, descriptive statistics, t-test, Anova test, Post-hoc test, Pearson correlation coefficient, and regression analysis were used in the statistical evaluation of the data. Findings revealed that there was a weak positive correlation between COVID-19 fear and academic procrastination behavior. Moreover, the results also revealed that students who worked out during the pandemic had less fear of COVID-19, however, this did not affect students' academic procrastination behavior.

Keywords: COVID-19, Academic Procrastination, Physical Exercise.

1. Introduction

Coronavirus (COVID-19) disease was first detected in Wuhan, China in December 2019, and then it became an issue as a pandemic across the world. COVID-19 pandemic, which became a global issue within the first months of 2020, spread almost everywhere in the world and had a big negative impact on most activities of the countries. The only solution to this deadly virus is social distancing and worldwide lockdown. Nearly all countries have adopted this lockdown policy in an attempt to lower the spread of COVID-19 [1] . The virus, which can be lethal and quickly spread from person to person, was first detected in Turkey on 11 March 2020. The universities in Turkey are affiliated to the Council of Higher Education (CoHE). In the beginning, CoHE announced that the universities would be closed for three weeks on 16 March 2020. Then, they ordered the universities to conduct distance learning and stated that there would be no face-to-face teaching in the spring semester of the 2019-2020 academic year. In many other countries, just like in Turkey, the COVID-19 pandemic pushed education to go through similar transformations. The pandemic caused sudden and rapid changes in the higher education environment. In the past, educational institutions have never been subjected to a sudden period of distance learning by using digital technological tools [2]. However, all these precautions affected billions of students negatively by depriving them of their education.

Educational managers strove to create solutions through distance learning to meet students' educational needs. Educators had to adapt their knowledge in the traditional environment to the digital environment rapidly to conduct their classes by using distance education tools. In this process, some have lost their internship opportunities, practice-based classes could not be implemented, and academic lives of students have been changed in various aspects, including the need to learn and use new technologies in the learning process [3]. Undoubtedly, this sudden and unavoidable change had a massive impact on students' education.

A limited number of studies have been carried out on the mental health of students conducted since the beginning of the pandemic. Along with the changes in university operations due to the COVID-19 pandemic, it is likely to observe an increase in the students' fear, anxiety, and stress levels. It is expected that precautions such as staying at home and strict isolation will affect students' mental health. Meanwhile, students who had to return to their homes due to the postponed face-to-face classes may also have experienced anxiety and fear for the health of their families [4]. Moreover, being exposed to news about COVID-19 cases in visual and social media has increased the anxiety and fear levels of individuals [5]. It is expected that university students, who actively use social media, will be highly affected by this factor.

Academic procrastination is an emotional state generally associated with poor mental health. Within this emotional state, causes such as anxiety, stress, and diseases are considered to be highly effective in creating academic procrastination [6]. Many studies indicate a positive correlation between academic procrastination, aggression and symptoms of depression [7, 8]. Academic procrastination refers to postponing and the behavioural tendency to postpone the activities and behaviours necessary for the educational processes in the school environment without any reason. Similarly, it has been also associated with lower academic performance, high levels of stress, anxiety, fear, and despair in the academic environment [9, 10]. A great number of academic studies on procrastination were conducted in the context of education, on behaviors of students in academic positions, and on schedule development recommendations for reducing academic procrastination behavior. This is specified as a highly widespread issue that has a clear negative correlation with academic performance, and physical and mental health [11].

It is predicted that negative emotional states such as fear, anxiety, and worry will have an impact on students' academic procrastination behavior in relation to their education life. Accordingly, the purpose of this study is to examine the COVID-19 fear levels of the students of the faculty of sports sciences and their academic procrastination behavior as well as to determine the correlation between them. Furthermore, the study also examined whether exercising behaviors of the students studying sports sciences in this period had an effect on both their COVID-19 fear levels and academic procrastination behavior.

2. Method

2.1. Research Goal

This study aims to examine the COVID-19 fear levels of the students of the faculty of sports sciences and their academic procrastination behavior and to determine the correlation between them. Accordingly, the students of the faculty of sports sciences were asked to provide information about their gender, age, branch, and exercise patterns at places such as their house, outdoor areas, or gym; thus, the effects of these variables on their COVID-19 fear levels and academic procrastination behavior were examined.

2.2. Research Model

The present research, which determined the correlation between sports sciences students' COVID-19 fear levels and their academic procrastination behaviors, was conducted using the "relational screening model". Relational screening models are used "to determine the presence and/or degree of change between two or more variables" [12].

2.3. Participants

The sample of the research consists of 342 students studying at different branches of Faculty of Sports Sciences at Atatürk University in the province of Erzurum. Of the participants, 129 (37.7%) are female, and 213 (62.3%) are male. An online survey was prepared using "Google Form", and all 550 students studying at the said faculty were invited to participate in the survey via email and social media; 342 students responded to the survey. This figure shows that 62% of the target group was reached.

2.4. Data Collection Tools

Fear of COVID-19 Scale (FCV-19S) and Academic Procrastination Scale (APS), and Personal Information Form were used as data collection tools in the research.

Fear of COVID-19 Scale had been developed by Ahorsu et al. (2020) and adapted into Turkish by Bakioğlu et al. (2020) [13, 14]. It consists of one dimension and 7 items. The scale has no reverse items. The items of the scale are scored using a five-point Likert scale ranging from "I strongly disagree" to "I strongly agree". The scores that can be obtained from the scale range from 7 to 35. A high score obtained from the scale means that the individual experiences a high level of Coronavirus fear. According to the results of the reliability analysis conducted by Bakioğlu et al. (2020), Cronbach's alpha reliability coefficient of the scale was found to be .88. The Cronbach's alpha reliability coefficient of the Fear of COVID-19 Scale was found to be .78 in the present study.

Academic Procrastination Scale was developed by Çakıcı (2003) to measure the students' academic procrastination behaviour [15]. It consists of 19 statements, including 7 positive and 12 negative statements. The items of this scale are scored using a five-point Likert scale ranging from "This does not reflect me at all" to "This completely reflects me". While the minimum score that can be obtained from this scale is 19, the maximum score is 95. The high score obtained from the scale shows that students exhibit academic

procrastination behavior. According to the result of the reliability analysis conducted by Çakıcı (2003), Cronbach's alpha reliability coefficient of the scale was found to be .92. The Cronbach's alpha reliability coefficient of the Academic Procrastination Scale was found to be .84 in the present study.

2.5. Data Analysis

The collected data were imported into the database of the Statistical Package for Social Sciences (SPSS 22.0) software and evaluated using the required statistical analyses. The test of normality was conducted to determine whether the data were normally distributed or not. The results of the tests of normality revealed that the data showed normal distribution; thus, parametric tests were performed (Table 1). Therefore, T-test was performed for the comparison of the two groups, ANOVA was performed for the comparison of more than two groups to determine the difference, and the Post-hoc test was performed to determine the source of the difference. Also, the Pearson correlation coefficient was calculated, and the regression analysis was performed to determine the correlation between COVID-19 fear level and academic procrastination behavior.

Table 1. *Descriptive Statistics and Normal Distribution*

Variables	N	Min.	Mak.	Mean	SD	Skewness	Curtosis
Fear of COVİD-19	342	1.00	5.00	2.46	.928	.481	-.015
Academic Procrastination	342	1.89	5.00	2.93	.466	.794	1.241

As can be seen in Table 1, the skewness and kurtosis coefficients of the scores obtained from the scales range between -2 and 2. A kurtosis value between -1.0 and 1.0 is considered ideal for most psychometric purposes, however, a value between -2.0 and 2.0 can also be accepted depending on a certain application [16]. It can be seen that the obtained data (-2, +2) have a normal distribution, thus, the parametric tests should be performed.

3. Results

Table 2. *The COVID-19 fear levels of students in the study group based on various variables and their comparison in terms of their academic procrastination behavior*

Scale	**Gender**	**n**	**X**	**Sd.**	**t**	**p**	Difference
Fear of COVID-19 Scale	Female[1]	129	2.73	,775	4.160	**.000**	1>2
	Male[2]	213	2.30	.978			
	Age	**n**	**X**	**Sd.**	**F**	**p**	Difference
	17-19	51	2.27	.697	1.935	,146	No
	20-22	192	2.45	.967			
	23 and more	99	2.58	.945			
	Branch	**n**	**X**	**Sd.**	**t**	**p**	Difference
	Individual Sports	177	2.48	1.000	2.334	.127	No
	Team Sports	165	2.34	.831			
	Exercise Behavior	**n**	**X**	**Sd.**	**t**	**p**	Difference
	Yes[1]	228	2.38	,911	-2,363	**,019**	2>1
	No[2]	114	2.63	,944			
Scale	**Gender**	**n**	**X**	**Sd.**	**t**	**p**	Difference

Academic Procrastination Scale	Female	129	2.90	,444	-,757	,264	No
	Male	213	2.94	,479			
	Age	**n**	**X**	**Sd.**	**F**	**p**	Difference
	17-19[1]	51	2.75	,416	1.317	**,002**	3>1
	20-22[2]	192	2.93	,495			
	23 and more[3]	99	3.03	,402			
	Branch	**n**	**X**	**Sd.**	**t**	**p**	Difference
	Individual Sports	177	2.97	,530	1.839	.067	No
	Team Sports	165	2.88	,381			
	Exercise Behavior	n	**X**	**Sd.**	**t**	**p**	Difference
	Yes	228	2.93	.503	,168	,867	No
	No	114	2.92	,382			

As can be seen in Table 2, in the study group, the variable of gender was found to have a statistically significant effect on the students' perceptions of the Fear of COVID-19 Scale (t=4.160; p<0.05). The COVID-19 fear levels of the females ($\bar{x}$=2.73) are higher than those of males ($\bar{x}$=2.30). Also, a significant difference was determined in the variable of the exercise behavior (at a house, outdoor area, gym, etc.) during the pandemic (t=-2.363; p<0.05). The COVID-19 fear levels of the students not exercising during the pandemic ($\bar{x}$=2.63) are higher than those students not exercising ($\bar{x}$=2.38).

As for the academic procrastination scale scores of students in the study group, the variable of the age was found to have a statistically significant effect (F=1.317; p<0.05). According to the post-hoc test performed, the students at the age of 23 or above have a higher level of academic procrastination behavior ($\bar{x}$=3.03) compared to students at the ages between 17 and 19 ($\bar{x}$=2.75).

Table 3. *The Correlation Between COVID-19 Fear and Academic Procrastination Behavior*

	Fear of COVİD-19	Academic Procrastination
Fear of COVİD-19	1	,127
		,019
Academic Procrastination		1

According to the correlations between the scales given in Table 3, it can be determined that there is a weak positive correlation between COVID-19 fear and academic procrastination behavior (p<0.05, p= 0.019, r=-0.127). The results of the regression analysis that tests the effect of COVID-19 fear on academic procrastination behavior are given in Table 4.

Table 4. *Results of the Regression Analysis Testing the Effect of COVID-19 Fear on Academic Procrastination*

	B	t value	p value	R2	Adjusted R2	F	Sig.
Sabit	2,777	38,986	,000	,016	,013	5,530	,019
Fear of COVİD-19	,064	2,352	,019				

According to the results of the regression analysis, it can be seen that COVID-19 fear has a weak significant effect on academic procrastination behavior. It is determined that COVID-19 fear explains 1.6% of the academic procrastination behavior ($p<0.05$). The following regression model was used in the analysis.

Academic Procrastination = 2.777-0.064 * Fear of COVİD-19

4. Discussion and Conclusion

The studies have reported that pandemics may cause various psychological effects such as anxiety, fear, and worry on university students [17]. It is expected that these negative psychological effects will negatively impact the students' behaviors regarding their education life. The main purpose of this research is to evaluate the psychological state of university students studying at the Faculty of Sports Sciences during the ongoing COVID-19 pandemic and to examine the impact of this situation on their academic procrastination behavior.

The present study revealed that sports sciences students have experienced medium-level fear in relation to the COVID-19 pandemic. The study also found that these students have exhibited academic procrastination behavior above the average level ($x=2.93$). A study conducted with university students reported that students experienced more health anxiety during the swine influenza pandemic and this was associated with their increasing fear [18]. Considering the variable of gender, female students were observed to experience more fear compared to male students according to their scores on the Fear of COVID-19 Scale. In a study on the fear experienced due to the pandemic, it was determined that females have higher levels of health anxiety compared to males. This finding is consistent with the findings of the studies revealing that females have higher levels of fear and anxiety than males [19, 20]. Another study reveals that male and female students experience similar stress and other negative emotions due to the pandemic [21].

Another finding of the present study is about the exercising behavior of sports sciences students during the ongoing pandemic period. It was found that students exercising in places such as a house, outdoor areas, or a gym experienced lower levels of COVID-19 fear compared to students not exercising. Several facilities like gyms, swimming pools, fitness and dance halls, outdoor recreation areas, and children's parks were temporarily closed in Turkey and many countries due to the ongoing pandemic; thus, the situation of limited physical exercise pushed people to find alternative locations for exercise. According to the findings of the present study, 67% of sports sciences students ($n=228$) exercised in this period under these unusual circumstances. The positive effects of regular physical activity on mental health is indisputable. The relationship between COVID-19 and physical exercise behavior has been studied in the literature, and the importance of regular exercise during the COVID-19 pandemic period has been highlighted [22]. Individuals who exercise regularly show fewer symptoms of depression and anxiety. Thus, it was suggested that regular physical exercise is beneficial and has a positive effect on mental disorders [23]. Furthermore, it has been reported that reducing levels of physical activity have a negative impact on the psychological state, and it is associated with the negative psychological state [24]. Moreover, the studies also reveal that physical activity has a potential role in improving mental health and preventing symptoms of mental disorders such as depression and anxiety [25, 26].

According to the distribution of scores of academic procrastination scale, no significant difference was observed by the variables of gender, branch, and exercise behavior. However, according to the age variable, students at the age of 23 and above have higher scores of academic procrastination levels compared to students at the ages between 17 and 19 ($\bar{x}=3.03$; $F=1.317$; $p<0.05$).

The present study examined the relationship between COVID-19 fear and academic procrastination behavior and found a positive weak correlation between these two scales. This can be interpreted that the COVID-19 fear level has a weak effect on academic procrastination behavior. According to the results of the regression analysis conducted in this study to determine the impact of COVID-19 fear on academic procrastination, COVID-19 fear was found to have a considerably low level of significant effect on academic procrastination behavior. Cao et al. (2020) determined a positive correlation between anxiety symptom levels of Chinese university students during the pandemic and COVID-19 related stress factors including their academic procrastination [21]. Satici et al., (2020) found a positive correlation between COVID-19 fear and uncertainty intolerance [27].

To conclude, it has been observed that stress, anxiety, and depression levels of students increased under the pressure of the COVID-19 pandemic, and meeting students' mental health needs has been an

urgent requirement. We should help university students get rid of their negative emotions by providing more social support and face the challenges caused by the pandemic in a positive attitude. Also, higher education institutions should develop programs to decrease university students' psychological pressures and help them overcome negative emotions such as fear, anxiety, and stress. It is interpreted that these efforts by universities will contribute to the students' performance during times of such crisis, and this will then contribute to their future education. Moreover, university counselling centers can create online platforms that enable students to receive social support when faced with unexpected circumstances and continue their social and academic lives with a positive attitude.

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Menstrual Cycle and Sporting Performance Perceptions of Elite Volleyball Players

Esin Ergin[1] and Alper Kartal[2]

[1,2] Assistant Professor Aydın Adnan Menderes University Sports Science Faculty Department of Movement and Training Aydin Turkey.

Abstract

The present study aimed to investigate menstrual cycle and sporting performance perceptions of elite volleyball players. The study was participated by 130 volunteering volleyball players who play in the Turkish Volleyball Sultans' League and the 1st League, aged 23,52□5,39 years, played an average of 71.31□85,71 times on the national team, have a sporting age of 13,11□5,79, train for 5,86□0,56 days a week, 3,23□1,24 hours a day with mean menarche age 13,36□1,62. The study employed a questionnaire form consisting of 25 questions about general and sporting performance before, during and after the menstrual cycle which was developed by the researcher upon receiving expert opinion. According to the study results; 61,5% of the participants described their general menstruation states as regular and 84,6% of them stated that they had menstrual problems due to sports. In addition, 58,5% of the volleyball players feel bad before menstruation while 52,3% feel themselves good during menstruation. Moreover, the responses show that menstrual periods of 46,2% of the participants sometimes affect their sports/training participation and 99,2% participate in competitions during this period. The volleyball players listed the problems they have during their menstrual periods as irritability (36,2 %) and anger (47,7%.); and 45,4% think that menstruation sometimes affects their sporting performance whereas 35,4% consider it does not. In conclusion, it can be said that female volleyball players do not experience such menstrual problems as delayed menarche, amenorrhea and oligomenorrhea and sports does not change menstrual period and that menstruation affects sporting activity rather psychologically.

Keywords: Volleyball, Menstruation, Menarche, Performance.

1. Introduction

While the popularity of competitive sports like volleyball is increasing as well as the number of women participating in sports and big competitions (1); misconceptions preventing women from participating in sporting activities for years have been overcome with scientific studies on the women's activity in sporting events. Doing sports in any period of life is no more a "disadvantage" for women. On the other hand, female athletes may encounter some sport-related health problems including menstrual disorders (2). Physiological differences between men and women influence their achievement, techniques and limits in the sports branch they are engaged in (3).

Menstrual cycle is described as the cyclic changes that are characterized by reproductive hormonal changes and menstrual bleeding repeated every month which affect the whole organism from menarche to menopause. Hormones produced by the corpus lutenum (estrogen and progesterone) and ovarian follicles lead to certain cyclic changes in the endometrium. The changes on the uterus wall form the endometrial cycle and since menstruation is clearly observed here, it is called the menstrual cycle or menstrual period (4). Throughout the menstrual cycle, hormonal balance disruptions may be observed as well as changes in muscle strength, exercise endurance capacity, body temperature, metabolism and blood flow. This is also supported by the increased evidence regarding the connection between female sex hormones and health including the relationship between melatonin, menstrual dysfunction and breast cancer (5). It has long been assumed that sport disciplines bring about the risk of developing menstrual disorders, eating disorders and osteoporosis. The American Society for Sports Medicine used the term "female athlete triad" first in 1992 to define these three interrelated health problems (6). Female athletes are more often exposed to menstrual problems muscular and/or skeletal injuries and poor nutrition intake than non-athletic women (7). The female reproductive system is responsive to environmental factors including body weight, diet, stress, sleep and resting times, excessive physical activity and training (8). Different training types and amounts of training, high-intensity training, low percentages of body fat, reduced body weight and psychological stress

have been claimed to be potential factors responsible for menstrual irregularities. (1). Moreover, such irregularities as functional disorders and primary dysmenorrhea that are commonly seen in women may affect sporting performance adversely. In many studies, common primary amenorrhea is observed more often in women taking high-intensity training than those who do not do sport; while primary dysmenorrhea is reported to be lower in athletes (9).

Volleyball is a complex sport requiring multi-dimensional training. The players need to have good endurance, speed, strength and technical skills and know about basic volleyball strategies (10). In volleyball, the physical and physiological requirements of the sport have changed with the rally point system and it has now become "power volleyball". This change has brought about other changes in volleyball players' training and competition intensities as well as their periodization. In addition to the branch-specific strength, power and fitness training, elite volleyball players have started to have faster, more powerful and better physical characteristics as a result of the skills that develop along with the yearly training planning (11). In addition to this, they have been participating in many national and international competitions. This stressful and busy competitive atmosphere may affect women's menstruation periods. Heavy training taken by elite volleyball players, competitive and power-requiring matches, tournaments from national level to Olympics which cause pressure and stress may increase the symptoms of menstruation; while these symptoms could be tolerated upon exercise adaptation and as a result of all these, volleyball players' perceptions in this period may affect their performance.

Based on this fact, the present study aimed to determine menstrual cycle irregularities of female athletes playing in the Turkish Sultans' League and 1st League in the 2019-2020 season as well as their perceptions about the effects of menstruation on their performance.

2. Method

2.1. Study Model

The present study was arranged in the single survey model among general survey models of quantitative research methods. The study was approved by the decision no 53043469-050.04.04 / 18 of the Ethics Committee of Aydın Adnan Menderes University Faculty of Health Sciences and was performed according to the Declaration of Helsinki.

2.2. Participants

The study was participated by 130 volunteering volleyball players who play in the Turkish Volleyball Sultans' League and the 1st League, aged 23,52±5,39 years (min 15, max, 36), played an average of 71.31±85,71 (min 1, max 354) times on the national team, have a sporting age of 13,11±5,79 (min 3, max 28), train for 5,86±0,56 days a week (min 3, max 8), 3,23±1,24 hours a day (min 1, max 7) with mean menarche age 13,36±1,62 (min 10, max 18).

2.3. Data Collection Instrument

The present study employed the questionnaire form which was designed based on the studies conducted by Çolakoğlu et al. (2005), Di Cagno et al. (2012), Karacan et al. (2013) and Özbar et al. (2016) in the literature and was developed by the researcher upon taking expert opinion. The form consists of 25 questions. The items were written from among questions about general and sporting performance before, during and after the menstrual cycle.

2.4. Data Analysis

The data were analyzed using the SPSS 24 package program. Descriptive statistics were used to display the statistical data. The data were presented considering frequency (f), arithmetic mean, standard deviation and percentage (%) values.

3. Results

According to the data obtained from the statistical analysis of the present study which aimed to investigate the relationship between menstrual cycle and sporting performance, the participants' ages, the leagues they play in, the ages they started sports, their states of playing on national teams and training participation are presented in Table 1.

Table.1 *Volleyball players' ages, leagues they play, sport starting ages, national athlete states and training participations*			
Question	Options	Frequency (F)	Percentage (%)
The league you play	Sultans' League	60	46,2
	1st League	70	53,8
Your age	15-19	41	31,5
	20-24	38	29,2
	25-29	33	25,4
	30 and over	18	13,8
At what age did you start sport?	5-6 years	11	8,5
	7-8 years	62	47,7
	9-10 years	44	33,8
	11-12 years	13	10,0
How many days do you train a week?	3-4 days	3	2,3
	5-6 days	121	93,1
	7 days and over	6	4,6
What is your average daily training time?	1-1,5 hours	3	2,4
	2-3 hours	54	41,5
	3-4 hours	32	24,6
	4 -5 hours	20	15,4
	5 hours and over	21	16,1
Are you a national athlete?	Yes	59	45,4
	No	71	54,6
State the number of times you played on national teams.	1-4	4	3,1
	5-9	12	9,2
	10-14	3	2,3
	15-19	1	,8
	20 and over	39	30,0

According to Table 1, 47,7% of the volleyball players who participated in the study voluntarily started playing volleyball at age 7-8, 93,1% take training 5-6 days a week and 41,5% of them train for 2-3 hours a day. 45,4% of these volleyball players are those who play on national teams.

Data pertaining to menstrual cycles of the participants are presented in Table 2.

Table 2. *Volleyball players' menstrual cycles*			
Question	Options	Frequency (F)	Percentage (%)
What's your age of first menstruation (menarche)?	11	10	7,7
	12	40	30,8
	13	24	18,4
	14	23	17,7
	15 and over	33	25,4
How would you describe your general menstruation status?	Regular	80	61,5
	Irregular	14	10,8
	Sometimes irregular	36	27,7
How long is your usual menstruation period?	Shorter than 3 days	2	1,5
	3-5 days	81	62,3
	5-7 days	44	33,8
	Longer than 7 days	3	2,3

What problem/s do you have during menstruation?	Irritability	47	36,2
	Anger	62	47,7
	Crying	2	1,5
	Nausea	1	,8
	Feeling bloated	6	4,6
	Abdominal pain	9	6,9
	Headache	1	,8
	Backache	2	1,5
When are the menstrual problems usually seen?	3 days before menstruation	54	41,5
	1 week before menstruation	30	23,1
	First 3 days of menstruation	34	26,2
	During menstruation	12	9,2
How often do you have menstruation problems?	Always	19	14,6
	Once a month	57	43,8
	Rarely	54	41,5
Do you take medicine for menstrual problems?	I do	30	23,1
	I do not	43	33,1
	I sometimes do	57	43,8
Does menstruation affect your daily life?	It does	42	32,3
	It does not	25	19,2
	It sometimes does	63	48,5
How do you generally feel before menstruation?	Very good	4	3,1
	Good	46	35,4
	Bad	76	58,5
	Very bad	4	3,1
How do you generally feel during menstruation?	Very good	2	1,5
	Good	68	52,3
	Bad	57	43,8
	Very bad	3	2,3
How do you generally feel After menstruation?	Very good	44	33,8
	Good	81	62,3
	Bad	5	3,8

As seen in Table 2, 30,8% of the participants had their first menstruation at age 12, and 25,4% of them at age 15 and over. As for the problems experienced during the menstrual period, 36,2% stated they had irritability while 47,7% felt anger; and 41,5% of them explained that these problems started 3 days before menstruation. The results of the study reveal that 58,5% of the participants felt bad before menstruation, 52,3% felt good during menstruation and 62,3% felt themselves good after menstruation.

Data concerning the menstrual cycles and sporting performance of the volleyball players who participated in the study are presented in Table 3.

Table 3. *Volleyball players' Menstrual Cycle and Sporting Performance Relationships*

Question	Options	Frequency (F)	Percentage (%)
Do you have any sport-related menstrual problem?	Yes	20	15,4
	No	110	84,6
How does sport affect your menstrual pain?	It does not	57	43,8
	It affects positively	46	35,4
	It affects negatively	27	20,8
Did you have any menstrual problems after starting sport?	Yes	19	14,6
	No	111	85,4

Does menstruation affect your participation in training or competitions?	It does	32	24,6
	It does not	38	29,2
	It sometimes does	60	46,2
Do you take medicine during exercise in your menstruation period?	I do	24	18,5
	I do not	66	50,8
	I sometimes do	40	30,8
How is your participation in competitions during menstruation?	I do	129	99,2
	I do not	1	,8
Does your menstruation period affect your competition performance?	It does	25	19,2
	It sometimes does	59	45,4
	It does not	46	35,4

As shown in Table 3, 84,6% of the participants experience sport-related menstrual problems. It is seen that menstruation sometimes affects competitive participation in 46,2% of the participants whereas 99,2% participate in competitions. In addition, 45,4% of the participants stated that menstruation sometimes affects their competitive participation.

5. Discussion and Conclusion

The present study aimed to determine elite female volleyball players' perceptions of sporting performance and menstrual cycles. Menarche, defined as the first menstruation period, is one of the sexual maturation stages of girls and studies concerning menarche age report that menarche can take place later in athletes than the sedentary population. It is stated that menarche at later ages that can be seen in athletes may be due to such factors as participation in high-intensity training, chronic physiological and psychological stress, eating disorders, low body weight and/or low body fat (12). Çolakoğlu et al. (2005) report that mean menarche age in the athletes in women's 1st League was 13,21±1,18 in 2002-2003 (9); while Özbar et al. state that mean menarche age of 40 volleyball players who participated in the study out of the 160 participants in the study group was 13,04±1,10; the menstruation time of 73,1% of the participants was 3-5 days and 72,5% had regular menstrual cycles(13). Kıshalı et al. (2006) found in the study they conducted with 241 athletes (81 volleyball player) that mean menarche age was 13,75±0,13 and 64,20% described their menstrual cycles as regular (14). Menarche age may vary by branch. Erlandson et al. (2008) reported mean menarche age as 13,29±1,36 in tennis players, as 13,32±1,36 in swimmers and as 14,49±1,47 in gymnasts (15). Di Cagno et al. (2012) found the mean menarche age as 15,0±1,5 in rhythmic gymnasts and as 12,8±1,2 in the control group consisting of athletes from other branches and stated that there was a statistically significant difference between the two groups and that menarche took place later in rhythmic gymnasts. They also reported the menstruation time was 5,3±1,3 in rhythmic gymnasts while it was 5,2±1,2 in the control group (6). The present study found that the mean menarche age of the participants is 13,36±1,62; the mean menstruation time is 3-5 days in 62,5% of the participants and 61,5% of them described their general menstrual cycles as regular, which is similar to other studies conducted with volleyball players in the related literature. Intensive exercises may cause hypothalamic dysfunction, and reproductive anomalies could lead to a delayed menarche, primary, secondary amenorrhea and oligomenorrhea (9). Depending on the sport discipline practiced, delayed menarche, amenorrhea and oligomenorrhea are seen in 6-79% of female athletes (6). The intensity of the sport/training may affect menarche and high intensity training could lead to repetitive musculoskeletal injuries along with dysmenorrhea and poor nutrition intake. Less repeated intensities, on the other hand, are reported to increase dysmenorrhea while having no effect on injury levels or nutrition (16). Looking at the findings of the present study, it is possible to say that volleyball players do not have delayed menarche, amenorrhea or oligomenorrhea. Wodarska et al. (2013) found the mean menarche age as 12,55±1,08 and menstruation time as 5,08±1,38 in 210 adolescent Polish volleyball players (16). The minimal difference in the menarche age and menstruation times with the present study is considered to be due to the fact that the participants of the study are elite volleyball players with high mean ages.

Regarding the problems faced during menstuation, 47,7% of the participants stated they experienced anger and 36,2% of them had irritability while 1,5% had lower back pain and 6,9% abdominal cramps. In the

study conducted by Çolakoğlu et al (2005), the participants explained to feel anger (55,4%), abdominal cramps (57,1%), lower back pain (53,6%) and irritability (25,0%). Despite the variance of problems experienced during menstruation, the times these problems occur are similar to each other. 41,5% of the participants in the present study and 63,6% of those in the study carried out by Çolakoğlu et al. (2005) stated that they had these problems 1-3 days before menstruation. Wodarska et al. (2013) reported that 58% of adolescent volleyball players feel pain before menstruation while 66% do after menstruation. Kıshalı et al (2006) state that 67,91% of the participants feel good before menstruation while 58,5% of the volleyball players in the present study said they felt bad before menstruation. The difference between the findings of the two studies is thought to result from the athletes' sporting levels. In the study conducted by Kıshalı et al (2006), 40,74% of the participants competed at regional level, 54,3% at national level and 4,93 at international level, all of the volleyball players in the present study compete at national level and 45,4% of them take place in competitions at international level

Another point to be considered about athletes' menstrual cycles is the effect of this period on performance or how the athletes feel themselves. Çolakoğlu et al. (2005) state that menstruation of 62,5% of the participants does not affect their competitive performance, all the participants join competitions in this period and 58,9% do not take any medication for menstruation (9). In the study conducted by Özbar et al. (2016), 91,3% of the participants stated that menstruation affected their physical performance positively and 97,52% explained that they participated in competitions during this period (13) while Kıshalı et al. (2006) found that 96,3% of the participants took part in competitions (14). In the findings of the present study 45,4% of the participants stated that menstruation sometimes affected their performance while 35,4% thought it did not. Volleyball is accepted as an intermittent sport based on explosive strength and anaerobic resources with increased game intensity and shortened rally times. Many studies in the literature provide evidence showing that menstruation does not affect strength performance (17, 18, 19, 20). Hazır et al. (2011) and Çakmakçı et al. (2005) suggest that menstruation has no negative effect on anaerobic performance (21, 22) , and Ön et al. (2014) report that menstrual cycle does not affect anaerobic power and jump performance in volleyball players (23).

The fact that the participants stated menstruation did not affect their performance in the findings of the present study could be because physiological requirements of volleyball are not affected by menstruation. On the other hand, the participants expressed that their performance is sometimes affected during menstruation. Mood swings, increased body temperature, anxiety and fatigue can be observed during menstruation which may change the metabolic balance completely (24). It is considered that the participants stated menstruation sometimes affected their performance because of the psychological effects of menstruation (anger stated by 47,7%, irritability stated by 36,2% etc.) as well as other performance components of volleyball. Contrary to these, Dölek and Ersöz (2017) found a statistically significant difference between menstrual phases of vertical jump with the highest values in the menstrual phase (1-2.) (24). In the literature review study they conducted, Dawson and Reilly (2009) report that there are data showing strength increase in the luteal phase and right before and after menstruation (5). Based on the data of the study, the fact that elite volleyball players feel no change in their performance in the present study is thought to be associated with the possible strength increase during menstruation.

Based on the findings of the present study, while no menstrual irregularities were found in the elite volleyball players playing in the Turkish Sultans' League and 1st League in 2019-2020, it is possible to suggest that some problems are experienced periodically. The participants stated that they faced most of these problems 1-3 days before menstruation. Although they think that they felt no change in their performance and they participate in competitions and training during this period, it is recommended that trainers take athletes' menstrual cycles into consideration while planning and programming trainings in case of the possible physiological or psychological effects of the problems they have such as irritability and anger. In addition, it was seen that the volleyball players who participated in the present study did not experience delayed menarche and amenorrhea. However, in athletes who started sport at young ages or those who are engaged in heavy sports, exercise-related menstrual irregularities could be more apparent depending on the difference in the sports they take part in. Also, it is recommended that menstrual cycle irregularities be closely observed during the intensive physical activities taken before puberty and training intensity be arranged considering this fact. Thus, delayed menarche can be prevented and menstrual irregularities and problems of the menstrual period could be reduced. There is a need for further studies providing

performance based data and athletes' perceptions about this period.

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Investigation of Mental Training in Sports Branches

Samet Zengin[1*] and Fatih Kirkbir[2]

[1] Avrasya University, Department of Sport Sciences, Trabzon, Turkey.

[2] Karadeniz Technical University, Department of Physical Education, Trabzon, Turkey .

**Corresponding Author*

Abstract

Researchers are interested in studies on the importance of mental research. It is not enough to be physically ready for success in sports. In addition to being physically good, mental processes are also effective in success. So, psychological factors are important in the success of athletes. The current study examined the athlete's Mental Training in terms of demographic characteristics. 236 athletes, 115 men and 121 women, participated in the study. As a data collection tool in the research; "Mental Training Inventory in Sports" developed by Behnke et al. [1] and adapted to Turkish by Yarayan and İlhan [2] was used. The data were tested primarily by normality tests. T test was used for variables with normal distribution and consisting of two categories, and one-way analysis of variance (ANOVA) for variables with three or more categories. The skewness and kurtosis coefficients between -1.5 and 1.5 indicate that the variable has a normal distribution. When the collected data is examined, it is among the specified values. The internal reliability coefficient of the data was found to be 913. The results of the analysis showed that regular sports and the sports branch make a significant difference to the visualization. In addition, significant differences were detected between amateur and professional athletes from the point of visualization.

Keywords*:* Mental Training, Sports Branches, University, Athlete.

Introduction

At present in sports world, the line between winning and losing has started to be prominent with the increase in the intensity of competition. The idea that athletes who are physically superior is insufficient for success, and psychological performance is thought to be important as well as physical performance.

Human also includes psychological, sociological and cultural characteristics. Therefore, the mental and emotional state of the athlete in sports environment is closely related to its performance. Performance in sports is defined as the physiological and psychological efficiency of the athlete during the activity [3] Accordingly, the effect of psychological factors on performance on sports has been the focus of sports psychologists and scientists [4]. Success in sports is achieved by a good performance. Good performance is possible with the combination of condition, technique, tactics and more importantly psychological factors [5]

There are many psychological skills that affect the development of physical performance. One of these skills is mental training [6]. Mental Training has synonyms as Imaginary, Mental Rehearsal, Mental Paractice, Mental Preparation, Imagery Training, Mental Imagery [7; 8].

Mental training has been extensively studied since the early days of psychology. From the first introspective studies of Sir Francis Galton to today's brain scan studies, the thought approach that includes semi-perceptual images has always attracted the attention of researchers in various fields of psychology. Undoubtedly, one of these areas is sports psychology [9]. Some coaches, technical director and athletes looked skeptically at sports psychology practices and thought that their authority would be shaken or that it would not work. However, the descriptions of the sports psychology of those who ranked in various Olympic and world championships, especially, led to a gradual decrease in doubts about sports psychology. The sports environment can contain many concepts such as difficulty, stress and failure. Therefore, in order for the athletes to succeed or to recover quickly, they should keep their mental resilience as high as possible [10; 11]. This is only possible by including mental training exercises in training programs.

Mental training has a positive and powerful effect on the emotions of the athletes. In order to be successful, the athlete has to overcome many physical and psychological obstacles (noise, audience, light, anxiety, anxiety, pain, boredom, rejection) [8]. As a matter of fact, this situation shows that physical, physiological, technical-tactical factors affecting success in sports have gained increasing importance in psychological factors [12]. This provides significant gains in increasing the performance of athletes [13]. Physical, psychological and mental development is an inseparable whole. It is vital to concentrate, set goals and increase self-confidence in order to achieve high performance in sports activities [14].

Knowing and researching the physical and physiological characteristics of the sport as well as its psychological and mental characteristics is a must for success. In this direction; It has become inevitable for athletes and coaches to work towards contributing to their physical, mental and affective development [15]. Among these psychological studies, mental training is considered as one of the most important studies in increasing the performance of the athlete and being ready for competitions [6]. Researches show that successful athletes and coaches use mental training techniques and strategies to achieve success in sports [16]. In addition, mental training, which is one of the applications that accelerate learning, is known to increase the skill learning of athletes [17]. According to Blair et al. [18], imagery is a psychological skill that improves performance in both beginner and master athletes. An effective and sufficient imagery creates a change in behavior, thoughts and emotions. The meta-analysis results of Feltz & Landers [19] and Hinshaw [20] showed that mental work is more effective than not doing any work in improving motor skill performance.

It is stated that the most important reason for the positive effect of mental training methods on motor skill acquisition is the realization of processes and preparation similar to physical application in the brain during the animation. As a result, research in sports psychology has revealed that mental training provides a successful performance and personally improves athletes [21; 22]. While such studies are mostly conducted abroad, it is thought that this study will contribute to the literature on mental training in our country.

It is important to enlighten trainers, physical education teachers and athletes about the benefits of imagination in sports. Individuals involved in sports can make a significant contribution to success if they see it as part of their mental training program. Therefore, the purpose of this study is; to reveal the importance of mental training activities in increasing the success of athletes engaged in individual and team sports and to to determine how it is shaped according to some demographic information.

Method

Participants

Athletes in different sports branches participated in the current study. 115 of these athletes are men and 121 are women.

Materials

Simple sampling method was used to determine the study group of the study. According to Gürbüz and Şahin, simple sampling method is a sampling technique that allows collecting data in a fast, cheap and easy way [14].

Sport Mental Training Questionnaire: The current inventory was developed by Behnke et al. [1] and adapted to Turkish by Yarayan and İlhan [2] in order to measure mental skills and techniques used in mental training practices in sports environment. This inventory developed for athletes consists of 5 sub-dimensions and 20 items: *Mental Foundational Skills* (4 items), *Mental Performance Skills* (6 items), Interpersonal Skills (4 items), Self talk (3 items), Mental imagery (3 items). The 5-point Likert type is scored as (1) "I totally disagree" and (5) "I totally agree". The lowest score that can be obtained from the inventory is 20 and the highest score is 100 [1].

Personal Information Form: It consists of demographic questions about the athletes included in the research regarding gender, sports branch, whether or not to do sports, the level of sportsmanship and imagery in the mind.

Data collection from athletes was carried out before training. Firstly, information was given about the study. Considering the voluntary participation principle, action was taken and data were collected from the athletes participating in the study.

Statistcal Analysis

The test of normality (Skewness-Kurtosis) was applied to the data collected from the athletes. The test result showed that the data had a normal distribution. In this context, t-test was used for variables consisting of two categories, and one-way analysis of variance (ANOVA) for variables consisting of three or more categories. ANOVA test is used to test whether the average of more than two parametric populations is equal [23]. Tukey test, which is one of the multiple comparison (Post Hoc.) Tests, was used to determine between which groups the result of ANOVA originated. The Cronbach's Alpha coefficient regarding the mental training levels of the athletes is given in the table.

Table 1. *The Sport Mental Training Cronbach's Alpha Coefficient*

Cronbach's Alpha	N of Items
,913	20

Results

Table 2: *Frequency / Percentage Distribution Of Variables*

Gender	**N**	%
Male	115	48,7
Female	121	51,3
Total	**236**	**100,0**
Related sports branch		
Football	69	29,2
Volleyball	51	21,6
Basketball	39	16,5
Handball	41	17,4
Badminton	36	15,3
Total	**236**	**100,0**
Athletics level		
Amateur	192	81,4
Professional	44	18,6
Total	**236**	**100,0**
Doing sports regularly		
Yes	103	43,6
No	133	56,4
Total	236	100,0
Mental Training		
Yes	113	47,9
No	32	13,6
Partially	91	38,6
Total	**236**	**100,0**

Frequency percentage values for the demographic characteristics of the athletes are given in table 2. According to the current table, 115 (48.7%) of the athletes participating in the study are men and 121 (51.3%) are women. The sporting branches that male and female athletes are interested in differ. In the study, 69 (29.2%) athletes football, 51 (21.6%) athletes volleyball, 39 (16.5%) athletes basketball, 41 (17.4%) athletes handball, 36 (15.3%) athletes deals with badminton 192 (81.4%) of these athletes are amateur and 44 (18.6%) are professional. While 103 (43.6%) of the current athletes do sports regularly, 133 (56.4%) do not exercise regularly. 113 (47.9%) athletes perform in the mind, 32 (13.6%) athletes do not. 91 (38.6%) athletes perform partially in the mind.

Table 3. *Scale Score Distribution*

Scale	**N**	**Min.**	**Max.**	**Mean**	**Std. Deviation**	**Skewness**	**Kurtosis**
The Sport Mental Training Questionnaire (SMTQ)	236	20,00	100,00	76,31	13,10	-,698	1,340

In determining whether the total score obtained from the The Sport Mental Training Questionnaire shows normal distribution, the skewness and kurtosis values in Table 3 were taken into consideration. According to the values accepted in the literature, the skewness and kurtosis coefficients between -1.5 and 1.5 indicate that the variable has a normal distribution [24]. According to this statement, it can be accepted that the skewness and kurtosis values of mental training in sports show normal distribution.

Table 4. *Result Of Gender Variable In Terms Of Sport Mental Training*

Scale and sub-dimensions	Gender	N	Mean	Std. Deviation	t	p
Mental Foundational Skills	Male	115	15,78	2,97	2,291	**,023***
	Female	121	14,85	3,25		
Mental Performance Skills	Male	115	22,11	4,16	2,506	**,013***
	Female	121	20,70	4,46		
Interpersonal skills	Male	115	16,47	2,74	-,427	,670
	Female	121	16,65	3,47		
Self talk	Male	115	11,40	2,94	-,309	,758
	Female	121	11,52	3,02		
Mental imagery	Male	115	11,81	2,27	1,387	,167
	Female	121	11,36	2,72		
The Sport Mental Training	Male	115	77,60	12,24	1,469	,143
Questionnaire	Female	121	75,09	13,81		

*p<0,05

Table 4 shows whether there is a difference in the level of mental training in male and female athletes. According to this table, it has been determined that mental training creates significant differences in the sub-dimensions of scale between male and female athletes (p <0.05). However, no difference was found between male and female athletes in the total score of mental training in sports (p> 0.05).

Table 5. *Result of Sport Branch Variable in Terms of Mental Training*

Scale and sub-dimensions	Sports Branch	N	Mean	Std. Deviation	F	p	Groups with significant difference
	Football (1)	69	15,89	2,62			
Mental Foundational	Volleyball (2)	51	15,29	2,92			
Skills	Basketball (3)	39	15,64	3,72	3,301	**,012***	1-5
	Handball (4)	41	15,4	3,04			3-5
	Badminton (5)	36	13,66	3,43			
	Football (1)	69	22,01	4,04			
Mental Performance	Volleyball (2)	51	20,98	4,07			
Skills	Basketball (3)	39	22,94	3,74	3,193	**,014***	3-5
	Handball (4)	41	20,73	4,83			
	Badminton (5)	36	19,83	4,91			
	Football (1)	69	16,79	2,59			
Interpersonal skills	Volleyball (2)	51	17,13	2,85			
	Basketball (3)	39	16,69	3,05	3,095	**,017***	1-5
	Handball (4)	41	16,78	3,31			2-5
	Badminton (5)	36	14,94	3,89			
	Football (1)	69	11,49	2,87			
Self talk	Volleyball (2)	51	11,64	3,01			
	Basketball (3)	39	11,84	2,87	,484	,747	-----
	Handball (4)	41	11,29	3,34			
	Badminton (5)	36	10,97	2,87			
	Football (1)	69	12,24	2,09			
Mental imagery	Volleyball (2)	51	11,03	2,48			
	Basketball (3)	39	12,17	2,42	4,054	**,003***	1-5
	Handball (4)	41	11,48	2,56			3-5
	Badminton (5)	36	10,55	2,92			
	Football (1)	69	78,44	11,45			
The Sport Mental	Volleyball (2)	51	76,09	10,94			
Training Questionnaire	Basketball (3)	39	79,30	13,28	3,216	**,014***	1-5
	Handball (4)	41	75,73	13,39			3-5
	Badminton (5)	36	69,97	16,36			

*p<0,05

Farklı branş sporcularında zihinsel antrenmanın anlamlı etkisi incelenmiş ve elde edilen sonuçlar tablo 5'te gösterilmiştir. The meaningful effect of mental training in different branch athletes is examined and the results are shown in table 5. Yapılan analizler, farklı sportif branşlarda sporcular arasında anlamlı farklılıkların oluştuğunu göstermiştir. Analyzes have shown that there are significant differences between athletes in different sports branches. Bu bulgu, sportif branşların zihinsel antrenman üzerinde anlamlı etkiye sahip olduğunu göstermiştir (p<0,05). This finding showed that sports branches have a significant effect on mental training (p <0.05).

Table 6. *Regular T-Test Result on Whether to Play Sports Regularly*

Scale and sub-dimensions	Exercising regularly	N	Mean	Std. Deviation	t	p
Mental Foundational Skills	Yes	103	16,05	2,82	3,300	**,001***
	No	133	14,72	3,27		
Mental Performance Skills	Yes	103	22,20	4,42	2,547	**,012***
	No	133	20,75	4,23		
Interpersonal skills	Yes	103	16,66	3,05	,398	,691
	No	133	16,49	3,20		
Self talk	Yes	103	11,53	2,89	,288	,774
	No	133	11,42	3,05		
Mental imagery	Yes	103	11,93	2,37	1,875	,062
	No	133	11,31	2,59		
The Sport Mental Training	Yes	103	78,38	13,03	2,153	**,032***
Questionnaire	No	133	74,71	12,97		

*p<0,05

The variable of doing sports regularly is examined and the related results are shown in table 6. The current table shows that there are significant differences between those who regularly do sports and those who do not (p <0.05).

Table 7. *Athletics Level T-Test Result*

Scale and sub-dimensions	Athletics level	N	Mean	Std. Deviation	t	p
Mental Foundational Skills	Amateur	192	15,01	3,15	-2,998	**,003***
	Professional	44	16,56	2,82		
Mental Performance Skills	Amateur	192	21,05	4,15	-2,507	**,013***
	Professional	44	22,86	5,01		
Interpersonal skills	Amateur	192	16,43	3,21	-1,336	,183
	Professional	44	17,13	2,73		
Self talk	Amateur	192	11,36	3,04	-1,139	,256
	Professional	44	11,93	2,68		
Mental imagery	Amateur	192	11,45	2,53	-1,684	,093
	Professional	44	12,15	2,37		
The Sport Mental Training	Amateur	192	75,32	13,00	-2,463	**,015***
Questionnaire	Professional	44	80,65	12,80		

*p<0,05

Table 7, provides information about the level of athletics. According to the current table, significant differences were detected both in the mental training and in its two sub-dimensions (p <0.05). This finding shows that amateur or professional level athletics have a significant effect on mental training.

Table 8. *Anova Test Result for Sport Mental Training*

Scale and sub-dimensions	Sport Mental training	N	Mean	Std. Deviation	F	p	Groups with significant difference
	Yes (1)	113	15,85	3,07			
Mental Foundational	No (2)	32	14,84	3,47	3,418	**,034***	1-3
Skills	Partially (3)	91	14,78	3,04			
	Yes (1)	113	22,10	4,67			
Mental Performance	No (2)	32	20,40	4,38	3,085	**,048**	1-3
Skills	Partially (3)	91	20,84	3,84			
	Yes (1)	113	16,51	3,18			
Interpersonal skills	No (2)	32	16,90	3,45	,214	,807	-----
	Partially (3)	91	16,51	2,98			
	Yes (1)	113	12,14	2,64			
Self talk	No (2)	32	11,71	3,03	7,736	**,001***	1-3
	Partially (3)	91	10,54	3,14			
	Yes (1)	113	12,29	2,41			
Mental imagery	No (2)	32	10,50	2,74	9,900	**,000***	1-2
	Partially (3)	91	11,08	2,32			1-3
The Sport Mental	Yes (1)	113	78,91	13,67			
Training	No (2)	32	74,37	13,24	4,395	**,013***	1-3
Questionnaire	Partially (3)	91	73,78	11,78			

*p<0,05

The result of the analysis of the athletes' mental trainig is shown in table 8. The present finding indicates that there is a significant difference between those who mental training and those who do not ($p < 0.05$). It is seen that there is meaningfulness both in mental training and sub-dimensions in sports.

Discusson

The data collected in the current study showed that the Mental Training Questionnaire score in Sports has a normal distribution. Parametric tests were applied as a result of normal distribution. In another study, as a result of the Kolmogorov-Smirnov analysis, the scores showed a normal distribution. Therefore, it has been deemed appropriate to use parametric tests to analyze the research question [25]. The skewness and kurtosis values in the total score distribution of the scale showed that the score distribution was normal [26]. In this study, significant difference was found in the sub-dimensions of mental training in male and female athletes. However, no difference was found between male and female athletes in the total score of mental training in sports. In the research conducted, the mean scores in cognitive imaging and motivational special imaging dimensions by gender variable are not statistically significant [27]. No statistically significant difference was found in the gender variable of the students in the control group, application group and mind animation group [28]. In another study, a significant difference was found in the cognitive imagery, motivational general mastery, and motivational general arousal subscales of male and female athletes [26]. Similarly, Bar and Hall [29] found that female athletes used mental training more than men in a study. However, in their study, Borman and Kurdek [30] revealed that gender-related differences are related to mental skills, including perception.

According to another result, significant differences occurred between athletes in different sports branches. This finding showed that sports branches have a significant effect on mental training. In addition, it can be concluded that the differentiation of the sportive branches creates a difference in the level of animation of the athletes. Karademir et al. examined different sports branches (football, athletics…) and there were significant differences in the mean scores of athletes in the imagination sub-dimensions [27]. The results of the study showed a significant difference between the groups belonging to the motivational special imagery sub-dimension [26].

Another result shows that amateur and professional level athletics have a significant effect on mental training. In this context, it is understood that significant difference occurred in favor of those who are professional athletes. Being at a professional level means reviving more minds. Cumming and Hall [28] compared elite athletes with non-elite athletes, stating that non-elite athletes were less concerned with their own performance during the competition and performed the imagination exercise much less.

Conclusion

In the current part of the study, the results of the analysis of the data collected from the athletes are included. Analyzes carried out in the light of the collected data showed that the Mental Training Inventory score in Sports has a normal distribution. As a result of normal distribution, parametric tests were applied. Significant difference was found in the sub-dimensions of mental training in male and female athletes. However, no difference was found between male and female athletes in the total score of mental training in sports. According to another result, significant differences occurred between the athletes in different sports branches. This finding showed that sports branches have a significant effect on mental training. In addition, it can be concluded that the differentiation of the sportive branches made a difference in the level of mental training of the athletes.

Whether or not doing sports regularly was examined and it was determined that there were significant differences between those who do sports regularly and those who do not. According to another result, it shows that sportsmanship at the amateur or professional level has a significant effect on mental training. The results show that significant difference occurred in favor of those who are professional level athletes. Being at a professional level means reviving more minds. It was determined that there was a significant difference between athletes in the mind and those who did not. It is understood that mental training has a significant effect on athletes.

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The Relation between Burnout in Sport and Life Satisfaction: A Research on University Students

Fatih Kirkbir[1*] and Samet Zengin[2]

[1]*Karadeniz Technical University, Department of Physical Education, Trabzon, Turkey.*

[2]*Avrasya University, Department of Sport Sciences, Trabzon, Turkey.*

**Corresponding Author*

Abstract

In this study, it was aimed to examine the relationship between university students' life satisfaction and burnout in sport. In accordance with the specified purpose, a total of 255 students, including 154 women and 101 men, participated in the study. "The Satisfaction with Life of Students Scale" that was developed by [1] and was adapted into [2] and "Sport Burnout Inventory" that was developed by [3] and was adapted into Turkish by [4] was used in this study. Normality tests were applied within the scope of the data obtained and it was determined that the data had a normal distribution. Accordingly, parametric tests were applied; t-test for binary groups and one-way analysis of variance (ANOVA) analysis for three or more groups. The relationship between student life satisfaction and sport burnout were tested by Pearson Correlation test. The normality test of the data showed that students' life satisfaction was moderate and sport burnout was low. The results of the analysis showed that there was no difference between female and male students' life satisfaction and sport burnout. It was seen that the type of program studied and the daily sleep time did not make a significant difference between students. Similarly, there was no significant relationship between student satisfaction and sport burnout.

Keywords: Student, University, Sport Burnout, Life Satisfaction.

Introduction

Sport, which is one of the preconditions of healthy life today, is considered as important by millions of people from various branches in terms of both sports performance and lifelong sports [5]. Sport is an important factor that affects not only physical but also social, cognitive and emotional development of individuals [6]. Sport is a social phenomenon that includes millions of people. The excitement and passion brought by sports have a positive effect on the quality of daily life and physical and psychological conditions on individuals [7].

Living a 'happy' life is, undoubtedly, important for many people [8]. However, today's people are faced with difficulties in all areas of life. These difficulties disrupt the balance of the individual and, on the one hand, reveal the energy required for the continuation of life, and on the other hand, leave the individual helpless, defenseless and weak [9]. These unfavorable conditions, as a result, create a feeling of burnout in individuals. Burnout is a term used to express mental and physical energy reduction in individuals. The concept of burnout, first introduced by Freudenberger, was later described by [10].

In recent years, psychological structures such as quality of life, life satisfaction, happiness, psychological and subjective well-being have begun to be handled and examined by researchers [11]. In this context, one of the important variables that can affect the individual's perception and perception about his/her life is "life satisfaction". Life satisfaction; It is a cognitive questioning that determines how far individuals can reach the foremost ones in order of importance from the conditions they want to have [12]. Similarly, life satisfaction is defined as general judgments and evaluations of the individual regarding his/her own life [13].

Both life satisfaction and sport burnout are extremely important for university students. The high satisfaction with life indicates that students lead a happy and healthy life. Low sport burnout affects life in together with life satisfaction. The current study is important in terms of examining the relationship between university students' burnout and life satisfaction. In addition, it will contribute to the work to be created as a resource. The purpose of working with these thoughts; to examine the relationship between university students' life satisfaction and sport burnout. For this purpose, answers to some questions were sought:

(1) What is the level of student satisfaction and sport burnout?

(2) Do life satisfaction and sport burnout differ significantly by gender?

(3) Do life satisfaction and sport burnout differ according to the curriculum studied?

(4) Does life satisfaction and sport burnout differ significantly according to the weekly training period?

(5) Do life satisfaction and sport burnout differ significantly compared to daily sleep time?

(6) Is there a significant relationship between life satisfaction and sport burnout?

Method

Participants: Students studying at Karadeniz Technical University and Trabzon University participated in the current study, which includes undergraduate and associate degree programs. These 255 students, 154 women and 101 man, are actively studying in the 2019-2020 education and training process.

Materials: Simple sampling method was used to determine the study group of the study. According to Gürbüz and Şahin, simple sampling method is a sampling technique that allows collecting data in a fast, cheap and easy way [14].

In the study, "Student Life Satisfaction Scale" developed by [1] and adapted to Turkish by [2], and "Sport burnout Inventory" developed by [3] and adapted to Turkish by [4] were used.

Student life satisfaction scale: The scale that aims to measure general life satisfaction consists of 7 items and has a 6-point Likert type rating (1= strongly disagree, 6 = totally agree). Two items are negative in the scale.

Sport Burnout Inventory: Inventory consists of 10 items and three sub-dimensions. The dimensions in the inventory were briefly used as (i) Exhaustion, (ii) Depersonalization and (iii) Insufficiency. Scoring of the inventory is done as 5-point Likert. The scoring intervals are 1= Strongly disagree, 2= Disagree, 3= Undecided, 4= Agree and 5= Fully Agree.

The data was collected from students during the education process. First of all, students were informed about the study. Then, data collection was carried out with the help of forms created via Google. A total of 255 data collected on the system were transferred to the SPSS analysis program for evaluation.

Statistical Analysis: Skewness-Kurtosis test was used to test the normality assumption of the data transferred to SPPS. The test result has been determined to have a normal distribution of data. In this context, in comparing the life satisfaction and sport burnout scores of university students, t-test was used for variables consisting of two categories, and one-way analysis of variance-ANOVA for variables consisting of three or more categories. ANOVA test is used to test whether the average of more than two parametric main mass is equal [15]. Tukey test, which is one of the multiple comparison (Post Hoc.) tests, was used to determine between which groups the result of ANOVA originated. In addition, the relationship between two different dependent variables was tested by Pearson Correlation analysis. In the scope of the analysis, Cronbach's Alpha coefficient of the Life Satisfaction Scale (7 items), 851; The Cronbach's Alpha coefficient of the Sport burnout Inventory is 831.

Results

Table 1. *Student Life Satisfaction and Sport Burnout Score Distribution*

Scales	N	Min.	Max.	Mean	Ss.	Skewness	Kurtosis
Student Life Satisfaction	255	7,00	42,00	3,66	7,35	-,234	-,228
Sport Burnout	255	10,00	50,00	2,32	8,01	,694	,455

The Skewness and Kurtosis values in Table 1 were taken into consideration in determining whether the total scores obtained from the Life Satisfaction Scale and the Sport burnout Inventory show normal distribution. According to the values accepted in the literature, the fact that the coefficient of skewness and kurtosis is in the range of -1.5 to 1.5 is an indicator that a variable is normally distributed [16]. According to this statement, considering the skewness and kurtosis values of both variables, it can be accepted that these variables show normal distribution.

Table 2. *Result of Gender Variable According to Student Life Satisfaction and Sport Burnout*

Scale and Sub dimensions	Gender	N	Mean	Ss.	t	P
Sport Burnout	Female	154	22,81	7,97	1,222	,223
	Male	101	21,56	8,07		
Burnout	Female	154	8,01	3,43	-,128	,899
	Male	101	8,06	3,45		
Insensitive	Female	154	6,40	3,07	1,923	,056
	Male	101	5,65	2,99		
Insufficiency	Female	154	8,40	3,06	1,434	,153
	Male	101	7,84	3,04		
Student Life Satisfaction	Female	154	25,81	7,10	,430	,668
	Male	101	25,40	7,75		

According to the t-test findings in Table 2, it can be said that the students' life satisfaction mean scores did not differ significantly by gender (p> 0.05).

Table 3. *The Result of The Program Variable That Is Studied According to Student Life Satisfaction and Sport Burnout*

Scale and Sub dimensions	Study program	N	Mean	Ss.	t	P
Sport Burnout	Undergraduate	110	22,09	7,87	-,399	,690
	Associate	145	22,49	8,15		
Burnout	Undergraduate	110	8,11	3,38	,334	,738
	Associate	145	7,97	3,49		
Insensitive	Undergraduate	110	5,82	3,04	-1,268	,206
	Associate	145	6,31	3,06		
Insufficiency	Undergraduate	110	8,14	2,97	-,158	,874
	Associate	145	8,20	3,13		
Student Life Satisfaction	Undergraduate	110	26,03	7,57	,728	,467
	Associate	145	25,35	7,20		

The t-test findings of the program variable under study are shown in table 3. According to this table, it was determined that the students' life satisfaction and sport burnout average scores did not make a significant difference in their undergraduate and associate degree programs (p> 0.05).

Table 4. *Result of Weekly Training Variable According to Student Life Satisfaction and Sport Burnout*

Scale and Sub dimensions	Weekly training	N	Ort.	Ss.	F	p	Significant difference
	0-1 days	111	23,69	8,02			
Sport Burnout	2-3 days	82	21,71	6,98	3,358	**,019**	0-1 and 4-5
	4-5 days	44	19,45	7,83			
	6-7 days	18	23,61	10,93			
	0-1 days	111	8,37	3,56			
Burnout	2-3 days	82	7,87	2,96	1,669	,174	-----
	4-5 days	44	7,15	3,16			
	6-7 days	18	8,77	4,91			
	0-1 days	111	6,77	3,19			
Insensitive	2-3 days	82	5,54	2,61	4,610	**,004**	0-1 and 2-3
	4-5 days	44	5,15	2,59			0-1 and 4-5
	6-7 days	18	6,83	4,10			
	0-1 days	111	8,54	3,00			
Insufficiency	2-3 days	82	8,29	2,99	2,311	,077	-----
	4-5 days	44	7,13	3,08			
	6-7 days	18	8,00	3,28			
	0-1 days	111	24,75	7,43			
Student Life Satisfaction	2-3 days	82	26,18	7,29	1,091	,354	-----
	4-5 days	44	26,86	7,19			
	6-7 days	18	25,77	7,50			

Considering the results in Table 4, no difference was found in students' life satisfaction. However, significant differences were found in the "insensitive" sub-dimension with regard to sport burnout in general.

Table 5. *Daily Sleep Hour Variable In Terms Of Student Life Satisfaction and Sport Burnout*

Scale and Sub dimensions	Daily sleep time	N	Mean	Ss.	t	P
Sport Burnout	0-6 hours	69	21,36	6,80	-1,164	,245
	7 hours and above	186	22,67	8,41		
Burnout	0-6 hours	69	7,84	3,14	-,550	,583
	7 hours and above	186	8,10	3,54	-	
Insensitive	0-6 hour	69	5,52	2,77	-1,975	,050
	7 hours and above	186	6,32	3,13		
Insufficiency	0-6 hours	69	8,00	2,79	-,572	,568
	7 hours and above	186	8,24	3,15		
Student Life Satisfaction	0-6 hour	69	26,34	8,35	,921	,358
	7 hours and above	186	25,39	6,95		

Table 5 shows the student life satisfaction and sport burnout mean scores. In the current table, it was determined that the daily sleep times of the students did not make any difference in their sport burnout and their satisfaction with life (p> 0.05).

Table 6. *The Result of The Relationship Between Student Life Satisfaction and Sport Burnout*

		Sport Burnout	Student Life Satisfaction
Sport Burnout	r	1	-,041
	p		,517
	n	255	255
Student Life Satisfaction	r	-,041	1
	p	,517	
	n	255	255

Correlation test results are given in table 6. According to this table, there was no significant relationship between students' life satisfaction and sport burnout. Although the current finding shows a negative result between the two variables, this is not statistically significant.

Discussion

In the current study, it was determined that both the Student Life satisfaction scale and Sport burnout Inventory scores showed normal distribution. The skewness and kurtosis values of the study performed by Çivitci have a normal distribution [17]. In another study, it was determined that the candidates of physical education teachers had a normal distribution of life satisfaction scores [18].

According to another result, the mean scores of university students' life satisfaction and sport burnout were compared by gender and no difference was detected. There are similar study results in the literature. In a study, no significant difference was found in the emotional burnout levels of the referees in terms of gender variable [19]. In another study, the difference between the satisfaction levels of male and female Muay Thai coaches was not statistically significant [20]. In the study conducted by Özkara et al., no statistically significant difference was found between the life satisfaction levels of the students [21]. Considering the studies with similar results, the life satisfaction scores of the participants [18], it was observed that the life satisfaction scores of female and male faculty members did not differ significantly [22]. There are also studies that do not match the research results stated. A statistically significant difference was found in the life satisfaction levels of female and male students [23]. In a study, it was found that there was a

significant difference between gender and life satisfaction level [24]. When the satisfaction of the participants was examined, a statistically significant difference was found in terms of gender [25].

According to another result, the relationship between students' life satisfaction and sport burnout was examined and no statistically significant relationship was found. Although the current result shows a negative sign between the two variables, this did not make a significant relationship. In a study, no statistically significant relationship was found between free time and life satisfaction scores [26]. However, different results were obtained in the studies. The relationship between athlete's commitment and burnout was examined and it was observed that there was a weak / moderate, negative relationship between both variables [27]. It was determined that there was a moderate negative relationship between the students' opinions about their professional future and their hopelessness levels [23]. A similar result has shown that there is a positive, low-level relationship between self-esteem and life satisfaction score averages [28]. When the relationship between life satisfaction and leisure time is analysed, a statistically significant positive relationship was found [25].

Conclusion

The data collected within the scope of the current study was analysed and it was found that the student's satisfaction with life and sport burnout scores showed normal distribution. As a result of this finding, the application of parametric analysis methods was considered appropriate.

Life satisfaction and sport burnout average scores of university students were compared by gender and no difference was detected. As a result of this finding, it can be said that female and male students show a similar tendency in terms of life satisfaction and sport burnout. The analysis shows that there is no significant difference in the life satisfaction and sport burnout scores of the students studying in undergraduate and associate degree programs. According to another result, the number of day-based training sessions that students attended on a weekly basis did not make any difference in terms of their life satisfaction. However, it is observed that the training done on different days created a significant difference in terms of sport burnout in general and "insensitive" in sub-dimension.

Daily sleep times of the students were examined and there was no difference in life satisfaction and sport burnout average scores. This finding shows that sleep does not have a significant effect on life satisfaction. According to another result, the relationship between students' life satisfaction and sport burnout was examined and no significant relationship was found. Although the current result shows a negative sign between the two variables, this is not statistically significant.

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A Modern Approach to the System of Training for Organization of Physical Culture and Sports Work of Physical Education Teachers

Yuliia Zaitseva[1], Iryna Taranenko[2], Maryna Grynova[3], Andriy Tkachenko[4] and Olexander Mikheienko[5]

[1,2]Ph.D. in Pedagogics, Lecturer of the Department of Theory and Methods of Teaching Sports, Poltava V. G. Korolenko National Pedagogical University, Poltava, Ukraine.

[3]Doctor of Pedagogical Sciences, Professor, Dean of the Faculty of Science, Poltava V. G. Korolenko National Pedagogical University, Corresponding Member of the National Academy of Pedagogical Sciences of Ukraine, Poltava, Ukraine.

[4]Doctor of Pedagogical Sciences, Associate Professor of the Department of Pedagogical Skills and Management named after I. A. Zjazun, Poltava V. G. Korolenko National Pedagogical University, Poltava, Ukraine.

[5]Doctor of Pedagogical Sciences, Professor of the Department of Health, Physical Therapy, Rehabilitation and Ergotherapy, Sumy State Pedagogical University named after A. S. Makarenko, Sumy, Ukraine.

Abstract

The article is devoted to the problem of preparation of future teachers of physical culture for the organization of physical culture and sports work in general secondary education institutions. We determined that the basic approaches to the formation of students' readiness for this type of activity are personality-oriented, active and axiological one; we allocated and substantiated the structure of preparation of future teachers of physical culture for the organization of physical culture and sports work in establishments of general secondary education during the school day and in extracurricular time; we theoretically substantiated and experimentally tested the holistic process in the unity of organizational and motivational, practical and active, independent and creative stages and also tested a set of pedagogical conditions for preparing future physical education teachers for the organization of physical culture and sports work.

Keywords: physical education teachers, physical culture and sports work, readiness for the organization of physical culture and sports work, step-by-step process, pedagogical conditions.

1. Introduction

The priority tasks of state policy are the comprehensive development of the individual, strengthening health and forming a healthy lifestyle, ensuring optimal motor activity, involving children and youth in physical culture and sports. A special role in the modern school is given to the teacher of physical culture, which is the embodiment of health and a healthy lifestyle, it depends on the attitude of students to these important aspects of human life. Therefore, there are new requirements for the training of physical education teachers who are able to organize physical culture and sports work, focused on improving the health and formation of students' need to engage in physical culture and sports.

Analysis of scientific literature and own pedagogical experience allows us to note that physical education classes have a direction towards health improvement, sports include classes in sports sections and participation in competitions, and it is the physical education teacher who provides such activities for schoolchildren in general secondary education institutions. Based on this, we note that the physical education teacher carries out physical culture and sports work. Because physical culture a priori has a health direction, and sports in general secondary education is aimed at mass involvement of students in various sport activities, it is appropriate to talk about physical culture and sports work of a physical education teacher. In our opinion, these areas of professional activity of physical education teachers are interconnected and complementary. At the same time, insufficient attention in scientific research is paid to the comprehensive study of the system of professional training of future physical education teachers as organizers of physical culture and sports work in general secondary education institutions [5; 6; 9; 12; 14; 15; 16; 17].

2. Materials and Methods

The aim of the study is to theoretically substantiate the conceptual foundations of the system of professional training of future physical education teachers in higher education institutions, to develop a

holistic step-by-step process and a set of pedagogical conditions for the preparation of future physical education teachers for the organization of physical culture and sports work in general secondary education institutions.

To achieve established goal and solve problems, general and special research methods were used, interconnected and consistently applied during the study: system-structural method, synthesis, generalization and systematization. To identify the state of development of the studied problem, to clarify the basic concepts, modeling method was used. We found out the peculiarities of the application of modern methodological approaches in the development of the system of professional training of future physical education teachers, established the components of their professional readiness for the organization of physical culture and sports work in general secondary education institutions, criteria, indicators and levels of its formation. We have developed a holistic step-by-step process of professional training of future physical education teachers for the organization of physical culture and sports work in general secondary education institutions, we have identified pedagogical conditions that ensure its effective implementation. We conducted a pedagogical experiment to determine the levels of readiness of students to organize physical culture and sports work in general secondary education. We used the methods of mathematical statistics for quantitative and qualitative processing of research results.

The pedagogical experiment consisted of ascertaining, formative and final stages of scientific and pedagogical search. The data of the experiment on preparation for the organization of physical culture and sports work in general secondary education institutions for the period 2012–2019 were analyzed. The data were obtained from students of I–IV courses of physical education faculties from Poltava National Pedagogical University named after V. G. Korolenko, Kharkiv National Pedagogical University named after H. S. Skovoroda, Pereyaslav-Khmelnytsky State Pedagogical University named after Hryhoriy Skovoroda.

At the ascertaining stage of the pedagogical experiment the state of the problem of preparation of students of the faculty of physical education for the organization of physical culture and sports work was found out, specified criteria (professional orientation, knowledge, operational, reflexive), which were analyzed at three levels (high, medium, low), the selection of methods for each criterion was carried out, which made it possible to determine the levels of formation of future teachers' readiness for the organization of physical culture and sports work. During the formative experiment the integral step-by-step process and pedagogical conditions of preparation of students of faculty of physical training for the organization of physical culture and sports work in establishments of general secondary education were introduced. The total number of future teachers, who were involved in the experimental work, was 534 people. Control (CG) and experimental groups (EG) were identified. The control group consisted of 273 students, the experimental group consisted from 261 students. At the control stage of the pedagogical experiment the results of realization of the integral step-by-step process and pedagogical conditions of preparation of students of faculty of physical education for the organization of physical culture and sports work in establishments of general secondary education were analyzed and qualitative and quantitative analysis of research results using the methods of mathematical statistics was made. In the course of a longitudinal experiment the dynamics of preparation of future physical education teachers for the organization of physical culture and sports work in establishments of general secondary education was found out on I, III and IV courses of training of students in institutions of higher education according to introduction of the proved step-by-step process and pedagogical conditions.

3. Results and Discussion

The activity of a physical education teacher has its own peculiarities, as it takes place in unusual conditions, in comparison with the activity of other teachers. The content and organization of physical culture and sports work in general secondary education institutions is determined by a set of factors that determine the specifics of the professional activity of a physical education teacher during the school day and extracurricular activities. These factors include: high level of professional responsibility (constant visual observation of motor activity of schoolchildren in order to prevent injuries and overload; the use of various forms, means and methods of physical education, taking into account the individual and age level of development of children, their health, the level of their physical fitness, etc.); multifunctional professional activity (performing of following functions: physical education teacher, educator, coach, sports judge, researcher, bearer of general cultural values and values of physical culture and sports, etc.); the presence of a

motor component (the need for the teacher to demonstrate physical exercises, perform physical movements with the group during classes, insurance of students during the exercises, etc.); the need for continuous professional and physical self-development; orientation of activity on formation in pupils of motivation necessary for regular and systematic physical culture and sports activities, formation of a healthy lifestyle, etc.

Based on the analysis of scientific and pedagogical literature, we have identified following approaches: *personality-oriented approach,* aimed at creating conditions for the realization of the student's personality, his interests, motives, learning opportunities, which is based on the cooperation and co-creation of all its participants, on initiative, activity, independence, creativity and responsibility of future teachers with the possibility of personal achievements in learning; *activity approach,* which provides the focus of the educational process on the organization of active and conscious activities of future teachers to master the knowledge, skills and abilities of the organization of physical culture and sports work; *axiological approach*, aimed at forming students' values to the organization of various forms of physical culture and sports [1; 2; 3; 4; 7; 8; 10; 11; 13].

In the context of personality-oriented approach, activity approach and axiological approach determination of the preparation of students of physical education faculty for the organization of physical culture and sports work in general secondary education institutions should be carried out according to the following components: motivational and denominational, cognitive, activity and reflexive. For each component the criterion according to which indicators are defined was formulated (Table 1).

Motivational and denominational component involves students' awareness of the importance of professional activities in the organization of physical culture and sports work in general secondary education institutions, the importance of mastering the theory and practice of physical education teachers in this type of activity and the desire to succeed in it; formation of the need for professional and physical self-improvement; the presence of values and a positive motive for professional activity. The criterion of the motivational and denominational component of training is the criterion of professional orientation of future physical education teachers, the indicators of which are the interest in future professional activity; a set of motives for mastering the knowledge, skills and abilities to organize physical culture and sports work and awareness of its significance; professional and denominational motives and personal desire for this type of activity.

The cognitive component characterizes the formation of complex of special, professional and pedagogical knowledge about the nature and specifics of the organization of physical culture and sports work in general secondary education. The cognitive component includes a knowledge criterion that includes the following indicators: a set of knowledge of theory and methodology, forms and stages of organization of physical culture and sports work, understanding of its pedagogical potential; theories and methods of development of physical qualities, teaching students technical and tactical actions in sports, the ability to analyze pedagogical, scientific and methodological literature on physical culture and sports, mastery of professional terminology.

The activity component determines the level of readiness for the implementation of physical culture and sports work in general secondary education institutions, its planning and organization of various forms, the level of general physical training and development of physical qualities, mastering of technical and tactical actions in the sports according to the school program and training of the student. The criterion of the activity component is the operational-activity criterion, indicators of which are practical skills and abilities of the organization of physical culture and sports work, ability to creatively implement professional knowledge, skills and abilities in practice.

The reflexive component involves the readiness of students to observe, self-observation, analysis, self-analysis, evaluation and self-evaluation of educational and professional activities for the organization of physical culture and sports work in general secondary education institutions. The reflexive criterion of this component has the following indicators: ability to observe, analyze, evaluate and implement, it also includes self-analysis, self-observation and self-assessment of educational and professional activities on the organization of physical culture and sports work, ability to adjust the process and results of this activity, the ability to self-criticism and self-improvement.

Table 1. *Indicators of the formation of the readiness of future physical education teachers for the organization of physical culture and sports work*

Components	Criteria	Levels	Parameters
Motivational and denominational	Professional orientation	High	Strong motivation to master the knowledge, skills and abilities to organize physical culture and sports work in general secondary education; belief in the value of future professional activity, motivation for success and personal desire for this type of work
		Average	Interest in future professional activity; understanding the value of future work; unstable interest in acquiring knowledge, skills and abilities in the organization of physical culture and sports work in general secondary education institutions to achieve success in this activity
		Low	Lack of motivation to master the knowledge, skills and abilities to organize physical culture and sports work in general secondary education, there is also no motivation to succeed in this activity; do not realize the value of this activity; passivity in mastering the future profession
Cognitive	Knowledge	High	Possess a holistic system of knowledge of the specifics of the organization of physical culture and sports work in general secondary education, and the feasibility of their application; inherent active cognitive activity; active processing and accumulation of educational information; perfect mastery in the professional terminology
		Average	They do not have sufficiently thorough and insufficiently systematized knowledge of future professional activity; partially and irregularly carry out cognitive activities; have professional terminology, but mistakes are possible
		Low	Have a superficial idea of the specifics of the organization of physical culture and sports work in general secondary education; there is no cognitive activity and ability to work with educational and methodical literature; make crude mistakes when using professional terminology
Activity	Operational and activity	High	Have an ability to apply knowledge, skills and abilities (planning, organization of logistics, self-organization and organization of student activities, etc.) on the organization of physical culture and sports work in general secondary education institutions, independently and creatively use them in practice
		Average	Knowledge, skills and abilities are insufficiently used in practice, some difficulties are possible, so students seek help from a teacher
		Low	They are not able to independently apply the acquired knowledge, skills and abilities in practice
Reflexive	Reflexive	High	Actively and with interest take part in discussion, analysis, estimation and adjustment of results of their and other students personal professional activity
		Average	Take a passive position when discussing, analyzing, evaluating and adjusting the results of their and other students personal professional activities
		Low	Not able to analyze, evaluate and adjust the results of their and other students personal professional activities

At the organizational and motivational stage of the process, students in general educational and physical culture and sports institutions performed simple functions: helped in the preparation of material and technical support of classes, observed, were participants in various activities, discussed and analyzed

samples of professional activity of qualified specialists, as a result of which they acquired the necessary pedagogical and professional skills. At the practical stage of the process, students organized and conducted: physical culture and sports activities with primary school students, preparatory and final part of classes in primary and secondary school, helped physical education teachers in organizing and conducting trainings, sports competitions in various sports, their refereeing. At the independent creative stage of the process, students had a sufficient level of knowledge, skills and abilities to organize various forms of physical culture and sports activities, gained their own professional experience. Working with specialists in physical culture and sports, students took a creative approach to addressing the organization of professional activities in general secondary education, independently performed work on the organization of physical culture and sports work with students.

The results of the statement experiment made it possible to build a diagram of the initial level of preparation of students (Fig. 1), on which the percentage of the formation of the criterion of professional orientation of students of control and experimental groups to the organization of physical culture and sports work in general secondary education is reflected.

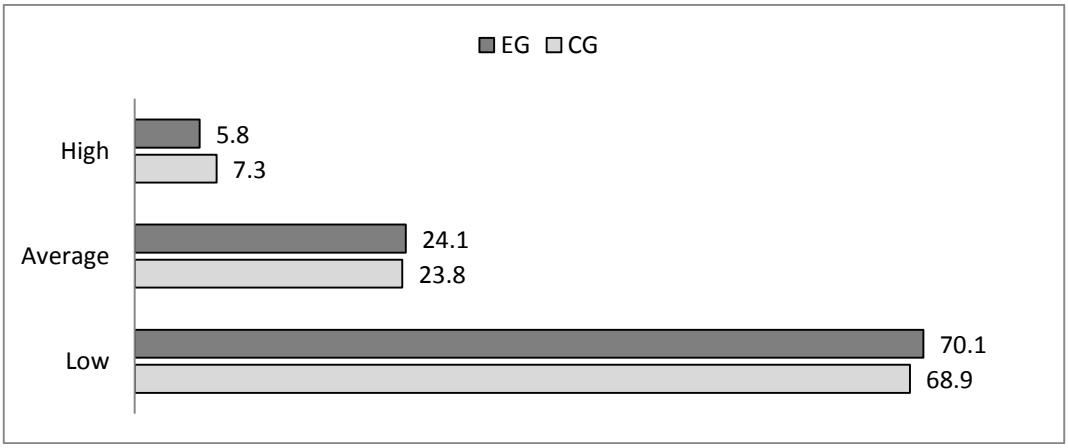

Fig. 1. *Initial levels of formation of professional orientation of future physical education teachers*

The low level of formation of readiness for the organization of physical culture and sports work is inherent in 70.1% of students of experimental and 68.9% of students of control groups. The average level is observed among 24.1% of students in the experimental group (23.8% of the control group), only 5.8% of students in the experimental group and 7.3% in the control groups have a high level. These results give grounds to speak about almost identical initial level of preparation of students of experimental and control groups for the organization of physical culture and sports work in establishments of general secondary education.

Based on indicators of levels of formation of professional orientation of future physical education teachers in general secondary education institutions at the organizational and motivational stage we built a chart (Fig. 2), which shows the levels of formation of preparedness at this stage of the process.

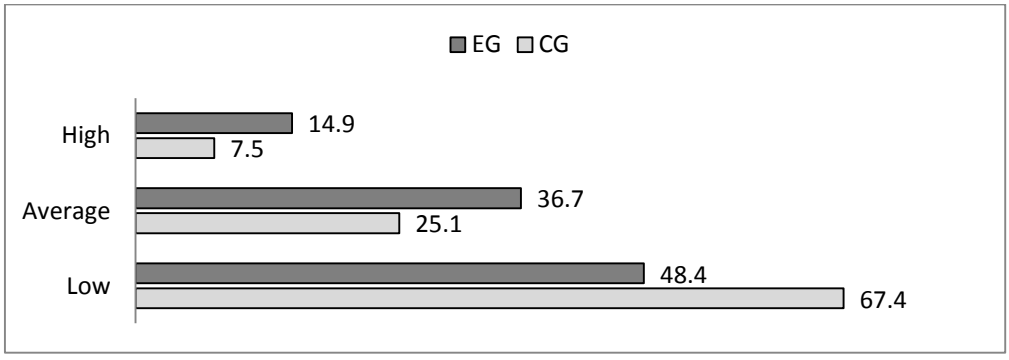

Fig. 2. *Levels of formation of professional orientation of future physical education teachers at the organizational and motivational stage*

The data obtained indicate, that a high level of readiness for the organization of physical culture and sports work in secondary schools at the organizational and motivational stage of the process have 14.9% of students in the experimental group and 7.5% in the control group, the average level is typical to 36.7% of students in the experimental group and 25.1% of the control group, 48.8% of students in the experimental group and 67.4% in the control group have a low level.

The results of the diagnostic section of the formation of students' readiness for the organization of physical culture and sports work at the practical stage can be presented in the form of a diagram (Fig. 3).

At this stage of the process, we see that a high level of preparedness for the organization of physical culture and sports has mastered 23.9% of future teachers of physical education from the experimental group and 9.8% from the control group, 47.5% of students in the experimental group and 32.1% in the control group have an average level, low level in 28.6% of students in the experimental group and 58.1% in the control group of students.

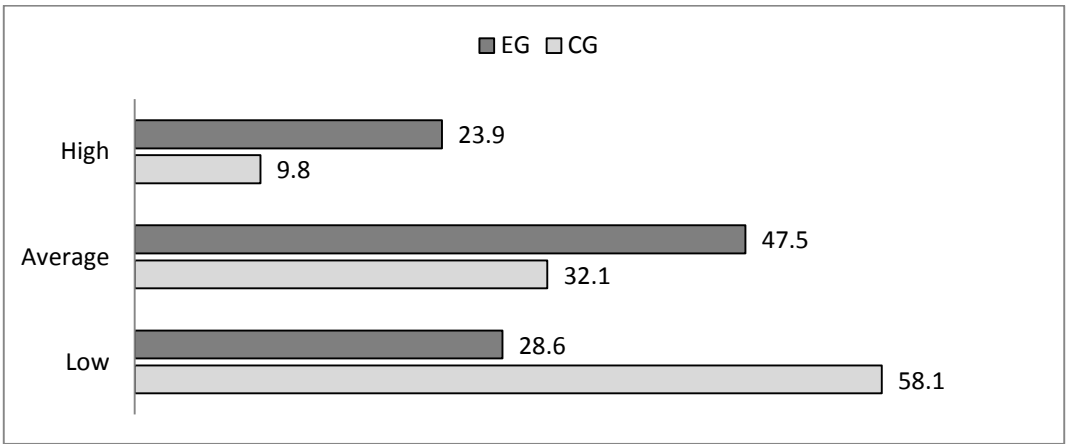

Fig. 3. *Levels of formation of professional orientation of future physical education teachers at the practical and activity stage*

The results of the independent creative stage made it possible to build a diagram of readiness for the organization of physical culture and sports work in general secondary education institutions for students of control and experimental groups (Fig. 4).

The data show that at the independent creative stage of the process 46.5% of students in the experimental group have a high level of preparation for the organization of physical culture and sports work in general secondary education institutions, against 13.3% of future physical education teachers of the control group, 45.4% of students in the experimental group and 50.5% in the control group have an average level, 8.1% of future teachers of the experimental group remained at a low level of training, against 36.2% of students of the experimental group.

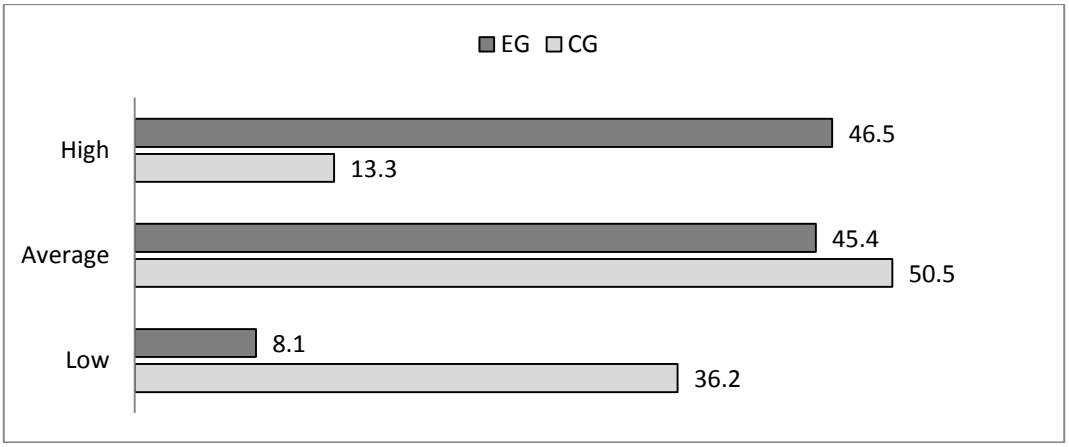

Fig. 4. *Levels of formation of professional orientation of future physical education teachers at the independent creative stage.*

Based on the data of experimental verification of the implemented holistic step-by-step process and pedagogical conditions of preparation of students of the faculty of physical education for the organization of physical culture and sports work, it was established, that the vast majority of students in the experimental group had mastered the average and high level of training by all criteria. They understand the value of future professional activity and are more motivated to achieve success, have the best theoretical knowledge and practical skills in organizing physical culture and sports work in general secondary education institutions and are capable of professional self-improvement..

We have received the generalized results of the formative experiment of formation of levels of preparation of future teachers of physical culture for the organization of physical culture and sports work in establishments of general secondary education in accordance with the stages of the process (organizational and motivational, practical, independent creative).

Experimental verification confirmed the effectiveness of the process of preparing students of the faculty of physical education for the organization of physical culture and sports work in general secondary education institutions by all criteria: high level of formation of the criterion of professional orientation (EG – 59.8 %, CG – 19.8 %), cognitive (EG – 27.2 %, CG – 9.5 %), operational and activity (EG – 48.7 %, CG – 13.2 %), reflexive (EG – 50.2 %, CG – 10.6 %); the average level of formation of the criterion of professional orientation (EG – 33 %, CG – 44.3 %), cognitive (EG – 65.9 %, CG – 53.1 %), operational and activity (EG – 42.9 %, CG – 53,5 %), reflexive (EG – 39.8 %, CG – 51.3 %); low level of formation of the criterion of professional orientation (EG – 7.2 %, CG – 35.9 %), cognitive (EG – 6.9 %, CG – 37.4 %), operational and activity (EG – 8.4 %, CG – 33.3 %), reflexive (EG – 10 %, CG – 38.1 %)(Table 2).

Table 2. *Criteria of prepardness students of the faculty of physical education for the organization of physical culture and sports work in general secondary education institutions*

Criteria	Levels												
	Low				Average				High				χ^2
	EG		CG		EG		CG		EG		CG		
	Amount of students	%	Amount of students	%	Amount of students	%	Amount of students	%	Amount of students	%	Amount of students	%	
Statement experiment													
Professional orientation	183	70,1	188	68,9	63	24,1	65	23,8	15	5,8	20	7,3	0,37
Organizational and motivational stage (I training course)													
Professional orientation	74	28,4	150	55	124	47,5	87	31,8	63	24,1	36	13,2	29,61
Cognitive	132	50,6	183	67	94	36	71	26	35	13,4	19	7	13,71
Operational activity	146	55,9	201	73,6	89	34,1	59	21,6	26	10	13	4,8	13,71
Reflexive	153	58,6	202	74	76	29,1	57	20,9	32	12,3	14	5,1	16,58
Overall indicator (%)	–	48,4	–	67,4	–	36,7	–	25,1	–	14,9	–	7,5	–
Practical stage (II-III training courses)													
Professional orientation	24	9,2	131	48	146	55,9	101	37	91	34,9	41	15	52,35
Cognitive	77	29,5	164	60,1	126	48,3	88	32,2	58	22,2	21	7,7	50,93
Operational activity	94	36	171	62,6	115	44,1	80	29,3	52	19,9	22	8,1	35,97
Reflexive	103	39,5	169	61,9	109	41,8	81	29,7	49	18,7	23	8,4	25,66
Overall	–	28,6	–	58,1	–	47,5	–	32,1	–	23,9	–	9,8	–

indicator (%)													
Independent creative stage (IV training course)													
Professional orientation	19	7,2	98	35,9	86	33	121	44,3	156	59,8	54	19,8	104,63
Cognitive	18	6,9	102	37,4	182	65,9	145	53,1	71	27,2	26	9,5	60,94
Operational activity	22	8,4	91	33,3	112	42,9	146	53,5	127	48,7	36	13,2	116,19
Reflexive	26	10	104	38,1	104	39,8	140	51,3	131	50,2	29	10,6	171,24
Overall indicator (%)	–	8,1	–	36,2	–	45,4	–	50,5	–	46,5	–	13,3	–

An important factor influencing the effectiveness of the implementation of a holistic step-by-step process is a set of pedagogical conditions for preparing students for the organization of physical culture and sports work, based on three-subject interaction. Three-subject interaction we understand it as an educational process within the framework of equal relations in the system "teacher - student - physical education teacher", aimed at preparing future physical education teachers to organize physical culture and sports work in general secondary education institutions. This involves the implementation of the connection of the faculties of physical education with secondary schools and other physical culture and sports institutions, where students are involved in the organization and conduct of various forms of physical culture and sports.

Teacher takes a leading place in the three-subject interaction, controls this process and directs it. The student is an active participant in the educational process, who has the opportunity to form their own professional readiness and gain experience in organizing physical culture and sports work. A physical education teacher and other specialists in this field help students to see and understand the essence of professional activity "from inside", he is the coordinator of students' activities for the organization of various forms of physical culture and sports work in the conditions of EGSE and other physical culture and sports institutions.

The pedagogical conditions of preparing students for the organization of physical culture and sports work include:

– directing the joint efforts of teachers of professional disciplines and physical education teachers to support the professional development of future physical education teachers anticipates uniform requirements for students; opportunities for students to realize their own intellectual abilities and master the practical skills and abilities of organizing physical culture and sports work with students in the real conditions of secondary schools and other physical culture and sports institutions. Students were also provided with samples of professional documentation on physical culture and sports work, which they had the opportunity to get acquainted with at the departments of the faculty of physical education and in the offices of physical culture of educational institutions.;

– integration of educational and professional activities in general secondary education institutions of future physical education teachers in the process of professional training is aimed at implementing the activity approach in teaching, purposeful inclusion of students in independent and creative activity on the organization of physical culture and sports work with students of EGSE and other physical culture and sports institutions, where in the course of the real educational process they gained pedagogical experience;

– formation of a positive style of cooperation and co-creation of the subjects of the educational process involved three-subject interaction in the system "teacher - student - physical education teacher", joint efforts and joint implementation of educational tasks, which motivated and encouraged future teachers to actively participate in the pedagogical process.

It can be stated that the pedagogical conditions created by us, the methods, means and methods of teaching used at the organizational and motivational stage of the process significantly affect the formation of interest and values to the future profession in experimental group, their awareness of the importance of mastering the theory and practice of physical education teachers; students have a deeper understanding of the essence of the work of a physical education teacher on the organization of physical culture and sports work in general secondary education institutions; in contrast to the students of the control group, in the experimental group the criteria of readiness for the organization of physical culture and sports work are

more successfully formed. This indicates the advantage of experimental training in the formation of future physical education teachers' interest and desire to master the future profession.

Thus, we tested the effectiveness of a holistic step-by-step process of preparing students of the faculty of physical education for the organization of physical culture and sports work in general secondary education, the influence of a certain set of pedagogical conditions on its effectiveness, identified the levels of formation of professional training criteria, which were analyzed at high, medium and low levels.

Diagnosis of students' readiness to organize physical culture and sports work in general secondary education institutions showed the advantage of experimental training over traditional, because future teachers of the experimental group have a significantly higher level of training by all criteria.

First of all, the students of the experimental group more clearly understand the specifics of the physical education teacher as an organizer of physical culture and sports work, have a higher personal desire for professional growth, able to analyze, evaluate and adjust the process and results of their own activities and the activities of others. In most future teachers of the experimental group there is consistency between the independent setting of goals and objectives of future activities, the appropriate choice of methods and means of their implementation.

The obtained data indicate a significant impact of experimental training on the theoretical and practical preparedness. At the same time, some students have difficulties with the documentation necessary for preliminary planning and for sports competitions. There were difficulties associated with the independent organization and conduct of various forms of physical culture and sports. It was found that at this stage, students are more successful in completing learning tasks, working in mini-groups.

4. Conclusions

In the process of experimental verification of the effectiveness of a holistic step-by-step process of preparing students of the faculty of physical education for the organization of physical culture and sports work in general secondary education institutions and a set of pedagogical conditions for its implementation were obtained results confirming the probability of the hypothesis. Preparation of students of the faculty of physical education for the organization of physical culture and sports work in general secondary education institutions becomes effective if: we theoretically substantiate and implement a holistic step-by-step process, taking into account modern requirements for professional knowledge, skills and abilities of future physical education teachers as organizers of physical culture and sports work; substantiate a set of pedagogical conditions aimed at creating positive motivation of students and achieving success in this type of work and values to it.

The growth of the number of future physical education teachers in the experimental groups, who have mastered the high level (46.5%) of the formation of the criteria of readiness for the organization of physical culture and sports work, has been confirmed, against 13.3% of future physical education teachers of the control group. There are 45.4% of students of the experimental group and 50.5% of the control group, who have an average level of formation of readiness criteria, while 8.1% of future teachers of the experimental group remained at a low level, against 36.2% of students of the experimental group. The given data convince of expediency of application of the proved step-by-step process and a complex of pedagogical conditions of preparation of future teachers of physical culture for the organization of physical culture and sports work in establishments of general secondary education.

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The Structure Model of Methodical System Usage Fitness-Technology in Student Physical Education

Olena Shkola[1], Valeriy Zhamardiy[2], Volodymyr Saienko[3], Hanna Tolchieva[4] and Iurii Poluliashchenko[5]

[1]*Department of Physical Education, Municipal Establishment «Kharkiv Humanitarian Pedagogical Academy» of Kharkiv Regional Council, Ukraine.*

[2]*Department of Physical Education and Health, Physical Therapy, Ergotherapy with Sports Medicine and Physical Rehabilitation, Ukrainian Medical Stomatological Academy, Ukraine.*

[3]*Faculty of economics and pedagogical, Academy of Management and Administration, Poland.*

[4,5]*Department of Olympic and professional sports, Luhansk Taras Shevchenko National University, Ukraine.*

Abstract

The article describes the model of a methodical system of fitness technology usage in the student physical education process. The structure of the author's model consists of motivational-target, content-organizational, technological and control-diagnostic blocks. The target block is formed by the purpose, tasks, functions, system of knowledge and skills, the structure of physical training, which aims at the formation of harmoniously developed highly qualified future specialists. The content-organizational block is based on the general didactic and partially didactic principles, and also meets the criteria of selection of the means and forms of fitness technologies. The foundation of the technological block is the educational-methodical complex in the discipline "Physical education" (lectures, practical, consultations, independent lessons, manuals, methodical recommendations, sets of tasks, means for self-preparation, test complexes, evaluation criteria of students in physical education, etc.). It is the technology of teaching physical education that reveals the conditions for the functioning of the methodical system, that is, in our case, the planned use of fitness technology to ensure the fulfilment of physical education tasks. The control-diagnostic block provides for monitoring and evaluating the effectiveness of the use of fitness, which allows checking the formation of the target, content, organizational and technological blocks of the methodical system.

Keywords: physical culture, methodical, model, fitness, students.

1. Introduction

A model of the methodical system of fitness technology usage was created following the changes taking place in Ukraine in connection with the integration of Ukrainian to European educational space. The model at the same time takes into account the components of the pedagogical process: the purpose, tasks, methodological approaches, principles, methods, forms, means and the ultimate goal, namely the training and education of the personality of the future specialist, which has perfect fitness and fitness skills and ability to apply fitness technologies in life. All this has led to the modernization and creation of a new methodical system, which should preserve in the institutions of higher education of Ukraine a certain level of physical fitness and health of student youth, ensure it's readiness for professional activity (Donchenko et al., 2020; Ivanchykova et al., 2018). We modelled the methodical system based on the developed concept, which is based on the basics of the theory and methods of physical education, the theory of professional training of specialists, as well as on the recommendations of specialists (Butenko et al., 2017; Shkola et al., 2019) of individual components of the training system at different ages.

2. Materials and Methods

For carrying out a pedagogical forming experiment on the introduction of methodical system application a control (CG) and experimental (EG) groups of students were created, which by their general characteristics and indicators of success did not differ from the general population of students of the faculties, which prepare future teachers. A representative sample of students was identified where 573 students (257 men, 316 women) were recruited to the final stage of the experiment. Ascertaining stage included conducting a pedagogical experiment aimed at researching: physical fitness, health status, morphofunctional development, professionally important psychological qualities, emotional state and mental capacity of students. According to the results of the ascertaining stage of the experiment, the effectiveness of training in fitness technologies as a means of physical education of students was also found

out. The formative stage of the pedagogical experiment involved the experimental verification of the effectiveness of the proposed methodical system. Control tests were conducted at the end of the first semester (December) and the end of the school year (May-June). All program requirements and tests in the control and experimental groups were identical and compiled according to the requirements of the physical education program. The main difference between the educational process in the experimental groups and control groups was the introduction of a methodical system application in the physical education of students. Following theoretical methods were used: study and analysis of scientific, pedagogical, philosophical, methodical literature, curricula, curricula documents; synthesis; generalization. Empirical methods include observation, method of system analysis, method of comparison, method of functional-structural analysis.

3. Results and Discussion

A model is a symbolic system by which one can reproduce the didactic process as a subject of study, show the whole of its structure and function, preserve this integrity at all stages of the study. By modelling, you can not only reproduce the static of the didactic process, but also its dynamics. The presence of a science-based model of the educational process allows predicting its development. This is especially important for the educational process because it should be sure to predict and predict the future positive result (Zhamardiy et al., 2020). According to Slastenin et al. (2007), who's defined that the pedagogical model is a model that reflects the interconnections and interdependencies between the projected qualities and personality traits as an object of pedagogy and the process of its development, as well as the organization of the pedagogical system within which it takes place and manages it. Reference source (Batyshev, 1999) show that education models are formed means of sign systems, thinking analogues (logical constructs) that schematically reflect educational practice as a whole or its fragments. They are classified as descriptive, functional, predictive. *The model methodical system* is considered by us as a descriptive model of education since it is developed for the first time in the system of physical education and physical fitness activity. This model can give an idea of the purpose, tasks, structure and basic elements of fitness and fitness activity using fitness technologies. Therefore, the purpose, functions, principles of students' physical-fitness activity can be considered as the content and technology, organizational and methodical support, psychological and pedagogical conditions of methodical system functioning. Depending on the purpose of use, according to Abdullin (2008), the model methodical system can perform the following functions: *descriptive* (is a guideline when choosing methods and techniques of training, education, management), *effective* (allows to use the model in training or management) and *prognostic* (final check of vitality and the expediency of the model). The methodology of the concept of building a methodical system was built based on *methodological*, *theoretical* and *practical* concepts. These concepts Hryban (2012) regard the student as a personality, individual, subject of his activity, which is a certain system and promotes the acquisition of systematic educational knowledge in the field of physical culture and sports, provides the development of physical abilities, skills and skills, the formation of physical and fitness competences, which are needed for the introduction of physical culture and sports in the field of professional activity and life situations.

The *methodological concept* was intended to reflect the interconnection and interaction of scientific approaches to the modernization of physical education according to the changes occurring in the education system of Ukraine and the updating of the methodical support in physical education. Aiming at the development of fitness and wellness competencies, ensuring physical fitness and efficiency, good health and acquiring the skills to maintain a healthy lifestyle. In doing so, we applied different approaches: *the humanistic approach*; *a systematic approach*; *activity approach*; *a personality-oriented approach*; *an innovative approach*; *cultural approach*; *competency approach*.

The theoretical concept defined the system of initial parameters and assessments, which are the basis for disclosing the content and structure of fitness technologies application methodical system as a pedagogical phenomenon, which included such basic provisions:

- standardization, systematicity and continuity, integrated, systematic, activity-based approaches and humanization are the prerequisites for a single educational space in which a fitness technologies usage methodical system should operate;

- physical education activities in HEI should be the main system-forming component of the health and recreation system, which ensures the state of health, the level of general and special physical fitness of students;

- leading element in the methodical system should be the principle of integration of the fundamental and wellness orientation of content, forms, methods and means of teaching;

- the content of fitness technologies application methodical system requires updating and modernization of the physical and fitness activity following the changes during the introduction of modern technologies in the educational process in Ukrainian HEI. These changes have their peculiarities in every educational establishment;

- the openness of fitness technologies application methodical system for the introduction of innovative health technologies, improvement and updating of traditional and national Ukrainian systems of physical education of students.

The practical concept was to check the effectiveness of the functioning of the methodical system, this test was to provide students with the skills to maintain health, the ability to maintain a high level of fitness and performance, motives for maintaining a healthy lifestyle. It also allows determining the psychological-pedagogical and organizational-methodical and practical conditions of functioning of the methodical system; assessment of criteria, indicators and levels of students' readiness to use fitness technology in their professional activities. The basis of modelling the educational process by applying fitness technologies is a specially created form for reproducing the characteristics of the object we are studying. The pedagogical content of the model is manifested in the fact that it allows highlighting current and perspective tasks of the educational process, to identify and analyze the relationship between the probable, expected and desired changes of the studied object.

In the study of the methodical system, it is important that the model, in many cases, along with the cognitive goal, should provide a formative goal. That is, the process of modelling the methodical system has not only cognitive but also its inherently formative function, because the model is not only a tool of cognition but also a prototype of the state of the object being modelled, bears the structure of what is not yet in the objective reality. The construction and implementation of a methodical system for fitness technologies usage in the health and fitness activities of students of HEI require the solution of methodological, content, psychological and pedagogical, methodical and organizational tasks. *Methodological* tasks are solved by developing the concept of building a methodical system, defining its structure and content; designing and designing of its components; establishing relationships between its components. *The content tasks* are aimed at the personal-oriented choice of fitness technologies according to personal needs of students; taking into account the specific content of fitness technologies, depending on staffing and logistical equipment; the possibility of formation of individual physical and fitness needs, individual level of physical fitness, state of health, mastering of sports and technical skills, etc.

Solving *psychological and pedagogical* tasks requires the development of psychological, pedagogical, fitness and health facilities that allow the use of fitness technology based on the individual and psychological characteristics of students, namely: a) to create individual motor trajectories of mastering the content of fitness technologies; b) to apply methods and forms of fitness technologies according to the peculiarities of interpersonal interaction and mastery of the material.

The solution of *methodical problems* is connected with: the creation of effective methods of activating of physical-fitness activity of students; developing a complete system of methods and forms that are appropriate for the state of health, level of physical fitness and features of future professional activity; with the development of methodical support for the use of fitness technologies in later life. The solution of *organizational tasks* is connected with: analysis of possibilities of application of different fitness technologies; with the organization of the group, collective and individual physical and fitness activities; providing physical fitness activities with modern fitness technologies.

Therefore, we fully share the opinion Hryban (2012), which states that the methodical system of physical education is a complex phenomenon, which consists of numerous components that form a certain aggregate due to the existence of internal connections between them. By term *"fitness technologies application methodical system"* we consider a set of teaching methods of various types of physical activity and their combinations, aimed at promoting health and ensuring a high level of physical fitness and efficiency of students. The created structure model usage fitness-technology in student physical education includes

(Figure 1): *purpose, task, content, principles, methods, forms, means and tests*. A system-functional approach to the study of the methodical system involves understanding the system as a multidimensional and multistage structure with many parameters, as a complex internally integrated social organism that can be analyzed and explained; as a set of elements, properties and relationships that interact and develop. The main features of systematicity include integrity and purposefulness, structure, composition of elements, internal division, ordering, classification of the whole; the relationship of external and internal; integration of individual elements and connections. The methodological system of application of fitness technologies has the following requirements: 1) all sports and mass events are health-improving; 2) aimed at comprehensive development and increasing students' work capacity in the future life; 3) components of fitness technologies provide the necessary level of physical activity of students.

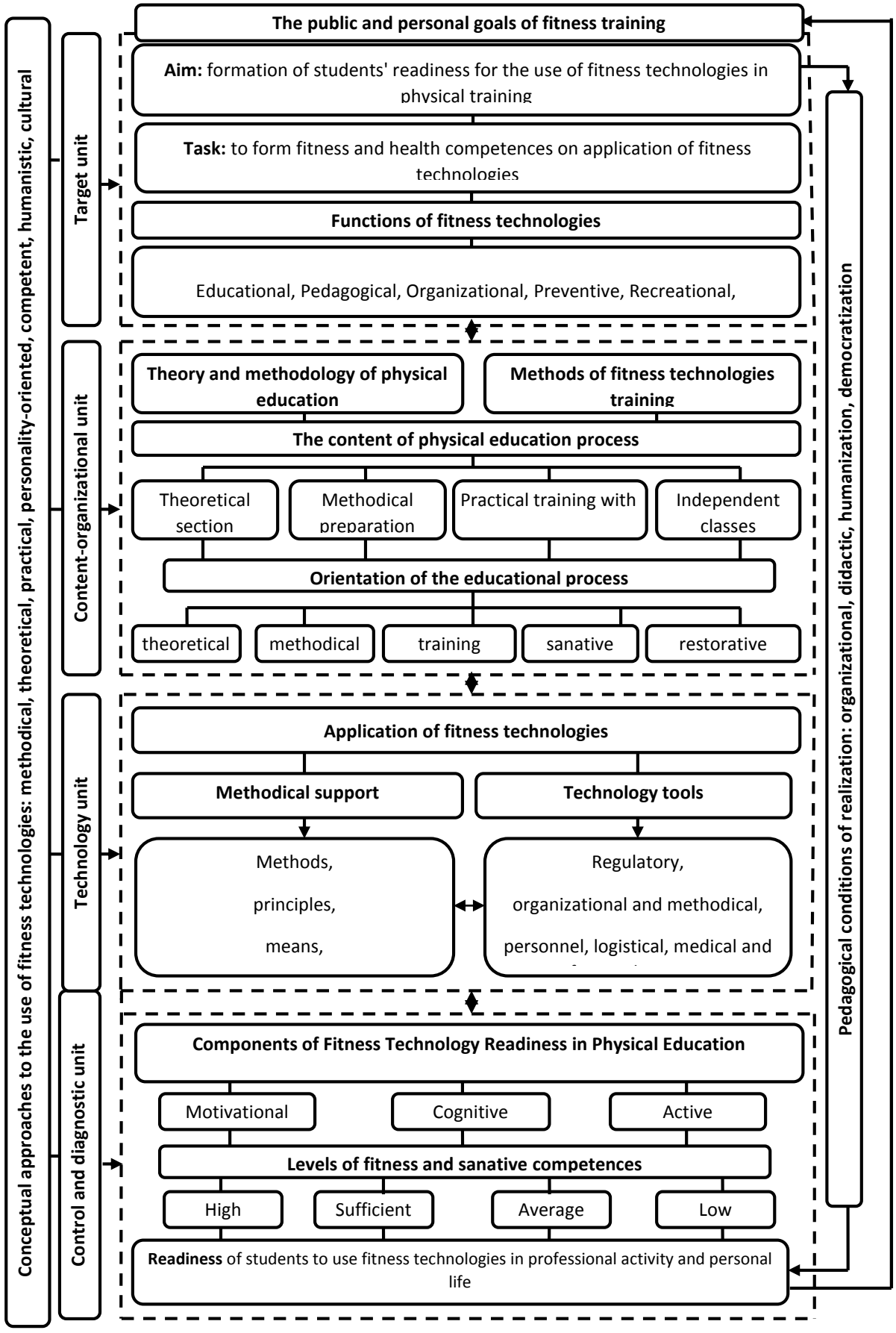
Conceptual approaches to the use of fitness technologies: methodical, theoretical, practical, personality-oriented, competent, humanistic, cultural
Target unit
Content-organizational unit
Technology unit
Control and diagnostic unit
Pedagogical conditions of realization: organizational, didactic, humanization, democratization
The public and personal goals of fitness training
Aim: formation of students' readiness for the use of fitness technologies in physical training
Task: to form fitness and health competences on application of fitness technologies
Functions of fitness technologies
Educational, Pedagogical, Organizational, Preventive, Recreational,
Theory and methodology of physical education
Methods of fitness technologies training
The content of physical education process
Theoretical section
Methodical preparation
Practical training with
Independent classes
Orientation of the educational process
theoretical
methodical
training
sanative
restorative
Application of fitness technologies
Methodical support
Technology tools
Methods,
principles,
means,
Regulatory,
organizational and methodical,
personnel, logistical, medical and
Components of Fitness Technology Readiness in Physical Education
Motivational
Cognitive
Active
Levels of fitness and sanative competences
High
Sufficient
Average
Low
Readiness of students to use fitness technologies in professional activity and personal life

Fig. 1. *The structure model of methodical system usage fitness-technology in student physical education*

Researches of scientists (Antonova, 2015; Zhamardiy et al., 2020) clearly state that the methodical system should also solve the following functions: *diagnostic-corrective, motivational-mobilizing, developmental, communicative-educational, analytical-evaluative.* The main reasons that prevent you from attending fitness classes: lack of free time (for men – 63.81%, for women – 86.39%); laziness (for men – 31.91%, for women – 27.53%); poor conditions and lack of sports equipment for training (for men – 11.28%, for women – 18.04%); low level of physical fitness (men – 9.34%, women – 10.13%). There are other reasons – the lack of a sports uniform and funds for the purchase of subscriptions and more. The analysis shows that even before admission, students have a very low motivation for playing sports. They cannot use their free time correctly. Also, sports do not always lead to good health, emotional recovery. Violation of the methodology for conducting classes, lack of physical activity, the level of functional readiness of students lead to the appearance of negative, cause fatigue, bad mood and depression. Therefore, in the implementation of the target block of this system, it is necessary: 1) to clearly define the values of fitness technologies, their place and role in a healthy lifestyle; 2) determine the most effective and affordable fitness technologies; 3) to develop and implement incentives for the development of interests and motives for fitness; 4) to form new relationships between students and teachers based on interaction; 5) to reorient the educational process to recovery; 6) to develop and introduce new forms of independent exercises in fitness technologies, to intensify student self-government; 7) involve students in a personality-oriented choice of fitness technologies. Thus, the convergence of the goals of the social order to the training of future professionals forms the goal of a methodical system of fitness technologies application, which provides for constant updating and improvement of the students' fitness process, namely: updating the content, forms and methods of using fitness technologies in the educational environment of institutions higher education.

The *content-organizational block* is based on the general didactic and partially didactic principles, and also meets the criteria of selection of the means and forms of fitness technologies, which can be applied both in the physical education and during independent physical education classes. The content of fitness technologies should be designed in such a way that students can achieve goals and objectives that provide the necessary health, fitness and performance, and generate sustainable interest and motivation for a healthy lifestyle. Each fitness technology involves the development of physical qualities, the formation of basic motor skills, provides health promotion and hardening of the body, etc. It is taken into account that the maximum efficiency of each fitness technology will be realized by the personal-oriented choice of physical activity, motivational and value preference of students.

The *technological block* provides students with mastering the system of knowledge, the formation of fitness and wellness skills. The foundation of the technological block is the educational-methodical complex in the discipline "Physical education" (lectures, practical, consultations, independent lessons, manuals, methodical recommendations, sets of tasks, means for self-preparation, test complexes, evaluation criteria of students in physical education, etc.). It is the technology of teaching physical education that reveals the conditions for the functioning of the methodical system, that is, in our case, the planned use of fitness technology to ensure the fulfilment of physical education tasks. Implementation of the technological block of the methodical system involves the use of three groups of methods, namely: *methods aimed at mastering knowledge; techniques aimed at mastering motor skills; methods aimed at the development of physical qualities*. The main factors contributing to the positive attitude of students to the fitness technology classes are: control of the department of physical education (men – 49.03%, women – 53.48%), responsibility for the level of physical fitness (men – 32.30%, women – 34.49%), responsibility and discipline (men – 26.07%, women – 28.16%) shown in Table 1.

Student survey indicators have shown that the factors that encourage students to take up fitness training have a different impact on students during their study and after-school hours. The most attractive factor for the pursuit of fitness technology in the after-school hours is the accessibility and comfort of sports facilities, which was indicated by 55.64% of men and 50.32% of women. 54.86% of students and 43.67% of students must understand their responsibility for their level of fitness. Therefore, students' physical improvement needs are a mental state characterized by an attraction to practising fitness to develop their physical qualities and promote health. The vital need to meet such needs leads to a student's motive for action.

Table 1. *The main factors of positive attitude of students to fitness training during the training process in physical education and extracurricular physical-fitness activities (men: n=257; women: n=316), %*

Factors	Gender	Educational time	Extraordinary time
Control of the Department of Physical Education and the Dean's office on the educational process	man women	49.03 53.48	16.73 19.94
Responsibility for the level of fitness	man women	32.30 34.49	54.86 43.67
Responsibility and discipline	man women	26.07 28.16	21.01 20.89
The pleasure of the emotional appeal of fitness training	man women	21.01 29.43	27.63 31.33
Accessibility and comfort of sports facilities	man women	19.84 24.68	55.64 50.32
Example and skill of the teacher, attentiveness and kindness	man women	16.34 23.42	15.18 31.91
Example of parents and friends	man women	8.97 11.39	18.68 17.09

The effectiveness of fitness classes is significantly influenced by the form of training. The greatest preference is given to classes in sports sections under the guidance of a teacher (30.75% of men and 37.66% of women). An important place is occupied by independent classes with colleagues (28.40% – men and 29.75% women), training classes are less attractive to students shown in Table 2.

Table 2. *Forms of fitness training preferred by students (men: n=257; women: n=316), %*

Forms of fitness training	Men	Women
Classes in sports sections under the guidance of the teacher	30.75	37.66
Independent classes with colleagues	28.40	29.75
Scheduled classes	21.01	24.36
Independent individual leisure activities	19.84	8.23

The content of fitness technologies, the place of their conducting, the emotional climate in the classes and the student-oriented choice of the means of development of physical qualities largely depends on the quality and effectiveness of physical-fitness activities in their free time. Therefore, one of the mechanisms of forming a positive attitude of students to the use of fitness technologies in the process of physical education is to activate social activity to a healthy lifestyle, to provide psychological and social training to overcome the difficulties in the self-realization of the individual in fitness activities.

The *control-diagnostic block* provides for monitoring and diagnostics of the level of students' knowledge, practical skills, level of physical fitness and mastery of fitness technologies. This unit provides for monitoring and evaluating the effectiveness of the use of fitness technologies, which allow checking the formation of the target, content, organizational and technological blocks of the methodical system.

4. Discussion

The methodical system of fitness technologies takes into account the following basic provisions:

1) physical education process of students is constructed as a methodical system, which has its purpose, tasks, content, methods, forms and means of physical and health activity;

2) in connection with the elimination of the discipline "Physical Education" in the curricula of higher educational institutions, physical and health activity is obligatory in the educational process of universities throughout the study period and should be considered in the unity of content, procedural and productive components;

3) theoretical information on health education should be a system of knowledge of history, psychology, pedagogy, anatomy, physiology, hygiene, ecology, biochemistry, nutrition, ethics, aesthetics, etc.;

4) physical enhancement, health improvement, boost fitness and performance is the result of students' free choice to use fitness technologies;

5) methodical system should provide: comprehensive physical training, be aimed at preserving health, the formation of efficiency; to provide the necessary educational level of knowledge in the physical education and health education and the norms of a healthy lifestyle; to promote the prevention of bad habits (alcohol, drugs, smoking, gambling), rational use of leisure time and recreation, etc.

6) methods, forms and means of fitness technology should be adequate to the level of physical fitness and health of students.

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Coronavirus (COVID-19) Pandemic: Immunity and Exercise Intervention

Erhan Kara

[1]*P.h.D. Tekirdağ Namık Kemal University, School of Physical Education and Sport Department, Tekirdağ, Turkey.*

Abstract

The aim of this review is to examine the mutual interaction of the regular moderate exercises that can be performed in an isolated environment and COVID-19 virus with the immune system and to emphasize the importance of physical activity and exercise practices which are known as complementary treatment method in struggling with diseases based on the data obtained. COVID-19 pandemic has become a great problem lately for the whole world population because of its fatal effect. Staying at home for months can cause sedentary behaviors and some changes in people's immune responses by restricting their physical and social activities. The databases such as PubMed, Elsevier, Scopus and Science Direct and Google Scholar have been used for scientific surveys while working on this review. The sources cited in this review include reports on past or current public health by more than one health institution, online information, and a total of 59 scientific articles published in refereed journals. In this review, the interaction of physical activity and exercise practices with immune responses during COVID-19 pandemic has been presented and it has been indicated that according to the data obtained from the studies conducted in previous years, physical activity and moderate exercise practices have a positive effect on immune system responses, but high-intensity and long term exercises suppress the immune system. As a consequence, social isolation during COVID-19 pandemic may cause sedentary behaviors. Therefore, individualized proper exercise practices are strongly recommended.

Keywords: Coronavirus, Exercise,Covid-19, Exercise immunology.

1. Introduction

In December, 2019, a new beta CORONAVIRUS (COVID-19) epidemic, called severe acute respiratory syndrome (SARS CoV-2) (10) has become an emergency as a public health problem causing a pandemic exercise immunology worldwide with high mortality and morbidity in Wuhan, People's Republic of China (43,53). It has been reported that the number of infected cases has reached hundreds of thousands and some of the infected people have died because of pulmonary involvement and multiple organ dysfunction in many countries of the world (58). COVID-19 medically causes symptoms like influenza.

2. Literature Review

The most common symptoms include fever and cough, partial headache in some patients, sore throat and sneezing (6,16,25). COVID-19 is a typically spreading respiratory disease on account of the fact that an infected person can transmit the virus by spraying saliva droplets after coughing or sneezing to anyone in close contact (43). Therefore, getting started to put the preventive strategies into practice can acutely limit the rapid spread of 2019- novel CORONAVIRUS (nCoV) globally (56). Within the scope of struggling with COVID-19, health authorities have tried to prevent people from being exposed to the virus by warning about not leaving the house and not travelling unless it is compulsory (42,55). Unfortunately, actions taken about business life, restrictions on regular physical activities and exercise have inevitably restricted daily routine activities of millions of people (42). During this period of social isolation, a limited number of studies have been found on what people can or should do to pursue their daily exercises or physical activity routines. This deprives people of proper exercise and physical activity based on a scientific foundation. Security measures have been published by International Health Organizations in case of exposure to the virus and with the intention of reducing its infectious effect (19,52,55). In spite of the fact that being protected from the outer environment is considered to be the most important measure in terms of contamination of the virus, it may cause an increase in some diseases (metabolic syndrome, cardiovascular diseases (CVD), diabetes mellitus (DM), dementia, etc.) in consequence of decreased physical activity and impaired diet. (23,33,39,57).

Physical activity and exercise practices within this period affect cardiorespiratory fitness that is important in determining the capacity of the lung, heart and circulatory system and in maintaining the

homeostatic balance (23). For this reason, performing simple, safe and easily applicable physical activities in home environment in order to stay healthy and keep immune defense is important in terms of both maintaining physical fitness level and being protected from COVID-19 (42). Keeping the physical fitness level depends on the type, duration, frequency and force of the exercise. In addition, a planned exercise program may include strength exercises, balance-control exercises, stretching exercises or a combination of these, but it is not limited with them. Alternatively, traditional Tai Ji Quan (11). exercises and Yoga are recommended as they can be practiced anywhere and anytime because they do not require equipment (50). Moreover, access to health and exercise videos through Internet, mobile technologies and television supports physical activity (50). At the beginning of COVID-19, although official measures have been taken to protect people from outer environment, no pronouncement has been come upon restricting physical activity and exercise practices in home environment. Widespread contamination of COVID-19 has made the control of infection and safety precautions compulsory (42). However, it is necessary to review the bilateral relationship of exercise and the immune system in detail in order to clarify the interaction of COVID-19 and exercise in detail.

3. Effects of Exercise on Immune Function

Publications on exercise immunology date back to the late 19th century. However, globally known researchers have conducted their studies on the relationship of exercise and immune system until the mid-1980s. (36). Immune system creates different responses as a result of acute and chronic exercise. The effect level of exercise on immune system functions depends on many parameters such as the frequency, intensity, volume duration and fitness level of the individual (20,51). It has been shown in the studies that moderate physical exercises have positive effects on the immune system against viral respiratory infections (2,27). After the moderate physical exercises, an increase in neutrophil and Natural Killer (NK) cell numbers which is the basic protective system of the body and immunoglobulin A (IgA) concentration in saliva has been found out (15). Cytokines secreted from Th^1 and Th^2 cells are known to increase immunity against infections (29). Thus, 20-30% reduction in upper respiratory tract infections has been observed in individuals who exercise regular and moderate physical activity during the day (29). In addition, long-term high-intensity physical activities have been shown to suppress the immune system and cause an increased mortality rate (4,8). In some studies, the relationship between physical activity and upper respiratory tract viral infection has been explained with "J Curve Model" (Figure 1) (14,49). According to the result of these studies, it has been reported that regular moderate physical activities strengthens the immune system and reduces the risk of upper respiratory tract viral infection, but long term high intensity physical activities cause an increase at the risk of upper respiratory infection by suppressing the immune system (1,34,35).

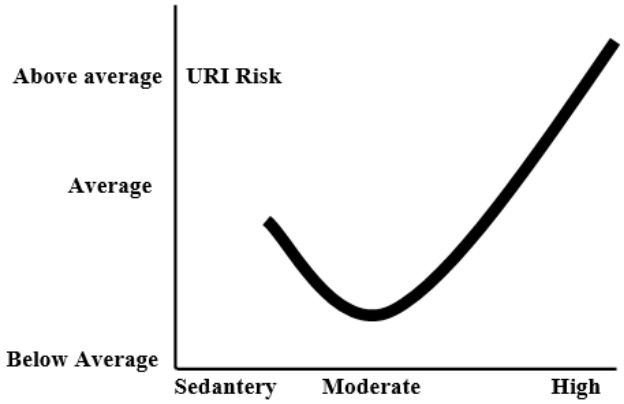

Figure 1. *J-curve model effects of exercise on immune system (14). Abbreviation: URI=Upper respiratory infection.*

Figure 2. *Open Windows Theory (14). Abbreviation: hrs=hours.*

Increased Susceptibility To Diseases After Intense Exercise. Theoretical concept of "open window" associated with immune responses to acute exercise (14). The relation between the susceptibility of changes in the immune system related to exercise to infections is expressed as "open window theory" (Figure 2). This period, during which immune defenses are reduced, ends 3-72 hours after an intense exercise program Thus, harmful microorganisms can penetrate into the body and cause infections during this open window period (14,41,48).

3.1. Acute Effects of Exercise On Immunity

"Acute moderate intensity exercise is to increase neutrophil chemotaxis, but does not increase their ability to adhere to the endothelium" (47). Thus, the vast majority of studies regarding the phagocytic activity of hereditary transmitted immune cells have been reported that neutrophil phagocytosis increases immediately after exercise, while monocyte phagocytosis may increase after prolonged submaximal exercise (13,14,32,37). In addition, many factors such as the frequency, force, duration, age, condition level, environmental factors (temperature, height, humidity, malnutrition and insomnia), nutritional and infection history are among the parameters of the exercise that affect the immune system (47).

3.2. Chronic Effect of Exercise on Immunity

Chronic and intensive exercise exercises immune cell and NK cell cytotoxicity function, including neutrophils, have the potential to have both positive and harmful effects on the immune system (3,9,12, 44,48). Moreover, athletes and elders are generally included in the studies. The reason for this is the fact that extreme and high intensity exercises in athletes suppress the immune system and that the problems arising from the differences in the immune responses of regular and moderate exercises in elderly is investigated. In some studies, related to the chronic effects of exercise on the immune system, it has been stated that high-intensity and high-volume exercises temporarily reduce the risk of infection, and in some studies, it may lead to weakening of immunity and increase the risk of infection in the long run (47,41).

4. Exercise in Isolated Conditions

The effects of exercise on the immune system have been investigated by many researchers. These effects present the fact that exercise can be safe in protecting the immune system against COVID-19 virus (59). In addition to this, individuals especially who perform physical activity and exercise should avoid close contact during exercise due to the possibility that the partner may be an asymptomatic carrier and the risk of infection (59). Therefore, wearing a surgical mask during exercise practices can be protective to reduce the infectious effect of COVID-19 (59). Researches show that unusual strenuous or prolonged exercise may reduce immune function (59). Thus, long and stressful exercise sessions should be avoided (59). In addition, it is recommended not to perform exercise in case there are symptoms such as severe sore throat, body pain, difficulty in breathing, general fatigue, cough or fever (59). However, it should not be forgotten that regular exercises can start when these symptoms are over (59). While preparing an appropriate exercise program during the isolation process at home, the basic elements such as frequency, volume, intensity and duration of exercise have been described in detail below. It is stated that multi-factorial (5 days' short-term low-intensity resistant exercise in average) (28) program is sufficient and acceptable as an exercise approach for especially elderly individuals (5,18).

4.1. *Frequency of Exercise*

International guidelines of physical activity state that especially elderly people should exercise 5 days a week, but in a special case such as quarantine, it can be increased up to 5-7 days a week, provided that the volume and intensity are adapted (18).

4.2. Volume of the Exercise

Guidelines recommend that it is necessary to perform at least 150 to 300 minutes of aerobic exercises per week and resistance training twice a week. Moreover, it is recommended that exercises can be widely planned between 5-7 days and increased between 200-400 minutes per week to compensate for the decrease in physical activity levels under quarantine mobilization exercises can be done in every session, but balance and coordination skills should be planned and practiced on different training days (18).

4.3. Exercise of The Intensity

According to the guidelines, it is emphasized that exercise sessions should be in moderate intensity and some strength exercises should be performed in weekly schedule. Especially moderate exercises create positive changes in immune system responses; high intensity exercises can suppress the immune system of especially sedentary people. Therefore, it is stated that moderate exercises during the quarantine with 40 – 60% of heart rate reserve and 65-75% of maximal heart rate can be a protective and ideal exercise option for elderly individuals (18).

4.4. Home Exercises

In the absence of special equipment, the activities recommended are holding a chair and squatting on the floor by only using a person's own body weight and without using an additional weight, doing sit-and-go movements on the chair; carrying light and medium-weight goods such as vegetables, rice, water; doing aerobics such as walking and dancing at home; trying to balance on a line; walking on the toes or on the heel, stepping over an obstacle (18).

5. Materials and Methods

5.1. Data Collection

The databases such as PubMed, Elsevier, Scopus and Science Direct and Google Scholar was used for scientific surveys in this study. Search language without any year limitation: "CORONAVIRUS, COVID-19, CORONAVIRUS and exercise, COVID-19 and physical activity, exercise and immune system, influenza and immunity" variations were written together in combination as keywords. As a result of data collection, while limited number of studies directly addressing the relationship between coronavirus and physical activity and exercise was found, the number of studies revealing the relationship between immune system and physical activity and exercise was quite high. Some studies are composed of studies reviewing the relationship of various epidemic diseases, influenza and exercise. Findings of these studies which are thought to be useful were included in the study. Research conducted on non-infectious diseases was excluded. The sources cited in this review include reports on past or current public health by more than one health institution, online information, and a total of 59 scientific articles published in refereed journals. Moreover, the references of the investigated studies were accessed and included in the research.

6. Discussion

The effects of physical activity and exercise practices that are scientifically accepted and regularly and properly performed on the immune system of people infected with COVID-19 have been investigated. Preventive and curative (biological effects) benefits of physical activity and exercise practices have been accepted as a real medicine thanks to epidemiological evidence (18,45,46). In addition, the fact that regular physical activity affects the quality of life positively indicates that exercise can be important in preventive medicine practices. As a result, the role of a properly designed exercise program in treatment is better understood day by day (22. Thus, during quarantine, it is very important for the health of all people not to completely interrupt people's lifestyle or to lead an active lifestyle at home (18). Although physical activities carried out outside are more advantageous in terms of facility, equipment, infrastructure, quarantine practice, which has become compulsory, require physical activities and exercise practices to be carried out in home environment (18). In a study conducted by Ong et al. (38) as a result of the study in which they investigated lung function and exercise capacity of the patients carrying SARS virus, in half of the SARS

patients, mild residual lung function (RAF) disorder was detected even 3 months after discharge from the hospital and also a decrease has come up in exercise capacities of many patients that could not be explained by respiratory dysfunction. As a consequence, COVID-19 and similar infectious viruses can reduce immunity or people with reduced immunity may be exposed to infectious diseases.

Thus, regular moderate exercise practices may be protective against infections by temporarily increasing the immune system. Kohut et al; Pedersen & Ullum (21,40) report that physical activity and exercises in older individuals may develop antibodies in response to influenza vaccine. In a clinical study conducted by Irwin et al. (17) it has been suggested that modified 15-week Tai Chi exercises significantly increase the immunity to zoster virus in men and women over 60 years of age. Improvements in psychological factors have mediated this effect partially (30). In addition, it has been found that Tai Chi increases vagal modulation and shifts the sympatho-vagal balance towards a decrease in sympathetic tone (26). In another study, it has been asserted that moderate-intensity exercises reduce inflammation and improve immune responses to respiratory viral infections (7,27,31). As a result, regular physical activity and exercise practices performed in an isolated safe home environment can be an important strategy in order to stay healthy during the struggle against COVID-19 crisis (42). Simple equipment such as pilates ball, rope, chair, resistance bands to be used at home during exercise should be suitable for cleaning and hygiene conditions. Another issue to be discussed is that using surgical masks during exercise may be helpful in preventing viral infections, but since it covers the nose and mouth, it restricts the inspired air flow and makes breathing difficult. For this reason, especially high-intensity exercises should be avoided while using surgical mask. Another issue thought to be important is whether performing physical activity is appropriate during this viral respiratory pandemic.

In a statement made by Woods et al. (54) who presented that regular exercise may have an anti-inflammatory effect on the body and is among the first researchers to examine the relationship between the influenza vaccine and the immune system of older individuals, has also emphasized that people who are infected with influenza, SARS or even COVID-19 may be able to perform regular exercise in moderate intensity providing that the typical symptoms such as nasal discharge, sinus congestion, sore throat, respiratory tract infection are in mild form. However, exercise should not be performed in case of severe symptoms such as severe sore throat, body aches, shortness of breath, general fatigue, cough or fever (10). In a study by Woods et al. (54) it has been revealed that exercise had a protective effect on mortality due to influenza in mice (24). It has been found that regular cardiovascular exercises for 10 months may prolong the protective effect of one-year influenza vaccine in elderly individuals with weak immune system and that it can maintain protective antibody levels throughout the influenza season (March and April) in the northern hemisphere. As can be seen from the data of the current studies, it has been presented that physical activity and exercise practices that are performed regularly at a moderate level can increase immunity. Research is necessary to understand whether the disease can increase recurrence or negative malignancy risks and survival times in people infected with COVID-19.

7. Conclusion

The interactions of COVID-19, exercise and immune system are presented demonstratively in this review. Due to COVID-19, scientific information about proper exercise practices has been updated during quarantine implementation. As a consequence, spending a long time especially in a closed environment can cause immobility and negative changes in the immune system. Due to this reason, it has been thought to be beneficial for health to perform aerobic exercises with a volume of at least 150-300 minutes with a heart rate of 65-75%, at least 150-300 minutes per week in order to prevent inactivity in the home environment. Moreover, it is recommended to prepare these exercise sessions by a specialist. Therefore, it is thought that the systematic exercise program prepared scientifically and personally can improve immune responses, which are thought to be important in the fight against COVID-19.

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Examine of the Effect of the Training Program Applied to Firefighters on Their Performance (Istanbul Case)

Zekiye Basaran[1]*, Ziya Yamac[2], Mine Gul[3], Serap Colak[4] and Murat Bilgin[5]
[1,4]*Assoc. Prof., Faculty of Sports Sciences, Kocaeli University, Kocaeli, Turkey*
[2]*Firefighter, Istanbul Metropolitan Municipality, Depart. of Fire Brigade, Istanbul.*
[3]*Assis Prof, Faculty of Sports Sciences, Kocaeli University, Kocaeli, Turkey.*
[5]*Instruct., Faculty of Sports Sciences, İstanbul University, İstanbul, Turkey.*
**Corresponding Author*

Abstract

Purpose: Firefighting profession that is hard and risky is characterized by physical exertion spent at different intensity by prolonged working periods. There is a need for a high level of condition for works that are the necessities of the profession such as carrying equipment, using heavy tools, and rescuing the injured persons. This is because the personnel of every organization regularly train. The purpose of this study was to investigation of the effect of the training program applied by firefighters on their performance.

Method: We used a quantitative research method in this research; a quasi-experimental study without a control group was also conducted. The research sample consisted of 373 male firefighters from Mimar Sinan, Avcılar, Beylikdüzü, and Çatalca Fire Authorities of Fire Department of the Istanbul Metropolitan Municipality. Firefighters performed 90 minutes of training 3 times a week. Measured data were recorded 3 times by 6-months periods to determine the body composition, aerobic and anaerobic capacity, muscular force, muscular strength, and flexibility development. T-test specified the difference between variables; we also utilized the Correlation test to determine the relationship between variables via demographic attributes.

Results: It is seen when we compared the fat measures of firefighters that there are significant differences between the 1st and 3rd measurements; 1st and 2nd measurement and also 1st and 3rd measurements for a push-up. There also is a significant difference between three measurements for pulse and Leg press. We also found a statistically significant difference between 1st and 2nd measurement in the sit-reach-stretch test; 1st and 2nd measurement and also 2nd and 3rd measurement in shuttle scores ($p>0,05$).

Conclusion: For the results, related training programs positively affect the condition of firefighters and provide continuity in performance.

Keywords: Firefighter, Training, Performance, Condition.

1. Introduction

Firefighting is a dangerous and physically demanding occupational group among working areas. Firefighters are in the position of being ready and quick always. They also interfere in emergencies, rescue life, and goods besides every kind of fire extinction. The fire department has been organized by developing by countries in time after big city fires. The first official organization consisting of tools such as seven firefighter groups and bucket, ladder, pole, the axe was established by the RomanEmpire in 6th century AD. There was exercised for a tool that carries water in the period of Neron; the water pump was discovered in this way. Fires were interfered more quickly by building a water pump in each street. The first professional firefighters union was established in London in 1680; the first fire authority was founded by Austria in 1685 [7,19].

Regarding the Ottoman Empire, the Fire Brigade that was established in 1714 served till 1825; the Fire Department Regiments that started in 1874 and increasingly continued till the Republic period. Fire Authorities based on Municipalities were established in 1923 [10]. Tasks of firefighters have increased by growing the cities and developing technology; their clothes and vehicles have multiplied and become heavier according to current conditions. Firefighters may be in the position of lifting, moving, pushing, pulling, and dragging victims who may be over 100 kilograms and also equipment up to approximately 50 kilograms in the air in extreme heat and cold. Firefighters need to have motor skills such as high level of muscle strength, endurance, aerobic and anaerobic power, agility, dexterity, balance, and flexibility to fulfill

the requirements of the task [3]. Namely, there is a need for good body composition with a quality motor feature for a great performance.

There may be seen injuries and early deaths during tough and dangerous professions; there also may occur asthma and chronic obstructive pulmonary disease, waist disorders, even stress-related stroke, and heart attacks [12,14]. Therefore, they regularly perform reaction time, coordination, balance, strength, agility movement, and flexibility from the skills and endurance, strength, speed, and resistance training from motoric features. Fitness programs have been developed for firefighters to keep in form, increase the life quality, and minimize the risks; it is compulsory for firefighters in each of the fire departments to perform related training. Authorities have controlled firefighters by taking measurements at regular intervals.

It is emphasized that firefighters need to perform regular exercises; stick to the proper training program and be tested on performance levels to do their tasks in the best manner [4].

Measuring the effect of training on performances of firefighters affiliated to the Istanbul Metropolitan Municipality Fire Department was the goal of this research.

2. Method

2.1. Research Group

Research sample composed of 373 male firefighters of Silivri (95), Mimar Sinan (73), Avcılar (99), Beylikdüzü (47) and Çatalca (59) Fire Authorities of the Istanbul Metropolitan Municipality.

Istanbul Metropolitan Municipality gave approval by 24,06,2020 dated and 50626539-903.99-11106 numbered document for this research to be published.

2.2. Research Method

We used a quantitative research method and a quasi-experimental study without a control group. 3 measurements were taken by 6-months period from sample group who participated in the training group.

Training Program: Table 1 shows the training of participator firefighters. At the end of training programs, measurements were taken in specified parameters to determine body composition, aerobic and anaerobic capacity, muscle strength, muscle endurance, and flexibility developments. Related parameters are as follows: leg-press, shuttle, push up, sit-reach and stretch, pulse, body weight, body fat measurement. Sport time was personally performed 3 times a week in a 90-minutes period without disrupting the daily routine activities of the group. Firefighters performed training within fixed repetition, violence, and fixed coverage within 18 months.

Table 1: *Training Schedule of Firefighters*

Movement	Set Repetition	Kg-Km/h	Time (min)
Warm up			5-10
Treadmill		8--9 Km/h	15
Bicycle		4. level	15
LatPullDown	3x10	30 Kg	3
MidRow	3x10	30 Kg	3
Horizontal bar	3x4	Body weight	4
LegExtension	3x10	30 Kg	4
LegCurl	3x10	30 Kg	4
LegPress	3x10	60 Kg	4
LegAbductor	3x10	20 Kg	3
Skipping rope	3x25	Body weight	4
Shuttle	3x20	Body weight	4
Push up	3x15	Body weight	4
Cooling (free)			10
Total time			87

2.3. Performance Measurement Tools Applied on Firefighters

Data were received from everybody in specified days. It was seen during entering data that the values of some firefighters who are tired or uncomfortable after work out were found as very low. However, this situation did not affect the averages much.

2.3.1. Flexibility Measurement

The goal of the test is to measure the flexibility of the hamstring muscle group and gluteal region by sit-reach test. A measuring board with a short edge of 23 cm, a height of 30 cm, and a 40 cm plate from the top and bottom edge, with measuring ranges from 0-40 cm on the top plate was the tool. Application: the test is applied when both feet are on the ground; right and left foot are at extension. Foot (feet) (without shoes) of the person lean on the inner part of the board. The movement is applied while the right and left leg are at flexion on the long sitting position. The back is vertical; hands on the graded board and parallel to the feet in the starting position. The farthest point from which the fingers are stretched is measured. Evaluation: the farthest point where the fingertip lies by making forward with body moves is recorded after the participator waits 2-3 seconds. Evaluation: the best score is recorded after 2 repetitions.

2.3.2. Shuttle Test (30sec)

The purpose of the test is to determine abdominal force and continuity in strength. Material: exercise mat, stopwatch. Application: the test is applied for 30 seconds, knees are bent 90^{o}, the arms are joined at the nape in the supine position; feet of the participator is fastened by the practitioner. Evaluation: the score is the total of proper shuttle repetition.

2.3.4. Push-up Test (30sec)

The purpose of the test is to measure the upper body force. Material: exercise mat and stopwatch. Application: participator gets push-up position on hands and toes. Application: arms are brought closer to the ground so as to touch by getting position by the right angle then the participator returns to the starting position. Only the chest touches to the ground during the push-up move. It is provided for 30 seconds that arms are completely vertical to the body and the body is completely tall. Evaluation: the score is the total of push-up moves that are performed based on the rules for 30 seconds.

2.3.5. Leg press Measurement

The purpose of the test is to determine the highest weight that a participator can hold by lower extremity (1TM force). Material: standard leg-press tool and 1 or 2 persons to support. Application: the participator was asked to sit suited for the tool. The participator gradually bends the knees up (hip, knee, and ankle) to 90 degrees and brings legs to an extension without bending the knees. Evaluation: there is counted how many times the participator performs the move by half the weight of his weight for 30 seconds.

2.3.6. 3 Min Step Test

The purpose of the test is to determine the working health of the heart based on heart rate level at the end of the exercises that are performed by taking 24 steps per minute to 30 cm high step for 3 minutes. Material: 30 cm high stepper board, stopwatch, and finger pulse meter. Application: going up and down a 30 cm high step with a pace of 24 steps per minute for 3 minutes. First, the right foot then left foot is used to going up. The participators use the right foot first and left foot then to go down. Evaluation: the participators immediately wear a heart rate monitor with the hand at the level of the heart after three minutes; the value at forty-fifth seconds is recorded.

2.4. Data Analysis

Data of measurements were analyzed by SPSS 25 packaged software. There were applied descriptive statistics for demographic attributes. Paired Sample T-test found the difference between two dependent variables; there was also applied Correlation test to determine the relationship between data.

3. Results

This chapter shows the findings that were obtained by statistical analysis of 3 intermediate measurement data of the parameters of Demographic information, Body Fat, Push-ups, Pulse, Leg-Press, Sit, Stretch, and Shuttle tests.

Table 2. *Descriptive statistics of Demographic Information of Participators*

	N	Min.	Max.	Mean±Sd
Age	373	29	62	40,64±7,55
Height (Cm)	373	150	193	175,42±6,17
Body Weight (Kg)	373	53	127	84,91±12,07

For Table 2, the age average of participators is 40,64±7,56; the youngest one is 29 years old; the oldest one is 62 years old. The height average is 175,42 ±6,17; the shortest one is 150 cm; the tallest one is 193 cm. Bodyweight averages are 84,91±12,07; the skinniest one is 53 kilos; the fattest one is 127 kilos.

Table 3. *Comparing Fat Measurement Scores (T-test Results)*

Fat (%)	Mean ±Sd	t	p
Fat 1st - Fat 3rd	18,52±7,05	-5,042	0*
	19,19±7,24		
Fat 1st - Fat 2nd	18,52±7,05	-1,487	0,138
	19,14±10,58		
Fat 2nd - Fat 3rd	19,14±10,58	-0,112	0,911
	19,19±7,24		

For Table 3, there is a statistically significant difference ($p<0.05$) between the 1st and 3rd measurements of firefighters while there is no difference between other measurements ($p>0.05$).

Table 4. *Comparing Push-up Measurement Points (T-test Results)*

30 sec Push-up	Mean±Sd	t	p
1st Push-up - 2nd Push-up	22,08±7,61	-5,14	0*
	23,43±7,28		
1st Push-up - 3rd Push-up	22,08±7,61	-2,82	0,005*
	22,99±7,59		
2nd Push-up - 3rd Push-up	23,43±7,28	1,57	0,115
	22,99±7,59		

For Table 4, there is a statistical difference between the 1st and 2nd measurements (0.000) and also between the 1st and 3rd measurements (0.005) ($p<0.05$) while there is no statistical difference between the 2nd and 3rd measurements ($p>0.05$).

Table 5. *Comparing Pulse Measurement Points (T-test Results)*

Pulse (3-min step test)	Mean ±Sd	t	p
1st Pulse - 3rd Pulse	113,68±14,82	9,1	0*
	105,93±11,17		
1st Pulse - 2nd Pulse	113,68±14,82	16,5	0*
	101,07±8,79		
2nd Pulse - 3rd Pulse	101,07±8,79	-8,09	0*
	105,93±11,17		

For Table 5, there are statistically significant differences between the 1st and 2nd measurement (0.000) and also between 2nd and 3rd measurements (0.000) and finally between the 1st and 3rd measurements (0.000) for the pulse ($p<0.05$).

Table 6. *Comparing Leg press Measurement Points (T-test Results)*

LegPress (kg)	Mean ±Sd	t	p
LegPress 1st - LegPress 2nd	48,02±23,85	2,177	0,03*
	45,70±17,10		
LegPress 1st - LegPress 3rd	48,02±23,85	4,006	0*
	43,26±15,66		
LegPress 2nd - LegPress 3rd	45,70±17,10	2,711	0,007*
	43,26±15,66		

For Table 6, there are statistically significant differences between the 1st and 2nd measurements (0.030); 2nd and 3rd measurements (0.007) and also between 1st and 3rd measurements (0.000) for the legpress values of firefighters ($p<0.05$).

Table 7. *Comparing Sit-Reach Measurement Points(T-test Results)*

Sit-Reach (cm)	Mean ±Sd	t	p
Sit-Reach 1st - Sit-Reach 2nd	21,82±7,73	-3,29	0,001*
	22,69±7,80		
Sit-Reach 1st. - Sit-Reach 3rd	21,82±7,73	-0,96	0,334
	22,14±7,75		
Sit-Reach 2nd - Sit-Reach 3rd	22,69±7,80	1,94	0,052
	22,14±7,75		

For Table 7, regarding sit-reach-stretch test results of firefighters, there is a statistically significant difference between the 1st and 2nd measurement (0.000) ($p<0.05$) while there is no significant difference between the 1st and 3rd measurement and also between 2nd and 3rd measurement ($p>0.05$).

Table 8. *Comparing Shuttle Measurement Points (T-test Results)*

30 sec Shuttle	Mean ±Sd	t	p
Shuttle 1st - Shuttle 2nd	25,35±7,15	-7,26	0*
	27,47±6,79		
Shuttle 1st - Shuttle 3rd	25,35±7,15	0,92	0,353
	25,00±7,65		
Shuttle 2nd - Shuttle 3rd	27,47±6,79	6,46	0*
	25,00±7,65		

For Table 8, regarding the comparison of shuttle points of firefighters, there is a statistically significant difference between the 1st and 2nd measurement (0.000); 2nd and 3rd measurement (0.000) ($p<0.05$) while there is no statistically significant difference between the 1st and 3rd measurement.

Table 9. *Relation Between Age and Pulse; age and Shuttle; Age and Push-up*

		Age	Pulse 1	Pulse 2	Pulse 3
Age	r	1	,152**	,274**	,065
	p		,003	,000	,213
	N	372	372	372	372
		Yaş	Shuttle 1 st	Shuttle 2nd	Shuttle 3rd
Age	r	1	-,404**	-,399**	-,453**
	p		,000	,000	,000
	N	372	372	372	372
		Age	Push-up 1st	Push-up 2nd	Push-up 3rd
	r	1	-,377**	-,417**	-,439**
Age	p		,000	,000	,000
	N	372	372	372	372

For Table 9, there is a positively directed and strong relationship between the age and pulse 1st and pulse 2nd (,000) measurements while there is no relationship between age and pulse 3rd. There was found a negatively directed and statistically significant relationship between age and shuttle; age and push-up 1st, 2nd and 3rd measurements (,000).

Table 10. *The Relationship Between Age and Leg-Press; Age and Sit-Reach-Strech*

		LegPress 1st	LegPress 2nd	LegPress 3rd	Age
Age	r	-,08	-,272**	-,457**	1
	p	103	,000	,000	
	N	372	372	372	372
		Age	Sit-Strech 1st	Sit-Strech 2nd	Sit-Strech 3rd
Age	r	1	-,173**	-,232**	-,257**
	p		,001	,000	,000
	N	372	372	372	372

		LegPress 1st	LegPress 2nd	LegPress 3rd	Age
Age	r	-,08	-,272**	-,457**	1
	p	103	,000	,000	
	N	372	372	372	372
		Age	Sit-Strech 1st	Sit-Strech 2nd	Sit-Strech 3rd

For Table 10, there is no statistical relationship between age and legpress 1st measurement while there is a negatively directed and strong relationship between age and legpress 2nd and also between age and legpress 3rd (,000). Again, there also is a statistical relationship between age and sit-reach-stretch (cm) measurements (,000).

Table 11. *The relationship Between Body Weight and Shuttle; Body Weight and Leg-Press*

		Body Weight	Shuttle 1st	Shuttle 2nd	Shuttle 3rd
Body weight	r	1	,005	,024	-,083
	p		,929	,651	,108
	N	372	372	372	372
		Body Weight	Leg 1st	Leg 2nd	Leg 3rd
Body weight	r	1	,011	-,110*	-,138**
	p		,832	,035	,008
	N	372	372	372	372

For Table 11, there is no statistical relationship between body weight and shuttle while there is a statistical relationship between bodyweight and leg-press 2nd (,035) and also between bodyweight and leg-press 3rd measurements (,008).

Table 12. *Relationship Between Bodyweight and Push-up; Body Weight and Pulse; Body Weight and Sit-Reach-Stretch*

		Body weight	Push-up 1st	Push-up 2nd	Push-up 3rd
Body weight	r	1	-,203**	-,229**	-,261**
	p		,000	,000	,000
	N	372	372	372	372
		Pulse 1st	Pulse 2nd	Pulse 3rd	Body weight
Body weight	r	,228**	,296**	,185**	1
	p	,000	,000	,000	
	N	372	372	372	372

		Body weight	Push-up 1st	Push-up 2nd	Push-up 3rd
Body weight	r	1	-,203**	-,229**	-,261**
	p		,000	,000	,000
	N	372	372	372	372
		Pulse 1st	Pulse 2nd	Pulse 3rd	Body weight
		Body weight	Sit Stretch Reach 1st	Sit Stretch Reach 2nd	Sit Stretch Reach 3rd
Body weight	r	1	,040	-,053	-,062
	p		,436	,303	,230
	N	372	372	372	372

For Table 12, there is a statistically powerful relationship between bodyweight and shuttle measurements; body weight and pulse measurements at 0.01 level. However, there is no relation between body weight and sit-reach-stretch.

4. Discussion

Firefighters in this study that was conducted to scrutinize the effect of a training program on performances were the persons who are quite different from each other in terms of demographic attributes. Their age average is 40,64±7,56; the age interval is 29-62. The height average of them is 175,42 ±6,17 and between 150-193cm. Bodyweight average is 84,91±12,07; the skinniest one is 53 kilos; the fattest one is 127 kilos.

Since the firefighters have to interfere in a case at any moment; they need to have an excellent performance. Since they lift equipment to skyscrapers; break through the door or window; pull and raise the hose and kits; cut something; extinguish; rescue and hump the victims, they regularly perform condition exercises and are tested in terms of performance [15]. Regarding pulse averages, we found positively directed (,000) and statistically significant difference between the 1st (113,68±14,82) and 2nd (101,07±8,79) measurement (,000), and also between 1st and 3rd measurement. On the other hand, there is a negatively directed (,000) and a statistically significant difference between the 2nd and 3d measurements (105,93±11,17) ($p<0,05$). There was found a statistical relationship between pulse 1st (0,00), pulse 2nd (0,00), and pulse 3rd (0,00) measurements at 0.01 level when we analyzed the relation between kilo and pulse. The same relation can also statistically be seen between age and pulse 1st, 2nd, and 3rd (,000). Hammer and Heath reviewed the difference of some anthropometric and physiological tests between two groups to determine cardiovascular appropriacy; they found that it is important to measure VO2max level with aerobic capacity as well [9]. For Stevenson et al., physical skill tests are important to establish the development standard for firefighting; cardiovascular performance, muscle strength, and endurance are the crucial components of physical fitness to fulfill firefighting tasks safely and effectively [16].

Being low the number of shuttle and push-up negatively affects the professional performance of firefighters by extending the test period [3]. It is seen when we compare the Push-up point averages that there is statistically significant difference between the 1st (22,08±7,61) and 2nd (23,43±7,28) measurement (,000); 1st (22,08±7,61) and the 3rd (22,99±7,59) measurement (,005) ($p<0,05$). Regarding the relationship between Body Weight and Push-up and also between Age and Push-up, there also is a statistical relationship between 1st (0,00), 2nd (0,00), and 3rd (0,00) measurements. Williford et al. found a high level of negatively significant relationship ($r =-0,38$, $p<0,01$) between the number of push-up and breaking, rescuing life, pulling a full hose, climbing ladders and the total test period [18].

We found when the shuttle measurement averages of firefighters that there is a statistically significant difference between the 1st (25,35±7,15) and 2nd measurement (27,47±6,79) (,000); 2nd (27,47±6,79) and 3rd (25,00±7,65) measurements (p<0,05). There is no statistical relationship between kilo and shuttle while there is a statistical relationship between age and shuttle 1st, 2nd, and 3rd measurements (,000)(p<0,05). Arslanoğlu found a negatively directed significant relationship between the number of shuttles and search-rescue [3]. Again, Michaelides et al. found a negatively directed and significant relationship (r =-0,41, p<0,01) between professional performance total test time of firefighters and shuttle (abdominal force) [13].

For findings, regarding Leg-press measurement averages, there is statistically significant difference between the 1st (48,02±23,85) and 2nd (45,70±17,10) measurements(,030); 2nd (45,70±17,10) and 3rd (43,26±15,66) measurements (,007); 1st (48,02±23,85) and 3rd (43,26±15,66) measurements (,000) (p<0,05). Again, a statistical relationship can be seen between body weight and leg-press 2nd (,035) with 3rd measurements (,008). A statistical relationship was found between 2nd and 3rd measurement averages (,000) while such a relation cannot be observed between age and leg-press1st measurement. There is not a regular increase or decrease in some parameter averages when averages of both three measurements are compared for all the variables. The reason is that measurements are taken when some firefighters were tired after shift; some of them were sick during the tests.

There is a statistically significant difference between the 1st (21,82±7,73) and 2nd (22,69±7,80) measurement (,000) for sit-reach-stretch averages (p>0,05). We can also see a statistical relationship between age and 1st, 2nd, 3rd measurement averages of the sit-reach-stretch test while there is not a statistical relation between body weight and sit-reach-stretch test.

For the findings of our study and other studies, a high body fat percentage negatively affects the professional performance of firefighters. Regarding the fat percentage of firefighters in our study, there is a statistically negative difference between the 1st (18,52±7,05) and 3rd measurement (19,19±7,24) (,000) (p<0,05) while such a difference cannot be seen between other measurements (p>0,05). On the other hand, there is a statistically significant relationship (,000) between body weight and measurement averages of the fat 1st, 2nd, 3rd. Clark et al. analyzed a group of American firemen and mentioned that 60% of them are overweight and 32% of them are sickly obese [5]. Williford et al. found the body fat percentage as 13,78±4,31 at the end of measurements for 91 firefighters whose age average is 31 (younger than our group). They concluded that there is a strong relationship between the task performance of firefighters and both body fat percentage and the fat-free weight [18]. For Lemon and Hermiston, there is a decrease in all the variables (MaxVO2 with claw force, shuttle, vertical jump) based on age. The group has 20.4% body fat. They also emphasized that firefighters need to have a better physical fitness profile compared to motionless people [11]. For Swank et al., as the age increases, the capacity decreases as a result of age and aerobic capacity of persons [17]. Michaelides et al., found relationship between skill tests and heart rate (r=0,36); skill tests and BMI (r=0,34); skill tests and body fat percentage (r=0,57) in firefighters. They also found a relationship between BMI average and body fat percentage (r=0,82); BMI average and body weight (r=0,88). Accordingly, it is thought that determining the state of firefighters may be an advisor for programming training and personal skill performance [13].

Abel et al, aerobic and anaerobic intensities of a circuit based training have many benefits in firefighters, suggested that cardiovascular training performed at medium and high intensity should be applied to firefighters periodically [1]. It is stated to increase performance also, which of resistance and plyometric training that improves motoric features [2] such as core workouts [8]. Denison et al, stated that regular exercise training at firefighters may limit decrements in work efficiency because of acute exercise fatigue and allow for superior work efficiency compared with not participating in a training program [6].

5. Conclusion

In conclusion, training that was performed provided development in the general run of performance parameters of firefighters or also have mean values close to each other. For other findings, body fat percentage, pulse, sit-reach, 30-sec shuttle, and push-up value averages vary between the intermediary measurements; there also are statistical differences and relationships. We observed that related exercises positively affected the conditions of participators and provide sustainability in their performances. It is thought that taking measurements by more frequent intervals and adding annual health screening into

related measurements will be beneficial for both the fire department to establish a database and firefighters to personally follow their own health and condition levels.

Suggestions;

- This research has been done by taking into account the averages of the training data that are the same in all fire brigade groups. Age range which is very wide can be grouped, the data of each firefighter group, and training programs can be compared. Detailed results will contribute to the literature.
- There can be made progress in their conditions by ever-increasing extent, intensity, and repetition methods by taking the individual maximals of the pre-exercise movements in firefighters.
- Awarding and honoring the personnel who display good performance by the organization may encourage other personnel who have a low performance to make exercises regularly.

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Physical Culture and Sport University Students' Psycho-Physiological Predictors of Social Adaptation

Olga A. Makunina[1], Evgeny V. Bykov[2] and Irina F. Kharina [3]

[1]*Candidate of Biological Sciences, Assistant Professor, Ural State University of Physical Culture, Chelyabinsk, Russia.*

[2]*Doctor of Medical Sciences, Professor, Ural State University of Physical Culture, Chelyabinsk, Russia.*

[3]*Candidate of Pedagogical Sciences, Assistant Professor, Ural State University of Physical Culture, Chelyabinsk, Russia.*

Abstract

Annotation. Social adaptation is an important component of human success at its various developmental stages. Students - athletes' social adaptation differs from ones, training in other specialties by a complex combination of mental and physical loads. According to various literature data, attention deficit disorder has a large variation in the prevalence rate of 1.5 to 50% in students. Based on the survey, we found that 8.7% of student-athletes have signs of attention deficit hyperactivity disorder (ADHD). Students-athletes' with ADHD psycho-physiological characteristics and social adaptation criteria were studied in our work.

It was found that students with ADHD signs tend to form stress, nervous system functional low level, and cardiovascular system stress index at sympathicotonia level. Students' with ADHD academic success rate was lower by 23.2% compared to students without this syndrom. Sports success rates were 53.6% higher for students with ADHD.

Despite the fact that ADHD is a medical diagnosis, educational institutions do not create special conditions and do not develop pedagogical tools, forms and methods for students with this pathology.

Along with performing educational tasks, universities fulfil students' physical, mental and moral health preservation ones. Therefore, the University should be the initiator and organizer of purposeful and effective work to preserve and increase its students' health.

Keywords: social adaptation, attention deficit hyperactivity disorder (ADHD), students – athletes, mental and physical loads, academic success.

1. Introduction

The appeal to the issue study: students' studying at higher education institutions of physical culture and sport social adaptation peculiarities is not a random event, but a logical regularity in the students' health monitoring study [1]. Groups of student-athletes with various psycho-physiological peculiarities, undoubtedly affecting social adaptation in combined physical and mental loads conditions were found [2, 3].

We adhere to "social adaptation" notion definition - "the process of the individual's active adaptation to the social environment conditions; the type of the individual's interaction with the social environment" [4]. The result of students-athletes' successful social adaptation can be seen by their achievements in educational and sports activities.

This research trajectory was initially based on university students' social adaptation an relevance understanding in Russian and foreign scientists' scientific publications. We have identified several directions while studying this issue. The first direction is the applicants' and school graduates' adaptation to the university environment, the second is the migrant students' adaptation to the socio – cultural environment of the university, and the third direction is the choice of questionnaires and methods, allowing to objectively and validly assess the student's adaptation degree. We will perform a scientific publications review.

2. Literature Review

In E. P. Al'bitova with co-authors, S. E. Kaplina and G. I. Rogaleva's series of works, the essence, factors, and social adaptation mechanisms are substantiated, in addition, it is shown that 14.2% of respondents in the experimental group and 36.5% in the control one did not adapt to the university environment. The effectiveness of the "model of social adaptation of university students based on pedagogical support" implementation was estimated by the authors at the level of 99.9 % [5, 6].

Chukri Akhras proved the influence of active learning on adaptation to the student group and the relationship between the adaptation level and success in the educational process [7].

María Carmen Martínez-Monteagudo, Beatriz Delgado, José Manuel García-Fernández and Cecilia Ruíz-Esteban studied the cyberbullying effects on different levels of students' social adaptation and concluded that students with a high level of social adaptation are significantly less likely to be negatively affected than students with low one [8].

One of this process' multi-faceted research blocks is the study of foreign and domestic students' social adaptation to a new socio-cultural environment of the university. In the work "Demographic Correlates of Acculturation and Socio-Cultural Adaptation: Comparing International and Domestic Students", Hande Güzel and Sharon Glazer, basing on a sample of foreign and local students from the University of Northern California, USA, proved that foreign students face such stressors as immigration status, new food, customs, limited knowledge of English, separation from family and friends, which negatively affects the immigrant students' adaptation to the University environment [9]. Russian scientists, studying the problems of foreign students' adaptation in the Soviet Union and modern Russia, come to similar conclusions based on empirical data, highlighting also the difficulties in learning the Russian language and the educational process peculiarities [10, 11].

Through an online survey, Nor Leelawati Jamaludin, David Lakland Com and Gro Mjeldheim Sandal assessed the foreign students' social adaptation impact over the decision to return to continue their studies at the University of Bergen (Norway) [12]. Similar results were obtained when studying the foreign students' coming mainly from Asia, social adaptation, to study at universities in Hong Kong [13].

Muhammad Akram Riaz and Rafia Rafique identified psychosocial predictors that affect the foreign students' adaptation in Pakistani institutions, such as time spent in the country and financial support, to manage social adaptation [14].

The next scientific direction, which can be traced in publications, is the choice of methods and questionnaires that reveal the social adaptation level in the studied age group. In a continuous and prospective study of G. A. Ignatenko and N. V. Kiosev, the questionnaire "Hardiness Survey" was used on a sample of first-and third-year students, gender features of social adaptation and maladaptation disorders in junior students were revealed [15].

Aurel Ion Clinciu using the Baker and Siryk's questionnaire revealed the negative impact of stress on the 157 students' adaptation to the social environment in the Transylvanian University in Brashov [16].

The objects of observation in the next study were students of Kharkiv universities (Ukraine), 24% were found to have weak adaptive capabilities of their physical condition and mental maladaptation. This study value lies in the therapeutic and preventive actions actualization of physical exercises to adapt the body to the educational process loads [17].

A special group, requiring a careful approach to their social adaptation study is students with a physical condition. In the compatriots' work, the adaptation problems in students with musculoskeletal pathologies and severe visual impairment using self-questionnaires and cardiointervalography were revealed. In the work negative dynamics of adaptation to physical and mental loads by the end of the school year was also revealed [18].

Zeinab Mihandoost conducted a meta-analysis of 17 empirical studies published between 2000 and 2013 to identify the correction programs impact over social skills, attention performance, and behavior in children and adolescents with attention deficit hyperactivity disorder (ADHD). It was found that children with ADHD showed deficits in several attention and social skills components, that were not associated with language learning disorders and weak overall intellectual abilities. This meta-analytical study has shown that treatment programs reduce attention deficit and social skills in children and adolescents with ADHD [19].

The scientific literature describes the psychological and psychophysiological features of people with attention deficit disorder in different age groups. According to various literature data, attention deficit disorder has a large variation in the prevalence rate of 1.5 to 50% in students. It is known that people with attention deficit disorder find it difficult to suppress, form their reactions at an automatic level, as is typical for people without it. Previously, we found that students with signs of attention deficit disorder are characterized by stress and adaptive potential failure [2].

All above - mentioned actualizes the study of students-athletes' social adaptation psycho-physiological predictors in the process of training at the University of physical culture. Students-athletes with signs of attention deficit disorder were the object of observation in this study. Based on theoretical data that attention deficit disorder is associated with impaired activity of neurotransmitters in the brain regions responsible for attention, we assume that this group of students has specific psychophysiological predictors of social adaptation, and therefore success in mental and physical loads combined conditions.

3. Method

3.1. Participants

The study was conducted at the research laboratory "Human body adaptation to extreme environmental factors" of the Ural State University of Physical Culture during the inter-sessional period.

On the basis of voluntary consent in compliance with all principles of the Helsinki Declaration at the beginning of the academic year (end of October), a survey of I, II and III year students-athletes' studying at University of Physical Culture random sample (n=254) to identify signs of attention deficit disorder (ADHD) by Toulouse-Pieron test [20]. According to the results of the survey, 25 people (8.7%) with signs of ADHD were identified, which made up the main group of subjects in this study. For comparison, a random sample of 25 students with no signs of ADHD was formed.

3.2. Materials

To establish psychophysiological predictors of social adaptation, we used the main battery of tests, which were performed using the methods proposed in the hardware and software complex "NS-Psychotest" (LLC "Neurosoft", Ivanovo) [21]. All requirements for conducting psycho-physiological testing were met and preliminary instructions were given before performing each test. Each subject voluntarily signed a consent to participate in the study.

The Luscher test was performed to assess the stress index, and the simple visual-motor response (SVMR) score was performed to determine the functional level of the system (by Loskutova) (FLS) - an integral calculated indicator of the reaction time spread over the entire testing period. Automatically, the program performed the calculation and the conclusion is used to evaluate the individual FLS value [21].

Using the hardware and software complex "Polyspectr-VNS" (LLC "Neurosoft", Ivanovo), the heart rate variability method was used to evaluate the regulatory systems' reactivity and voltage [21]. Heart rate indicators were recorded within five minutes of recording (300 cardiocycles). Background indicators were recorded (in the supine position) and an orthostatic test (when moving to the vertical state). Electrocardiogram analysis was performed automatically with preliminary processing of artefacts. Based on the survey, the stress index was calculated – a coefficient that shows centralization degree in heart rate management [22].

The criteria for social adaptation were the results of sports achievements and educational sessions. Educational records analysis was conducted with the students-athletes' academic performance score establishment - from 1 to 5, where 5 - excellent, 4 - good, 3 - satisfactory, 2 - unsatisfactory, 1 - not certified. Sports scores were converted to scoring system: 1 point - participation in the competition without a prize, 2 points – participation in competitions and receiving prizes, 3 points for participating in competitions, receiving prizes and sport performance level increase.

The relationship between the students' stress index and FLS criteria, academic and athletic success was determined on the basis of correlation analysis using the Pearson method.

Students' social adaptation predictors determination was carried out using regression analysis to assess the individual's number of psychophysiological characteristics "contribution" (independent variables, predictors) to adaptability variation (dependent variable).

In statistical processing of the obtained data, we used the Jamovi program for processing research results, in particular, descriptive statistics were used as an analysis tool. The statistical significance between samples was determined by the U - Mann-Whitney statistical criterion.

4. Results

Based on the conducted surveys, a table was compiled, reflecting the indicators of students-athletes' with ADHD psycho-physiological characteristics, their academic and athletic success in comparison with students without it.

Table 1. *Students-athletes' psycho-physiological characteristics values (M±δ).*

Value	Students with ADHD	Students without ADHD
Stress index, score	18,2±3,3***	7,0±5,0
FLS, RU.	4,2±0,3	4,9±0,2**
Index, RU.	97,4±25,1***	58,2±23,2
Academic success, score	3,3±0,2	4,3±0,7*
Sport success, score	2,8±0,2*	1,5±0,5

Note: p – statistical differences values in indicators between groups: * - p<0,05; ** - p< 0,01; *** - p<0,001.

The presented data indicate statistically significant differences in psychophysiological indicators. The stress index in the group of students with ADHD indicates a tendency to stress formation. In the group of students without such signs, no manifestation of stress states was detected.

The functional level of the system (FLS) allows us to assess the central nervous system current functional state. In the group of students with ADHD symptoms, the average value of this indicator is characterized as low. In the group of students without such signs – a high FLS value.

Regulatory systems' stress index characterizes an autonomic nervous system division activity. The stress index in a group of students with ADHD symptoms is characterized as sympathicotonia. In a group of students without such signs - as normotonia.

Students' with ADHD average academic success score was 23.2% lower compared to students without it, however, the results for athletic success were higher by 53.6% in the group of students with ADHD symptoms.

The correlation analysis between the analyzed parameters allowed us to establish a positive relationship between the stress indicators, FLS, stress index, academic and athletic success. Establishing the direction and communication form between the signs showed a direct correlation and confirms the stress indicator influence over the life support systems reactivity (FLS), as well as on the mental and sports activities quality.

As the regression analysis result, weight values of students' social adaptation predictors were obtained. Regression equations for students with and without ADHD allowed us to prove that the selected indicators are predictors of social adaptation. However, the regression equation coefficients values were higher in the group of students without signs of ADHD and reflected a higher level of their social adaptation.

5. Discussion and Conclusion

The differences in the analyzed indicators were statistically significant between the samples of students with ADHD and those without it. The results obtained indicate psycho-physiological peculiarities typical for students with ADHD symptoms.

Students' with signs of attention deficit disorder physiological mechanisms of adaptation peculiarities cause such behavioral styles, as: impulsivity, disorganization, reduced speed and attention accuracy, and some others, which reduces the social adaptation effectiveness. The publications present the results of research confirming that students' with ADHD academic success is reduced due to their cognitive characteristics and behavior, as well as to the lack of organizational and educational adaptation. At the cognitive level, difficulties arise when it is necessary to stop, think, reason, and develop an adequate response to the demands of the context, and at the behavioral level - when it is necessary to suppress behavior, avoid a certain reaction, or control an immediate and disproportionate response. There are publications that offer didactic and organizational strategies ("inclusive strategies") [23], approaches [24] that can be adjusted to such students' educational needs and ensure their educational success and social adaptation quality.

For students-athletes in combined mental and physical stress conditions, it is important to develop a strategy of adaptive and compensatory behavior that ensures physiological and psychological well-being. Physiological and psychological systems' harmonious interaction will contribute to a favorable social adaptation. Social well-being is an important component of health.

The results of our study can be compared with the results obtained [18] and confirm the students-athletes' with ADHD signs unfavorable social adaptation, manifested in low values of academic success.

Students-athletes' academic success is a resource for personal development and quality assurance of future bachelor of physical culture professional and adaptive physical culture education.

The publication [17] confirms the positive impact of physical culture on students' social adaptation. For students-athletes, this is not a significant factor, since most students are already qualified athletes, so they should be offered other mechanisms to ensure a favorable social adaptation.

Educational activities for students-athletes place high demands on the psychophysiological resources of the body. It can be manifested in the tendency to stress formation, low indicators of nervous system functional level, and circulatory system tension. The indicators we analyze reflect the reactivity of the body's physiological systems to the combined mental and physical loads. Stress is a negative factor of social adaptation according to the results ofAurel Ion Clinciu [16]. Our received results allowed us to establish a tendency to stress formation in a group of students with signs of ADHD. Regression analysis confirms that the stress index, functional level of the nervous system, and stress index are predictors of students-athletes' social adaptation.

At the stage of obtaining professional education, the academic success results are important, they form a criterion for social adaptation and determine the bachelors' of the University of physical culture competitivenes. The obtained results characterize the significance of students' with ADHD social adaptation problem and determine the practical significance of the work in the direction for developing a program to help students-athletes' with ADHD social adaptation. In teaching, it is important to use a variety of pedagogical tools, forms and methods to ensure an individual approach to students-athletes, taking into account their psycho-physiological characteristics. Modern studies on educational process individualization are sufficiently described in scientific publications [23]. However, the process of students' education at the University of physical culture individualization is not sufficiently described. Our experience shows positive results when applying a synergistic approach to individualizing students-athletes' education [24].

Despite the fact that ADHD is a medical diagnosis, educational institutions do not create special conditions and do not develop pedagogical tools, forms and methods for students with this pathology. We recommend: the stimulating (motivational) mechanisms for teaching use by the teacher; the development of key tasks on the topic and algorithms for their implementation; not determining the time limits for completing the task; forming the ability to self-organization and self-education.

Along with performing educational tasks, universities perform tasks to preserve students' physical, mental and moral health. Therefore, the university should be the initiator and organizer of purposeful and effective work to preserve and increase the students' health.

Thus, students-athletes' favorable academic success and social adaptation in general will be ensured.

Conflict of Interests

There is no conflict of interests to be declared.

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Biomedical Problems of Female Boxing (Literature Review)

Max W Aranson[1]*, Larisa N.Ovcharenko[2], Edvin S.Ozolin[3] and Olga V. Tuponogova[4]
[1,2,3,4]*Laboratory of sports training problems, Federal Science Center for Physical Culture, Moscow, Russia.*
**Corresponding Author*

Abstract

Scientific publications in foreign scientific literature on the physiology, biomechanics and biochemistry of female boxers has been analyzed. Coverage period 2007 -2019. It was revealed that the greatest interest among researchers is caused by motor abilities, which are the basis for building a training program. In addition, the functional properties of a number of systems (nervous, cardiovascular) and functional asymmetry, which are essential for working capacity, are being actively studied . These areas of research need to be developed in order to create adequate scientific and methodological support for training competitive activity in female boxing.

Keywords: Women, Boxing, Biomechanics, Physiology, Biochemistry.

1. Introduction

The intensive development of female boxing in the world stimulates interest in scientific methods that can help increase productivity, reduce morbidity and injuries. Earlier [1], we have already published a review of foreign literary sources on the scientific and methodological support of female martial arts. However, as a result of further discussion with specialists in this sport - coaches, employees of complex scientific groups - it turned out that there is a significant lack of information on this issue. In this paper, we focused on Olympic women's boxing , for which the lack of scientific data is most pronounced .

2. Method

Methods. A review of the scientific literature, available primarily through databases - Google Scholar , Pubmed , Scopus , Web of Science. Initial search range 2016-2020.

In this paper, we will consider issues related to physiology, biomechanics, biochemistry of female boxing. Research on the psychological aspects, features of the training process and the issues of the so-called "gender equality" will be covered in separate articles.

3. Results

The goal of the work of Chinese scientists [2] is to study the effect of the training exercise "direct blow into the air" on the muscles of the upper extremities and lower back in female boxers by changes in the electromyogram. In 10 female boxers, electromyogram biceps (flexor), the triceps muscle (antagonist), flexor forearm (flexor), extensor forearm (antagonist) and muscles of the lumbar region were analysed with an ME 6000 instrument (Mega Electronics Ltd). Subjects performed direct air strikes with dumbbells weighing 2.5 kg to failure. As fatigue developed, a decrease in the magnitude and speed of the average frequency of the upper limb antagonist muscles was observed; the ratio of the work done showed that the flexors did more work than the antagonists. Compared to the EMG of world champions, for most lower-skilled athletes, the average frequency of the muscles of the lumbar region did not tend to decrease, and the percentage of work done for the muscles of the lumbar region was small. After comparing EMG muscles of the upper limbs and the lumbar region at the middle of athletes and world champions found that the amount of training the muscles of tested areas is too small and required increase.

In a joint work of scientists from Romania and Ukraine [3] , the characteristics of the speed of hand movements in female boxers with various types of functional asymmetry during dynamic work were determined . The research contingent is 50 highly qualified female boxers (masters of sports, world-class athletes). The study of the psychomotor functions of boxers was carried out according to generally accepted methods. The motor component of the movements was investigated using a tapping test. The time of a simple and two complex visual-motor responses was determined. Next, we determined the time of identification of visual stimuli of varying complexity without a motor response. It was assumed that this will allow to identify the visual-cognitive component in a pure form. This construction of the experiment makes it possible to evaluate the contribution of each component of the psychomotor response to the reaction rate of athletes with different types of profiles of interhemispheric psychomotor asymmetry. It was found

that ambidextrous athletes perform exercises at a faster rate than right-handed athletes in the usual mode. In this case, the speed of the right hand is higher than the left. The total number of movements for left-handed people is greater than that of right-handed and ambidexters (for both the right and left hands). The speed characteristics of female boxers with different types of asymmetry in accelerated mode were the same. The pace stability of right-handed and left-handed people was high, but worse than that of ambidexters. The ambidextrous boxers using the right stance were in a better position than the righties. Left-handed people performed movements with greater speed than right-handed people. Maintaining an optimal pace in lefties and righties was worse on the right hand than on the left. Lefties generally worked faster than right-handers.

Authors from Turkey [4] studied some physical and biomotor parameters in members of the female junior national team of Turkey on the boxing during a six-week charges before the European Championship. The work involved 27 athletes - members of the team . The average age of the athletes is 15 , 85 ± 0 , 45 years , body length 163 , 00 ± 6 , 08 cm, body weight 63 , 78 ± 14 , 30 kg . The training program of the training camp was developed and approved by the Boxing Federation of Turkey. Determined : the mass of the body and the body mass index (BMI) , the percentage of fat in the body , the speed of running on 10 and 30 meters , the height of the vertical jump, anaerobic power; measurements for all participants were made at the beginning and at the end of the training camp . Statistical processing of materials was carried out in the software package SPSS 17.0. Analysis of the normality of the distribution was carried out by the Shapiro - Wilk method . Comparison of body weight and BMI before and after collection was carried out according to the Wilcoxon method ; comparing the content of fat , the speed of running at 10 and 30 m , the height of jump and anaerobic power performed with using a paired t -test . Level of significance p <0 , 05. The values of the parameters before and after charges made : mass body 63 , 78 ± 14 , 35 - 61 , 25 ± 14 , 31 kg ; BMI , 23 , 09 ± 5 , 44 - 21 , 86 ± 4 , 45 kg / m ^{2} ; the percentage of fat in the body 26 , 91 ± 9 , 50 - 25 , 61 ± 9 , 29 ; running time for 10 m, 3 , 03 ± 0 , 25 - 2 , 93 ± 0 , 23 sec; running time for 30 m, 6 , 44 ± 0 , 36 - 6 , 25 ± 0 , 34 seconds; jump height, 0 , 21 ± 0 , 09 - 0 , 31 ± 0 , 07 m; anaerobic power, 63 , 71 ± 20 , 13 - 74 , 47 ± 15 , 48 kGm / s; differences were statistically significant (p <0.05). The results confirm that well-organized training camps contribute to the improvement of physical and biomechanical parameters among athletes of the female junior boxing team before crucial competitions.

Motor abilities play an important role in achieving mastery in games and sports. Motor preparedness is the ability of an athlete to perform effectively while playing sports. This indicator includes a combination of speed, agility, power , coordination, strength and so on, and this is important for competitions at high levels. Authors from India, [5] studies these parameters 2 samples of 20 people: female boxers (after 6 months of training) and students of physical education , speakers at level of district or state. Age - 17 - 19 years. To measure motor fitness, Barrow's motor ability test was used . To find significant differences between the boxers and students of physical education, applied applied unpaired t - test. The study revealed differences in terms of leg strength, speed and strength of the arms and shoulders in female boxers and students of physical education , but they were not statistically significant . It was found that female boxers have higher strength of the legs, arms and shoulders, while the students in physical education superior boxers in speed.

The purpose of research scientists from Turkey [6] is to study the influence of the percentage of fat in the body for a long stay in balance and anaerobic power in female boxers. 18 female boxers who have been engaged in boxing for at least 2 years took part in the work . Body composition measurements were performed using a segment weight analyzer (TANITA BC 418). To measure the dynamic balance, the stable Lafayette platform (16020) was used. Anaerobic power is calculated using the Lewis anaerobic power formula. As a result, although the study does not have a significant relationship between the percentage of body fat on balance and anaerobic power (p> 0.05), it can be seen that athletes who have a higher percentage of body fat have the ability to balance (X = 0 , 83, 0.97, 0.76, 0.96) and the average values of anaerobic power (X = 0.53) are lower than those of others. We could not determine the important differences, since the percentage of fat in the body of the participants in our sample is not too high. But according to the literature and the results of our research, the percentage of fat in the body is an important factor affecting the boxer's performance and balance, as well as achieving success and sufficient athletic performance. Athletes should be encouraged to maintain a low or normal fat content .

Research of Indian authors [7] was carried out on a sample of 40 women in the age group 18-25 years, engaged in boxing th and judo. The subjects were students at Punjabi Patial University. To test the cardiovascular endurance of the subjects, they were divided into two groups of boxing and judo, and passed the AAHPER Youth Fitness Test, which determines their performance. Collected data before and after the test; cardiovascular endurance was measured in each person using the AAHPER Youth Fitness test, i.e. 12 minutes of running or walking. Research hypothesis - there will be no significant difference in cardiovascular endurance of women involved in boxing and judo. Descriptive statistics and a t-test are used to test the hypothesis. The results showed that the cardiovascular stamina of women boxers is significantly higher than judokas.

Female boxing has been recognized relatively recently, so women boxers in India do not have energy costs. The purpose of an article by a research group from India [8] is to evaluate the energy costs of Indian female boxers during a fight. The work involved 20 athletes of heavy weight category. Energy expenditures were estimated using an individual pulse – oxygen consumption curve using the regression equation . Heart rate was recorded by radio telemetry. The obtained average and maximum values were 12.7 ± 1.3 and 14.4 ± 1.6 kcal / min, respectively. These values are high enough for athletes. Further research are needed, which will help coaches to optimize training female boxers taking into account the energy needs of the sport.

The task of the study of scientists from China [9] is to determine changes in biochemical parameters associated with oxidative stress during sports. Sample consists of 24 women (age 17 , 80 ± 2 , 63 years, body length 164 , 10 ± 6 , 65 cm, body weight 58 , 64 ± 11 , 30 kg) and 15 are not engaged in sports (ages 20 , 00 ± 0 , 79 years, body length 161 , 96 ± 4 , 09 cm, body weight 53 , 53 ± 6 , 86 kg) . The Na +, K + - AT Phase , ROS and T-AOC levels were determined before the match. The results show that female boxers tend to increase levels of Na +, K + - AT Phase , ROS and T-AOC ($P < 0.01$) compared with the control group; Serum CK-NAC and LDH-L are obviously higher than in the control group ($P < 0.05$, $P < 0.01$). Explanation: in female boxers, the activity of Na +, K + -ATPase in the RBC membrane is maintained at a high level, which plays a positive role for athletes in maintaining high sports performance .

The goal of the work of Italian scientists [10] is to compare the basic indicators of cognitive performance in boxers - women and men. The test sample consisted of 28 amateur boxers, and a control group of 56 male boxers, similar in age, occupation, and skill level. The subjects did not have a history of concussions (other than those obtained during boxing). Athletes completed a questionnaire containing demographic data, education and occupation, information about boxing and the number of shocks during a sports career. Then they passed a computer neuropsychological test (CogSport) with determination of the time of a simple and complex reaction. Women had less body weight than men (56 ± 7 vs. 73.1 ± 9.8 kg , $p<0.0001$). No significant differences in test results between groups were found. Men have a tendency to a longer simple reaction time at the end of the test compared to the beginning (0.247 ± 0.007 versus 0.243 ± 0.007 s, $P = 0.02$), however, with a significantly smaller number of errors (0.7 ± 1.6 against 2.0 ± 3.1%, $p = 0.005$), as in the group of women (0.5 ± 1.1 vs. 2.2 ± 3.0%, $P = 0.005$). None of the parameters related to boxing (results, number of knockouts, etc.) correlated with the test results. Thus, Olympic-style boxers, both men and women, practically do not differ in basic indicators of cognitive performance. Additional studies are required to confirm this.

4. Discussion and Conclusion

Thus, the research topic in female boxing includes a wide range of questions, primarily motor abilities, since they are the basis for building training programs. In addition, the functional properties of a number of systems that are essential for the performance of athletes (nervous, cardiovascular) are studied. Interest of experts draws functional asymmetry of the athletes, as it also Mauger t significantly affect the performance.

In most of the works examined by us, the authors acknowledge that there is still insufficient information on the biomedical problems of female boxing. This area of research is developing rapidly. Nevertheless, there are still opportunities for intensive development. Specialists involved in the organization of scientific and methodological support for female martial artists are encouraged to pay attention to this problem and solve it with the involvement of all possible resources and human potential.

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The Validity and Reliablity Study of the Brunel Mood Scale with the Adult Athletes (Turkish Adaptation)

Ali Adnan Çakiroğlu[1], Erdal Demir[2] and Mehmet Güçlü[3]

Abstract

The purpose of this study is to adapt Brunel Mood Scale (BRUMS) into Turkish and to evaluate its validity and reliability in order to evaluate adult athletes' mood. Method of the study is cross sectional scanning pattern. This study is performed on the basis of test-retest method. The study group contains 608 athletes from different branches, who are above 18 and licensed, 76.64 of whom are male and 23.36% of whom are female. As data collecting tool, "Brunel Mood Scale (BRUMS)" and personal information form are used. For the purpose of data analysis, Cronbach alpha coefficient is used for reliability analysis. The test-retest reliabilities are found as (α=.866) and (α=.853) respectively, and thus it is determined that the scale is quite reliable. The explanatory factor analysis (EFA) results conclude that item 3 (confused) disrupts factor structure in the first factor analysis, and therefore it is excluded from the analysis. The remaining 23 items result in a 4-factor structure with varimax rotation as a result of explanatory factor analysis (EFA) performed on the basis of principal components method. In order to test validity of the obtained structure, confirmatory factor analysis (CFA) is performed and it is determined that the model obtained as a result of the explanatory factor analysis (EFA) is not valid in exactly the same way. Therefore, items 1 (Panick), 6 (Downhearted), 17 (Muddled), 18 (Nervous) are excluded. While sub-dimensions of the model obtained as a result of the confirmatory factor analysis (CFA), namely Fatigue (α=.811) and Depression (α=.859) are found as highly reliable, the sub-dimensions Anger (α=.756) and Vigor (α=.786) are found as quite reliable, in reliability analysis. Dependent sample test is performed for test-retest item factor analysis and it is revealed that the results obtained in two different time periods are similar and thus that the scale is constant. Because explanatory factor analysis (EFA) model results are 2.95 for χ2/sd 0.93 for GFI, 0.91 for NFI, 0.94 for CFI, 0.057 for RMSA, it is revealed that the model has good fit; and because of the result 0.05 for RMR, it is revealed that the model has best fit. On examination of correlation coefficients among sub-dimensions of the scale, it is determined that there is a reasonable relation among them. Consequently, it is revealed that Turkish version of Brunel Mood Scale (BRUMS) is a valid and reliable.

Keywords: BRUMS, Mood, Performance, Athlete, Validity, Reliability.

1. Introduction

Mood and emotions are derived from a set of psychological circumstances that we may or may not reflect as a result of our internal and external reactions we continuously experience throughout daily life. A human which is an existence affected by several phenomena has a reciprocal relationship with the body and mental structure, and reacts to these effects. While the thoughts in mind influence the human body, some changes in the body affect the human spirit. Human has a complicated, complex, and holistic spirit (Özakkaş, 1995). The mood drives humans to act consciously in the face of a situation. Thus, emotions constitute the most significant factors. "As much as you can control your emotions, revealing your mood, you can be free and happy" (Bowdon 2015: p. 285). Well, why the mood is that significant: the person's mood is "more important than daily activities, money, position, and personal relationships" (Bowdon 2015: p. 288). Because we experience everything that happens in our lives through the filter of our mood. If we are in a bad mood, we do not care about our successes or assets. When we are in a positive mood, we can overcome many improbable challenges (Bowdon 2015).

2. Literature Review

Karageorghis and Terry (2011) described the mood as a set of continually changing feelings that vary in terms of strength and duration. The mood commonly contains more than one emotion. Hence, the mood is stated as an accumulation of emotional responses to daily events. According to Ekkekakis (2012), the mood is generally more enduring in terms of duration if we compare the mood with affect and emotion. Emotion is normally a general set of reactions. It is obtained as an emotional element, including anger, fear, jealousy, pride and love. On the other hand, Frijda (2009: p.258) described the mood as, "the appropriate

designation for affective states that are about nothing specific or everything." Emotions, especially the dark and dishonored ones, hold a tremendous amount of energy (Mclaren, 2011). Emotions are the response to the meaning we attach to interactions with the world in our universe. Therefore, they appear to create a mood that can shape your ways of reacting to the world around you **(**Karageorghis and Terry, 2011). People tend to observe their moods and emotions to align their feelings, whether they feel good or bad, and to keep their consciousness about how they are intuitively moving and how energetic they feel. There is a mutual, bilateral relationship between moods and emotions. The existing mood influences the emotional reaction to a particular situation and the emotional experience contributes to mood (Karageorghis & Terry, 2015). For example, the mood can positively or negatively affect the individual's thoughts. Many significant studies are examining the effect of mood on decision making of the humans (Doğan & Şahin, 2007: p.234). They stated mood and emotion are used as having the same meaning in the literature. Some scientists have argued that they have the same meaning, while others said these are similar terms but different circumstances in the end (Beedie et al., 2005). Mood and emotion complement each other. It is not probable to acknowledge and comprehend the mood without emotion.

Many studies on emotion and mood have been conducted in the literature on exercise and sport psychology. In these studies, it has been revealed that negative emotions such Anxiety (Chapman, Lane, Brierley and Terry, 1997), anger (Ruiz and Hanin, 2011), tension, (Brandt, Bevilacqua and Andrade, 2017), depression and fatigue (Brandt, da Silveira Viana, Brusque Crocetta and Andrade, 2016), decrease the sportive performance while positive emotions such as vigour (Brandt et al., 2016) increase the sportive performance. While exploring the relationship between sportive success and emotions, Beedie, Terry and Lane (2000) reviewed 29 researches using the Profile of Mood States (McNair, Lorr and Droppleman, 1981; POMS) and they stated there is a positive relationship between the performance and vigor and there is a negative relationship between the confusion and depression emotions and performance. Spielberger (1991), defines the angers as an "emotional state of feeling that varies in intensity, from mild irritation to fury and rage and this is related to stimulation of autonomic nervous system. Beck & Clark, (1988) defines the Confusion as the problems in controlling emotions, characterized by moods ranging from confusion to uncertainty. It has been revealed that the negative state is associated with some emotions such as the depression, despair, personal incompetence, and worthlessness. On the other hand, tiredness is identified mentally and physically, tension is defined by feelings such as irritability, anxiety, grief and concern. Lastly vigor can be defined emotions of excitement, wakefulness and physical energy (Terry et al. 1999). In the face of all these emotions, it may not be feasible for people to be constantly well. Apart from routine activities, it is possible to establish social relations for a good mood while it is possible to benefit from physical activity for having a healthy body and mood (Çağlayan Tunç, 2020).

A measurement instrument has been developed for the evaluation and determination of mood of athletes in the various cultures in the literature. Although the reliability-validity studies of the measurement instruments used in general psychology for evaluating the emotions of the athletes such as Profile of Mood States (POMS, McNair, Lorr and Droppleman, 1981) and Positive and Negative Affect Schedule (PANAS ; Watson, Clark and Tellegen, 1988) have been conducted (For example, Gaudreau, Sanchez and Blondin, 2006; Lan, Lane, Roy and Hanin, 2012; Crocker, 1997; Terry v Lane, 2000; Terry, Lane and Fogarty, 2003); no sport-specific purpose is mentioned in the purposes and methods of development. Furthermore, some methodological problems were also discussed about these scales (Urfa and Aşçı, 2019). These studies contributed significantly to the literature on sports psychology, and these scales have been developed in the form of short questionnaires specific to sports in time. For example; "Brunel Mood Scale" developed by Terry et al. (2003), is based on the Profile of Mood Scale (POMS), developed in the USA in the early years of the 1970s (Karageorghis and Terry, 2011). This measurement instrument gives sports psychologists and researchers the opportunity to observe the daily or weekly mood of athletes, defining the mood of their superior performance levels. Nevertheless, it helps to create the desired mood before and after the competition. Another popular use of mood profile is to support coaches and fitness specialists to make recommendations on appropriate training levels to help prevent overtraining as well as positively contribute to an athlete's overall psychological state (Karageorghis & Terry, 2015). The reliability and validity studies of the Brunel Mood Scale (BRUMS) have been conducted. Malay, Hashim et al., (2010). Persian, Terry et al., (2012). French, (Rouveix, Duclos, Gouarne, Beauvieux and Filaire, 2006). Afrikaans (Terry, Potgieter and

Fogarty, 2003). Hungarian (Lane, Soos, Leibinger, Karsai, & Hamar, 2007). Italian, (Lane et al., 2008). Portuguese, (Rohlfs et al., 2008). Turkish, (Çakıroğlu, 2016).

The purpose of this study is to apply the Brunel Mood Scale (BRUMS) to Turkish athletes, comprehend better the mood of athletes and coaches, and contribute to their performance. Recent studies revealed the importance of mental formations in sports. The studies explained, in this context, that athletes focus on psychological factors and obstacles before, during and after the competition. Hence, the Brunel Mood Scale (BRUMS) has been adapted to Turkish to be used for determining the mood affecting of the athletes since it affects the performance of the athletes and the reliability and validity studies of the scale have been conducted. As a result of this study, it is believed that the number of studies on the mood of athletes will increase and the studies will contribute to the literature of sports psychology.

While the concept of emotions is used in terms of the theoretical scope of this study, it was considered commonly as the mood. Because emotions represent our mood. Many sports psychologists use the concept of mood rather than the concept of *emotion* in order to simplify.

3. Method

This section details the type of study, the scale adaptation process, the universe, and sample of the research, data collection tools, the data analysis method, and the process of data evaluation.

3.1. Type of the Study

This study is a cross-sectional study conducted in the screening model, one of the quantitative research methods. The screening model is one of the research approaches aiming to describe the situation as it happened in the past or as it is still happening. It consists of describing the event, individual or object in the specific conditions as it is. The study does not try to change or influence the object in any way (Karasar 2009: p.77-79).

3.2. Characteristics of Psycholinguistics Examination/Language Adaptation Process of the Scale

The permission was first obtained by establishing communication by e-mail, in terms of the adaptation of the scale into Turkish. Subsequently, special attention was attached to adapt the language and expressions based on theoretical practice to Turkish culture. "Group translation" and "back translation" methods are used for the translation. The original form of the scale was translated from English to Turkish by nine academicians, experts in their fields. With a 2-month interval, the translation was applied twice to the same translation team. After controlling the similarities and differences in the translations, the required corrections were made. If translation items having the same content are discovered, the independent observers made the necessary arrangements. The Turkish draft obtained was compared with the original form, and the item with the closest meaning was selected. After the group translation, the traditional approach used in scale translation was adopted, and the "back-translation" (Brislin, 1986) was realized by two independent translators. The content integrity of each word was tested, and the final form was obtained. Although the back translation method takes much time, it is the method that is used more frequently to ensure the cultural equality of the scale. After completing the translation process of the scale, the scale was assessed by three linguists and ten students in terms of understandability, and no problems were detected.

3.3. Sample Selection of the Study

The sample of the study consists of 608 active athletes that are 18 years old or older, selected with the Simple Random Sampling method (Karasar, 2009). 466 male and 142 female athletes from different branches of sports participated in the study. While 76.64% of these participants were male and 23.36% were female. Table 1 presents the detailed frequency and percentage values of the participants.

Table 1. *Frequency and Percentage of Participants*

		F	%
	Total	608	100.00
Gender	Male	466	76.64
	Woman	142	23.36
	Total	608	100.00
Branch	Team sports	426	70.1

	Individual sports	182	29.9
	Total	608	100.0
Age	18-22 age	371	61.02
	23-27 age	180	29.61
	28-32 age	52	8.55
	33 and above	5	.82
	Total	608	100.00
License Age	1-5 year	197	32.40
	6-10 year	249	40.95
	11-15 year	122	20.07
	16 and above	40	6.58
	Total	608	100.00

3.4.Data Collection Tools

"Brunel Mood Scale" (BRUMS) was used in the study with its adapted version. "Brunel Mood Scale (BRUMS)" developed by Terry et al. (2003) was derived from "Profile of Mood States – Adolescents (POMS-A)" and it was changed as Brunel Mood Scale (BRUMS). This scale consists of 24 items and 6 sub-scales and was constructed on a five-point Likert scale (Terry & Lane, 2010; Terry & Lim, 2011). Athletes assess their feelings between 0 (Not at all) to 4 (Extremely). The scale assesses the emotions of the athletes before, during and after the competition in 6 sub-scales; Anger, Confusion, Depression, Fatigue, Tension, Vigor. Athletes evaluate their answer on a 5-point scale based on whether they have experienced such emotions. Although other reference time periods may be used with the following question, "How did you feel last week, including today?" the reference time period is expressed as follows "How do you feel right now?". It is possible to use the following expressions, "How did you feel last month" or "How do you normally feel?". It only takes a few minutes to fill out the scale (Terry and Lane, 2010).

3.5.Data Collection and Analysis Method

The translated Turkish version of the scale was implemented in the study by getting the consent of the universities, clubs and athletes. There is no definite rule regarding the duration of the study in the literature's test-retest method in the validity-reliability studies. The expression of "periodically" is used in some scientific research books and articles. Nevertheless, the test-retest is considered to suitable in three to six weeks, according to Ergin (1995), and in an average of four weeks, according to Büyüköztürk (2005). Akın et al. (2007), Öztürk and Coşkun (2015) conducted their study at a three-weeks interval while Çetinel et al. conducted their study after 2 to 6 weeks. When conducting retest soon, the athletes remember the questions of the scales. If the retest is conducted at a long interval, the possibility of the participants not being in the same environment increases (Vincent and Weir, 2014). Hence, the researcher needs to adjust the retest interval thoroughly and sensitively. During the implementation, the researcher strived to finish the study in the planned schedule by paying attention to the time, environment, and condition of the athletes. Computer-aided software was used to analyze the data. Mean, standard deviation, and frequency values were calculated to state the descriptive statistics.

The Cronbach alpha was conducted for the *reliability* analysis of the scale, while the Pearson product-moment correlation was used to analyze the item correlation. A sample t-test was conducted for comparing differences. The Explanatory Factor Analysis (EFA) was conducted for observing the underlying sub-dimensions of the Brunel Mood Scale. Confirmatory Factor Analysis was conducted for validity. Consequently, the reliability analysis of the scale and its dimensions were conducted. Kolmogorov Smirnov and Shapiro Wilk tests were used to test the normal distribution of the variables obtained at the end of (CFA). Spearman's rank correlation coefficients were used to note whether there was a significant relationship between the sub-dimensions of the scale.

4. Results

The inter-item correlation analysis was reviewed in this section to analyze the invariance and the reliability of the scale while the Cronbach's alpha coefficient and item analysis were calculated for the internal consistency of the scale.

Item Reliability Analysis

In order to test the internal consistency of the scale, the Cronbach alpha coefficient, signifying the internal consistency coefficient of the test-retest, was calculated, and item analysis was conducted.

Table 2. *Test-Retest Reliability Analysis*

	Cronbach's Alpha	N of Items
Test	.866	24
Retest	.853	24

In this study, the Cronbach Alpha coefficient was calculated to measure the internal consistency of the data obtained from the scale and the obtained number (n =.866) was found to be highly reliable. When retest reliability analysis results are examined, it has been determined that that retest results are also highly reliable (n =.853).

Table 3. *Item Level Test-Retest Reliability*

	Scale Mean If Item Deleted	Item Scale Variance If Item Deleted	Total Correlation	Cronbach's Alpha If Item Deleted
Panicky (T)	23.80	168.726	.334	.863
Panicky (RT)	23.64	147.524	.266	.852
Lively (T)	21.68	181.890	-.231	.881
Lively (RT)	21.42	158.382	-.220	.870
Confused (T)	23.65	165.192	.424	.861
Confused (RT)	23.62	144.100	.418	.848
Worn out (T)	23.32	159.660	.517	.858
Worn out (RT)	23.32	139.348	.518	.844
Depressed (T)	23.63	158.334	.658	.854
Depressed (RT)	23.58	137.984	.631	.841
Downhearted (T)	23.51	156.669	.659	.853
Downhearted (RT)	23.47	135.841	.686	.838
Annoyed (T)	23.37	157.982	.594	.855
Annoyed (RT)	23.14	135.785	.553	.842
Exhausted (T)	23.57	157.711	.647	.854
Exhausted (RT)	23.58	138.135	.609	.841
Mixed up (T)	23.47	156.863	.656	.853
Mixed up (RT)	23.34	137.210	.602	.841
Sleepy (T)	23.13	159.263	.477	.859
Sleepy (RT)	22.98	138.421	.432	.847
Bitter (T)	23.58	159.186	.613	.855

Bitter (RT)	23.51	138.382	.575	.842
Unhappy (T)	23.64	157.900	.687	.853
Unhappy (RT)	23.58	137.480	.659	.840
Anxious (T)	23.54	158.387	.649	.854
Anxious (RT)	23.40	138.290	.597	.842
Worried (T)	23.52	160.388	.551	.857
Worried (RT)	23.52	139.690	.563	.843
Energetic (T)	21.80	179.235	-.140	.882
Energetic (RT)	21.44	156.369	-.147	.870
Miserable (T)	23.74	159.293	.602	.855
Miserable (RT)	23.78	140.152	.579	.843
Muddled (T)	23.73	158.680	.681	.854
Muddled (RT)	23.74	141.367	.547	.844
Nervous (T)	23.47	156.220	.679	.853
Nervous (RT)	23.42	137.275	.601	.841
Angry (T)	23.34	159.077	.507	.858
Angry (RT)	23.34	136.769	.568	.842
Active (T)	21.87	176.350	-.062	.878
Active (RT)	21.53	153.472	-.059	.867
Tired (T)	23.13	159.779	.472	.859
Tired (RT)	23.08	137.676	.516	.844
Bad tempered (T)	23.47	161.390	.455	.860
Bad tempered (RT)	23.50	138.666	.526	.844
Alert (T)	22.02	175.625	-.043	.878
Alert (RT)	21.75	153.038	-.049	.867
Uncertain (T)	23.38	157.142	.602	.855
Uncertain (RT)	23.31	138.315	.541	.843

When the test item analysis table was considered, it was discovered that there was no need to exclude any item. Any deleted item will not provide a considerable increase in the reliability coefficient. As a result of the item analysis, the total correlation coefficient was determined to be between .043 and .687. When the test item analysis results were considered again, it was stated that deleting an item from the analysis would not considerably increase the overall reliability of the scale. After reliability and item analysis conducted in terms of test and retest, any item among 24 items included in the scale was excluded from the study. In both practices, it was determined that the scale's internal consistency is high, and every item should be included in the scale according to the item analysis results.

Table 4. *Test-Retest Item Variance Analysis and Item Correlation Analysis*

		Paired Differences					t	sd	p	n	r
		Mean	SD	St. Error	In 95% Confidence Interval						
					Minimum	Maximum					
Twinning 1	Panicky (T) Panicky (RT)	-.053	.913	.037	-.125	.020	-1.421	607	.156	608	.311
Twinning 2	Lively (T) Lively (RT)	-.153	1.362	.055	-.261	-.044	1.816	607	.070	608	.329
Twinning 3	Confused (T) Confused (RT)	.071	1.041	.042	-.012	.154	1.675	607	.094	608	.297
Twinning 4	Worn out (T) Worn out (RT)	.107	1.185	.048	.013	.201	-1.238	607	.216	608	.420
Twinning 5	Depressed (T) Depressed (RT)	.046	1.079	.044	-.040	.132	1.052	607	.293	608	.401
Twinning 6	Downhearted (T) Downhearted (RT)	.066	1.110	.045	-.023	.154	1.462	607	.144	608	.454
Twinning 7	Annoyed (T) Annoyed (RT)	-.127	1.362	.055	-.235	-.018	-1.814	607	.70	608	.335
Twinning 8	Exhausted (T) Exhausted (RT)	.113	1.087	.044	.027	.200	-1.153	607	.250	608	.435
Twinning 9	Mixed up (T) Mixed up (RT)	-.030	1.159	.047	-.122	.063	-.630	607	.529	608	.419
Twinning 10	Sleepy (T) Sleepy (RT)	-.051	1.314	.053	-.156	.054	-.957	607	.339	608	.470
Twinning 11	Bitter (T) Bitter (RT)	.031	1.158	.047	-.061	.124	.665	607	.506	608	.355
Twinning 12	Unhappy (T) Unhappy (RT)	.038	1.082	.044	-.048	.124	.862	607	.389	608	.385
Twinning 13	Anxious (T) Anxious (RT)	-.031	1.128	.046	-.121	.059	-.683	607	.495	608	.369
Twinning 14	Worried (T) Worried (RT)	.097	1.187	.048	.002	.192	.365	607	.715	608	.290
Twinning 15	Energetic (T) Energetic (RT)	-.262	1.567	.064	-.386	-.137	-.192	607	.848	608	.331
Twinning 16	Miserable (T) Miserable (RT)	.143	1.146	.046	.052	.234	-1.602	607	.110	608	.297
Twinning 17	Muddled (T) Muddled (RT)	.113	1.034	.042	.031	.196	-.457	607	.648	608	.352
Twinning 18	Nervous (T) Nervous (RT)	.058	1.207	.049	-.039	.154	1.176	607	.240	608	.369
Twinning 19	Angry (T) Angry (RT)	.110	1.430	.058	-.004	.224	1.900	607	.058	608	.259
Twinning 20	Active (T) Active (RT)	-.237	1.637	.066	-.367	-.106	1.188	607	.235	608	.236
Twinning 21	Tired (T) Tired (RT)	.053	1.386	.056	-.058	.163	.936	607	.350	608	.334

Twinning 22	Bad tempered (T) Bad tempered (RT)	.132	1.363	.055	.023	.240	1.803	607	.72	608	.254
Twinning 23	Alert (T) Alert (RT)	-.171	1.568	.064	-.296	-.046	-.300	607	.764	608	.351
Twinning 24	Uncertain (T) Uncertain (RT)	.039	1.221	.050	-.058	.137	.797	607	.426	608	.407

The paired sample t-test was conducted for test-retest item difference analysis, and as a result of the study, no significant difference was found in all items. Based on this result, the invariance of the scale utilized in two separate periods was discovered. According to Pearson correlation analysis between test-retest items, a significant relationship between all items was determined ($p < .05$). Based on these results, it was discovered that athletes responded sincerely to the items in the scale and that the items of the scale measured similar characteristics in two separate periods. When the correlation table is reviewed, the highest correlation coefficient is found to be $r = .470$ in "sleepy" item, while the lowest correlation is found to be $r = .236$ in "active" item. When the correlation coefficients are investigated, it can be assumed that the test is stable since the coefficients are statistically significant although there are items that do not show a high level of correlation.

Construct Validity

The factor analysis was used for the validity of the Brunel Mood Scale. The current factor construct was explained by using first the (EFA) Explanatory Factor Analysis. The construct validity was tested by using (CFA) Confirmatory Factor Analysis, and the last factor construct of the scale has been established. It is understood that there is no significant difference between the explanatory factor analysis results based on the Test and Retest. In this context, the explanatory factor analysis is presented as follows.

Table 5. *Explanatory Factor Analysis*

Factors	Items	Factor Loads	Eigenvalue	Explained Variance %	Cronbach Alfa
1. Fatigue	Sleepy	.773	8.521	37.049	.811
	Worn out	.761			
	Tired	.693			
	Exhausted	.651			
	Muddled	.506			
2. Depression	Depressed	.419	2.382	10.357	.847
	Worried	.742			
	Panicky	.618			
	Anxious	.610			
	Unhappy	.595			
	Mixed up	.582			
	Uncertain	.520			
	Miserable	.463			
3. Anger	Angry	.841	1.247	5.421	.823
	Annoyed	.822			
	Nervous	.683			
	Bad tempered	.551			
	Downhearted	.487			
	Bitter	.428			
4. Vigor	Active	.840	1.146	4.981	.786
	Alert	.797			
	Energetic	.776			

	Lively	.591			
Kaiser-Meyer-Olkin Testi			.927		
Bartlett's Testi			Ki-Kare	6493.776	
			Sd	253	
			p.	.000	

Before implementing Factor Analysis, KMO and Bartlett's test was performed. An anti-image matrix was calculated to test the suitability of our data set and sample size for factor analysis. When the KMO test result (KMO =.927) is examined, it has been discovered that the number of samples included in the data set was suitable for factor analysis and the Bartlett test was found to be significant (p =.000, p <.05). It was emphasized that the data set was suitable for factor analysis since the data had the multivariate normal distribution.

As a result of the explanatory factor analysis, factor loadings are in a relatively extreme range, ranging from 0.419 to 0.841. Alpha coefficients are within acceptable limits for every factor. Item 3 (confused), was excluded from the analysis because it disrupted the factor structure in the first-factor analysis trial. At the end of EFA, conducted varimax rotation and basic components method with the remaining 23 items, a four-factor structure was obtained. While Factor 1 explains 37.09% of the variance, Factor 2 explains 10.357% of the variance. Factor 3 explains 5.421% of the variance, while Factor 4 explains 4.981% of the variance. 58.249% of the total variance was explained. In this factor structure obtained, it has been found out that Factor 1 (α =.811), Factor 2 (α =.847), Factor 3 (α =.823) are highly reliable, while Factor 4 (α =.786) was found to be quite reliable. At the end of EFA, a different factor structure than the original scale was obtained. In the original scale, Terry et al. (1999) solicited 24 expressions of the scale under six dimensions as a result of their explanatory factor analysis. When the results are considered, although the factor structure is different, it has been concluded that the structure obtained is suitable for theory and literature. As a result of statistical analysis, (anger, fatigue and vigor) sub-dimensions maintained their status in the original scale, (depression, tension and confusion) sub-dimensions obtained in the Turkish population were formed differently from the original scale as a result of the analysis. In this study, six dimensions included in the original model were reduced to 4 dimensions, and a different model has been shaped. The resulting new dimension (4th Dimension) was named as "depressiveness", after getting the opinion of the experts.

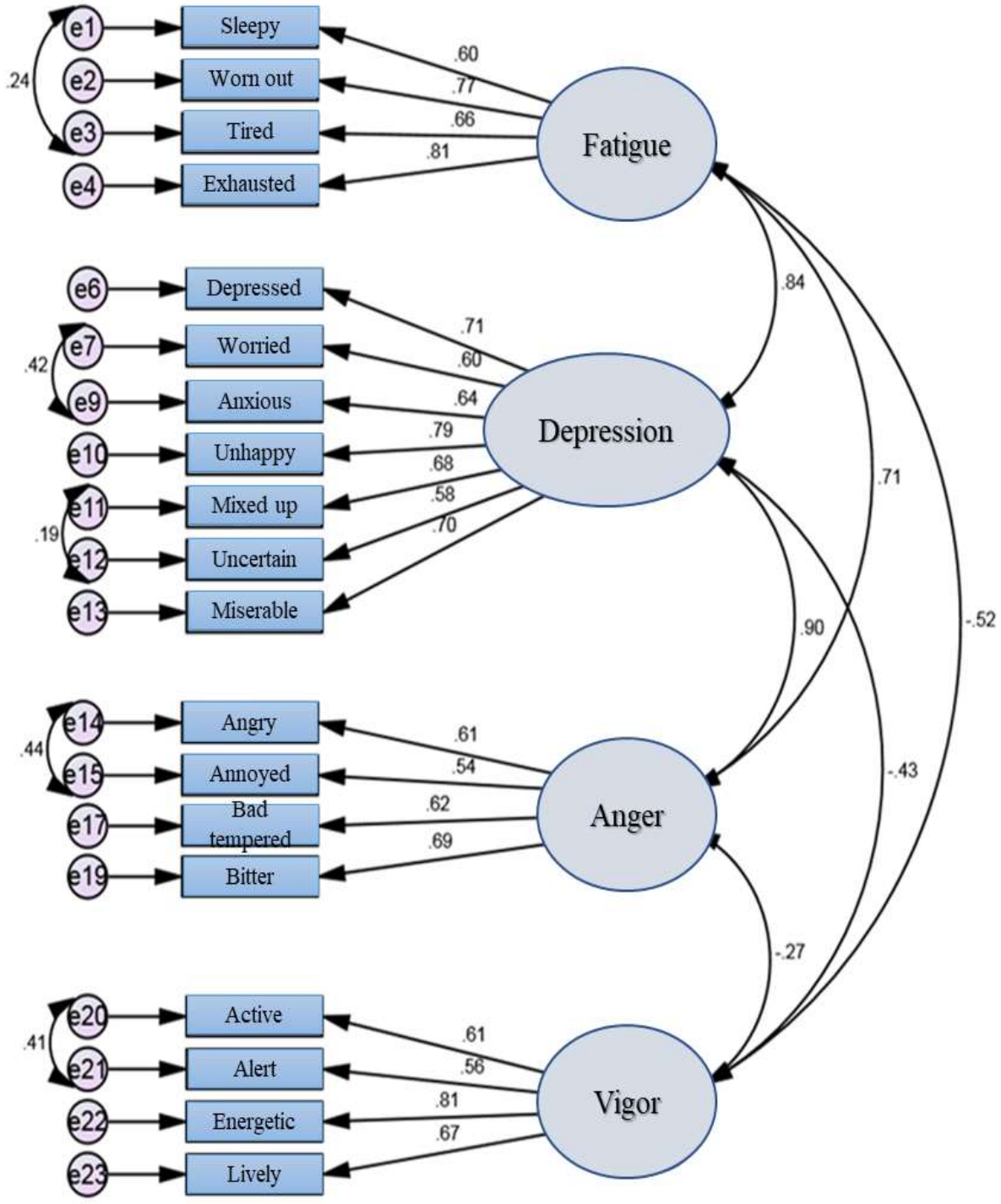

Figure 1. *Model Based on Confirmatory Factor Analysis for BRUMS Scale*
Fatigue, Depression, Anger, Vigor

Table 6. *Sub-dimensions, Standard and Non-standard Factor Loading of Items*

SUB-DIMENSIONS	ITEMS		STANDARD FACTOR LOADING	NON-STANDARD FACTOR LOADING
Fatigue	4.	Worn out	.60	1
	8.	Exhausted	.77	1.03
	10.	Sleepy	.66	.99
	21.	Tired	.81	1.02
Depression	5.	Depressed	.71	1
	14.	Worried	.60	.84
	13.	Anxious	.64	.93
	12.	Unhappy	.79	1.11
	9.	Mixed up	.68	1.06
	24.	Uncertain	.58	.92
	16.	Miserable	.70	.92
Anger	19.	Angry	.61	1
	7.	Annoyed	.54	.96
	22.	Bad tempered	.62	.97
	11.	Bitter	.69	1.02
Vigor	20.	Active	.61	1
	23.	Alert	.56	.97
	15.	Energetic	.811	1.33
	2.	Lively	.67	.99
DELETED ITEMS			1. Panicky	
			3. Confused	
			6. Downhearted	
			17. Muddled	
			18. Nervous	

As a result of the confirmatory factor analysis, it has been determined that the model obtained as a result of EFA is not valid as it is. Item 17 (muddled) is excluded since the factor loading is low and the item 1 (panicky), item 3 (confused), item 18 (nervous), item 6 (downhearted) are excluded from the model because they reduce the harmony of the model (Table 6). The model obtained after the exclusion of the items is presented in (Figure 1).

The item structure of the factors was reviewed and the following names are given to the Factors, Fatigue for F1, Depression for F2, Anger for F3 and Vigor for F4. In the framework of the confirmatory factor analysis conducted, the goodness of fit index below was calculated.

Table 7. *Goodness-of-fit Indices for the Confirmatory Factor Analysis*

x^2	sd	x^2/sd	p	GFI	AGFI	CFI	RMR≤	NFI	TLI	RMSEA
416.056	141	2.95	.000	0.93	0.98	0.94	0.05	0.98	0.99	0.057

If in the results of CFA model, χ^2/sd value is lower than 3.0, it means that the goodness-of-fit is well adapted (Kline, 1998). When the goodness-of-fit index is examined, it has been determined that the x^2/ sd value is equal to 2.95 and the model shows a good fit. The Root Mean Square Error of Approximation (RMSEA) is used to evaluate the goodness-of-fit of the model in this study since it reveals the two-index strategy, i.e., the Comparative Fit Index and the average discrepancy between them, and it provides the advantage of being sensitive to the complexity of the model. A value of 0.05 or less of RMSEA indicates a good fit and values up to 0.08 indicate an acceptable fit (Browne and Cudeck, 1993). For CFI, Hu and Bentler (1999) suggested that values should approach 0.95. When the other goodness-of-fit indices of the model are reviewed since the model takes 0.93 value in the Goodness of Fit Index GFI, NFI shows the value of 0.9, CFI

shows the value of 0.94, RMSEA shows the value of 0.057 RMSEA, and the model shows the RMR value of 0.05, the model reveals a perfect fit. In light of this information, it is observed that the model obtained as a result of the analyzes has adapted well.

Table 8. *Reliability Analysis Results Regarding Sub-Dimensions of Brunel Mood Scale Adapted to Turkish*

	Cronbach's Alpha	N
Fatigue	.811	4
Depression	.859	7
Anger	.756	4
Vigor	.786	4
Brunel Mood Scale	.800	19

When the reliability analysis table is reviewed, it has been found out that Fatigue (α =.811) and Depressiveness (α =.859) sub-dimensions are highly reliable, while Anger (α =.756) and Vigor (α =.786) sub-dimensions were found to be quite reliable. To test the validity of this structure obtained after the Explanatory Factor analysis, the confirmatory factor analysis was conducted, and the model valid after the analysis result is presented in Figure 1.

Table 9. *Alpha Values and Mutual Correlation Analysis Results for Brums' Sub-Dimensions*

	Alpha	Anger	Depression	Fatigue	Vigor
Anger	.75	1			
Depression	.85	.596**	1		
Fatigue	.81	.469**	.635**	1	
Vigor	.78	-.121**	-.259**	-.382**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Spearman's rank correlation coefficients were used to reveal whether there was a significant relationship between the sub-dimensions of the scale. It was noted that the correlation coefficients between all scale sub-dimensions were statistically significant at the 0.01 level (p <.05), as a result of the analysis. When Table 9 is analyzed, the following significant relationships are found; a positive relationship between Fatigue and Depressiveness at a level of 0.635, a positive relationship between Anger and Fatigue at a level of 0.469, a negative relationship between Fatigue and Vigor at a level of -.382, a positive relationship between Anger and Depressiveness at a level of 0.596, a negative relationship between Vigor and Depressiveness at a level of -.259 and a negative relationship between Anger and Vigor at a level of -.121.

5.Discussion

This section discusses, interprets and evaluates the findings obtained from Turkish athletes in the Validity of Reliability study of the Brunel Mood Scale based on to the hypotheses of the study. Since the BRUMS has been developed and validated on English-speaking participants, it should be noted that further validity and reliability studies are needed to ensure equivalence between the original version and the adapted version (Hashim et al., 2010). Accordingly, it is necessary to conduct new studies to improve the validity of the BRUMS. The Turkish version of the adult athlete form is a reliable measurement tool of Brunel Mood Scale (BRUMS). As the analysis of the test reliability (α=.866) and retest reliability (α=.853) was conducted, it has been concluded that the scale is quite reliable (Table 2). When the reliability analysis results of the sub-dimensions of the model obtained at the end of CFA, Fatigue (α=.811) and Depression (α=.859) sub-dimensions are highly reliable, while Anger (α=.756) and Vigor (α=.786) sub-dimensions were found to be quite reliable (Table 8). The Brunel Mood Scale is a scale measuring the mood of athletes, it has been extensively used in international sports literature, and its validity and reliability have been tested multiple times in various countries. Hashim et al. (2010) conducted a study on 355 young athletes in Malaysia. Compared to this study, they reported the results of the study under 6 dimensions excluding only one item (item 24). Nevertheless, the reliability they obtained and the dimensions of the scale are respectively obtained as follows; tension (α =.72), depression (α =.64), anger (α =.73), vigor (α =.69), fatigue (α =.65), confusion (α =.58). Consequently, the reliability results of the dimensions obtained by Hashim et al. are quite low compared to this study. It may be assumed that this is due to the lower age of the athletes participating

in the study (mean 14.69). The reliability coefficients of the 14-item Farsi Mood Scale obtained as a result of the study conducted on 405 Iranian University students Terry et al. (2012) supported fewer items (14 items). However, it showed the distribution of the items in 6 sub-dimensions, although it consisted of fewer items. The participants are coded as the athletic participant and non-athletic participant and included in the analysis. Sub-dimensions according to the athletes and non-athletes are as follows respectively, Anger (α =.71.70), Confusion. (α=.72.69), Depression (α =.51.45), Fatigue (α =.56.56), Tension (α =.82.81), Vigor (α =.82.77). Consequently, the reliability results of the dimensions obtained by Terry et al. are quite low compared to this study. The four sub-dimensions exceeded the benchmark value. Nevertheless, reliability coefficients of depression and fatigue dimensions were found to be marginal. It is possible to state this is because fewer items were obtained compared to the original version of the scale, and the sub-dimensions were composed of one or two items. 1485 volunteer athletes competing at the Malaysian Games of 2010 participated in the study of Lan et al. (2012) (N = 929 Male participants and N = 556 Female participants). According to this study, the reliability results of the study conducted by Lan et al. are found to be low as follows, Anger (α =.72) Tension (α =.77) Depression (α =.74) Fatigue (α =.70) Vigor (α =.71), Confusion (α=.70). It is possible to argue that different values were obtained since the selection of the universe and sample is handled differently and independently.

As a result of the EFA applied to the Brunel Mood Scale, Item 3 (confused) was excluded from the analysis because it disrupted the factor structure in the first-factor analysis trial. As a result of the EFA performed with the remaining 23 items with varimax rotation and basic components, a 4-factor structure was obtained. While Factor 1 explains 37.09% of the variance, Factor 2 explains 10.357% of the variance. Factor 3 explains 5.421% of the variance, while Factor 4 explains 4.981% of the variance. 58.249% of the total variance was explained. When the EFA results obtained at a different factor structure compared to the original scale are considered, although the factor structure is different, it has been concluded that the structure obtained is suitable for theory and literature. If the model obtained is compared with the original model, the Brunel Mood Scale in the original model consists of 24 items and six sub-dimensions, and each sub-dimension contains four items. As a result of statistical analysis conducted within the context of this study, (anger, fatigue and vigor) sub-dimensions maintained their status in the original scale, (depression, tension and confusion) sub-dimensions obtained in Turkish population were formed differently from the original scale as shown in the following table. The new dimension obtained as a result of the study was named as “depressiveness” after getting the opinion of the experts. The reason for calling this dimension "depressiveness" is that exclusively one item has been excluded from its original form, and the concept of depression has a broader place in the psychology literature than other sub-dimension concepts and has been widely investigated (Table 6).

It was ascertained that the model obtained as a result of EFA is not valid as it is. Item 17 (muddled) is excluded since the factor loading is low and the item 1 (panicky), item 3 (confused), item 18 (nervous), item 6 (downhearted) are excluded from the model because they reduce the harmony of the model (Table 6). The model obtained after the exclusion of the items is presented in (Figure 1). Based on the findings of Terry et al. (1999), while depression has a moderate positive relationship with anger, confusion, exhaustion and tension, it has a negative correlation with vigor. While there was a positive relationship between depression, fatigue and anger items in this study, a negative relationship was observed with vigor sub-dimension. The mutual correlation between the sub-dimensions presents similar results in the literature. In other words, in terms of the direction of mutual correlations between the subscales, the results are consistent with the results reported by Terry et al. (1999, 2003). Rohlfs (2008) conducted a factor analysis of 24-items Brunel Mood Scale in their study, held on 62 university students, 170 athletes, 66 primary and secondary school students in Brazil and collected the statements under six sub-dimensions, consistent with the original. These six dimensions, obtained as a result of retesting, explain 72% of the total variance. The factor analysis has been conducted to the 24-items Brunel Mood Scale to factor analysis, and 19 valid expressions are grouped under four dimensions. 4 dimensions obtained from this study conducted in Turkey explain 58,249% of the total variance. Furthermore, Rohlfs (2008) performed confirmatory factor analysis in test-retest stages. As a result of all these findings, it can be assumed that BRUMS is a valid and reliable measurement tool. Nevertheless, new studies are required to increase the validity of BRUMS in the future. Findings of the study would contribute to exercise and sports psychology literature if the research is conducted with different samples such coaches, referees, exercise participants, individual and team athletes, exercise and recreational

participants, sports trainers, etc. The study in this context presents an excellent way to discover the nature of emotions and moods in diverse cultures. It is recommended to use BRUMS in different age groups (minors, teens, adults and elders) and different scales (anxiety, stress, personality, etc.). It should be considered that new studies are required to increase the validity of this study in the future.

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Multiculturalism in Inercultural Tolerant Communication of Innovative Educational Space of Ukrainain Preschool

Rozlutska Galyna[1], Mariana Sokol[2], Ömer Mert Denizci[3], Olha Hvozdyak[4], Fedorovych Anna[5] and Palasevych Iryna[6]

[1]*Doctor of Pedagogical Sciences, Professor of General pedagogy and High school pedagogy Department, Uzhhorod National University. Uzhhorod, Ukraine.*

[2]*Doctor of Pedagogical Sciences, Professor of Romanic-German Philology Department, Ternopil Volodymyr Hnatiuk National Pedagogical University. Ternopil, Ukraine.*

[3]*Doctor of Communication, Assistant Professor, Marmara University. Istanbul, Turkey.*

[4]*Associate Professor, PhD in Pedagogy, Head of German Philolody Department. Uzhhorod National University. Uzhhorod, Ukraine.*

[5]*PhD in Education, Associate Professor of General Pedagogy and Preschool Education Department, Drohobych Ivan Franko State Pedagogical University. Drohobych, Ukraine.*

[6]*PhD in Pedagogy, Associate Professor, General Pedagogy and Preschool Education Department. Drohobych Ivan Franko State Pedagogical University. Drohobych, Ukraine.*

Abstract

The article outlines the innovations in preschool education caused by axiological transformations of society. The preschool space of has been defined as the initial basis of education, formed by a combination of social and educational environment. The methodological foundations of the studied problem have been determined and the ontology of the main research concepts has been made. The preschool age is favorable for the tolerance formation as the most sensitive basis for learning values human life priorities. An attempt has been made for the first time to explore the possibilities of using the principle of multiculturalism as an organizational component of tolerant intercultural communication in the educational space of Ukrainian preschool, created within the framework of the updated regulatory and methodological support.

The analysis of pre-school child development programs has shown that, despite their regional or state application, they, in the context of the current legal framework, provide a methodological basis for the creation of a local educational space for a preschool institution. The program content filling includes the potential for preschooler's tolerance formation in the context of combination of cultural, linguistic, social and related competences, in accordance with the age-old psychological mechanism of preschool age of child development.

The described innovative approach in the organization of tolerant intercultural communication in Ukrainian preschool space can be creatively and practically adapted in the conditions of any modern multicultural society.

Keywords: innovation, intercultural communication, multiculturalism, tolerance, educational space, educational principle, preschool organization.

Introduction

Problem statement in general. Globalization and internationalization have led to socio-cultural changes and, consequently, cause striving for world openness for openness to the world against the backdrop of the desire to preserve ethno-cultural traditions and to strengthen nationalist aspiration against the backdrop of the desire to preserve ethnocultural traditions and strengthen nationalist aspirations. Pre-school education, as a preliminary education space, responds flexibly to new societal demands, creating an innovative, open to dialogue environment. However, there is a problem of tolerance in the context of intercultural communication in the organization of preschool educational space. The norms of international law for the childhood protection are reflected in the updated legal framework of Ukrainian education with the requirements of compulsory education of older preschool children and state guarantees to facilitate the creation of proper conditions for obtaining pre-school education through the development of a network of educational institutions of various forms. The preschool educational institution as the first social and at the same time educational environment is obliged to ensure the harmonious development of the child's personality, his health, upbringing a valuable attitude to himself, the natural and social field, develops

mechanisms of social adaptation and creative self-realization in the environment of strangers and adults. The presence of representatives of different cultures in this unfamiliar environment actualizes the application of the principle of multiculturalism as organizational for tolerant communication of participants in the educational process. Children of preschool age, pedagogical workers, assistants of tutors and nannies; medical workers; parents or persons who replace them; teaching assistants to children with special educational needs are active participants in the field of pre-school education.

The aim of the study is to analyze the possibilities of organizing tolerant intercultural communication in the educational space of the Ukrainian preschool on the principle of multiculturalism. According to the stated aim, the following tasks have been determined:

1. To outline the methodological backgrounds of the problem and the ontology of the basic concepts of the study.

2. To analyze the legal and regulatory methodological supply of preschool education on the possibility of using the principle of multiculturalism as organizational in a tolerant educational space with an accent on the age and psychological features of the child's development.

3. To summarize identified opportunities and outline prospects for further research.

The methodology of the research. The versatility of the studied problem necessitated an interdisciplinary approach using the tools of pedagogy, psychology, and social communications. The analytical and synthetic research methods in the analysis of sources and scientific and methodological literature, as well as the diversification principle have been used to achieve the aim of the study. A systematic approach and the use of structural-functional analysis have been contributed to the generalization of the research results

The main material of the research. Innovative transformations of education of the beginning of the XXI century have been outlined by such leading concepts: traditional (mastering of basic knowledge, abilities and skills; studying and mastering of academic knowledge), rationalistic (reliance on knowledge as a strict set of objective facts based on creation of effective and comprehensively developed technology) and humanistic (creation of such an environment in which the individual will develop, learn and be educated positively). From the scientific point of view, the educational environment has been interpreted as a set of conditions that ensure the organization of comfortable life of the educational services provider. S. Smolyuk's studies (Smolyuk S., 2017, p. 138) determines the integrative nature of the educational environment, which synthesizes a number of factors that, through interaction, ensure the effective socialization and development of the child's personal values. As a result, the creation of conditions for tolerant communication in accordance with the principle of multiculturalism in the preschool environment is possible within the integration of socio-cultural, psychological, pedagogical and other factors.

The analysis of pedagogical research in the field of innovative educational environment formation in different types of educational establishments (Smolyuk S, Smolinskaya O., Tsymbalaru O.) prompts us to consider the educational space as part of objective reality, which is characterized by material and procedural nature, structure and presence of borders. Meanwhile the educational environment is always specific, existing only in a particular place and at the exact time of the environment for a particular subject. According O. Tsymbalaru statement (Tsymbalaru O. 2016, pp. 44-45) the educational space and any of its components such as: information, cultural, social environment; educational program and educational tasks; the interaction of participants in the educational process, etc. under the influence of external or internal factors may be the object of purposeful change. Accordingly, the formation of preschooler tolerant personality is an indispensable condition of the educational space of a preschool educational establishment, while the set of interacting local educational environments is the object of innovation.

The content of the educational environment, mainly its specially organized innovation component, which is the most flexible to the requirements of society, has been specified in the article. Thus, innovations in education are a natural phenomenon, dynamic in nature and developmental in results. Their introduction allows resolving the contradictions between the traditional system and the needs for qualitatively new education. An essential feature of innovation is its ability to influence the overall level of education quality, to expand the innovative field of the educational environment in the educational establishment, region, and country. As a systemic formation, innovation is characterized by integral qualities: innovation process, innovation activity, innovation potential, innovation environment. The source of innovation is a purposeful search for an idea in order to resolve contradictions. Its realization is carried out through implementation in

practice. The development of innovation depends on how the environment requires new ideas. Innovations in education are the process of creation, introduction and dissemination in educational practice of new ideas, tools, pedagogical and managerial technologies. As a result, the indicators (levels) of achievements of education structural components increase and a transition of the system to a qualitatively different state arise. Since innovation has a multidimensional significance, from idea to process, it has been proposed (Dubaseniuk O., 2019, p. 15) to classify innovations according to the following indicators: object of influence (pedagogical, social, psychological, organizational, managerial), level of distribution (system-methodological and local-technological) and innovative potential of the new (radical, modification, combinatorial). According to the given classification, the subject of the research has been in the context of combinatorial potential of organizational, social and pedagogical innovations of methodological level.

However, the educational environment only enables, but does not guarantee success in the educational process, because the special achievements of each child are the result of their own cognitive activity (Smoliuk, S. 2017, 43-45). The efficiency of the environment is improved by taking into account the following organization characteristics:

- *dominance* (the presence of potential in the environment for the development of personal values of the child, its importance in influencing the growing identity in relation to other social factors influence. It is important that a positive educational environment has been dominant in personality formation);
- *pedagogical intensity* (dynamic characteristics that indicate the insensitive degree of the environment by the teacher's use of innovations, non-traditional forms and methods of organizing the educational process (trainings, business games, design and computer technology, etc.);
- *latitude* (confirming the extent of inclusion of educational process subject in a particular environment);
- *emotional intensity* (effective ratio of emotional and rational, focus on positive emotions);
- *coherence* (the level of individual integration into the existing environment, the consistency of the impact of different types of environment (educational game, socio-cultural, healthcare, computer-oriented, research, etc.);
- *socio-cultural mobility* (criterion of socially oriented creative potential of the environment, its ability to progressive changes, rapid implementation of innovations taking into account social requirements (especially regional));
- *coordination* (harmonization of goals, content, forms and methods of activity of all participants in the educational process);
- *stability* (resistance of the environment in relation to purposeful progressive influence on the child in combination with preservation of pedagogical traditions.

In accordance with the above characteristics, the functions of the educational environment are didactic-educational, information-developmental, coordination, communication, integration, socio-cultural, etc.. These functions have been implemented through the content of preschool education as a holistic system. The communicative function has been realized by organizing partnerships between participants in the educational process. The socio-cultural function determines the entry of the preschooler into the cultural and educational environment, social interaction in it, the cultivation of knowledge; mastering the values of universal and national culture, the skills formation, the skills interaction, behavior and activities in a multicultural environment. Thus, the main idea of the study on the need to change traditional approaches to innovation in socio-cultural and communication functions organization of the educational environment based on multiculturalism has been outlined.

The intercultural communication in education is a form of social communication, which in the context of the article has been determined by ethnic, religious, and other cultural aspects. The specificity of communication is that it takes place in a multicultural context through direct contact between different cultures; their indirect communication (for example, through an interpreter or through technical means of communication such as telephone, computer, etc.); through texts on various media (paper, electronic, audio and video devices), through which individuals learn the features of another culture. The studies of intercultural communication are sometimes reduced to mastering foreign languages without being immersed in the specifics of the culture, that are mainly reflected in norms, traditions, symbolism, myths, values, etc. The intercultural communication by L. Kazentseva definition (Kazantseva, L. 2014, pp. 37-38) is outlined as the interaction of cultures, in which they enter into dialogue and their actualization, as a result of

which the universal and specific of each culture as a system. The studies of Russian scientists (Vasilkova V., Kozlovsky V., Khokhlova A., 2010.) show that intercultural communication should be considered in three directions:

1) informative, where intercultural communication acts as a social influence or the influence of a subject on the object, as a process of transmitting information from source to recipient;

2) interactive, in which intercultural communication appears as an interaction during which new meanings and definitions appear;

3) post-classical, which takes into account discursive and narrative moments in intercultural communication. In terms of age limits of preschool children and psychological and pedagogical features of their development mainly given study, has been focused on the information and interaction sphere of intercultural communication.

The multiculturalism principle as a way to form tolerance in communication based on the understanding of the diversity of languages and cultures and the importance of their interaction requires the perception of educational space as a holistic and nonlinear system, in which tolerant intercultural communication will ensure the effectiveness, identification and management of the educational space. However, multiculturalism, based on universal values will determine the socio-cultural development of the individual, his ability to live in a multicultural environment (Rozutska G, 2005, pp. 16-19). O. Smolinska states: the structures that determine the target (personal), content-operational (program-methodical) and productive (innovation-creative) blocks are the key structures in the educational space organization (Smolinska O., 2015, p. 23). The processes of goal setting, the formation of motivation occur in the subsystem of efficiency ensuring. The identification subsystem in the organization of the educational space includes exactly those aspects (age, gender, race, ethnicity, religion, social, national, cultural, etc.), which are harmonious with the abovementioned manifestations of tolerance.

The main idea of modernizing the preschool education system is that the effectiveness of preschool child development can be improved through the design and implementation of the latest educational systems and technologies. An essential condition for the organization of preschool education space is the consideration of pedagogical principles. They include the development of preschoolers in the context of personality-oriented approach taking into account sensitive periods, leading activities, as well as taking into account the socio-cultural context of the educational space and its cultural relevance and dialogicity (Dobosh O., Dovbysh T., 2017, p. 11).

The paradigm of the concept "tolerance" is characterized by a variety of manifestations. The most relevant tokens are impartiality, liberalism, variation, charity, obedience, endurance, patience, tolerance, indulgence, clemency, kindness, compassion, respect, and others. (Wardle, F. 2019). The diversification approach has been used to avoid excessive enthusiasm for determining the level of tolerance in the identification of certain dynamics of its development in the educational space, whereas, excessive tolerance leads to vulnerability. Ukrainian researcher N. Barbelko (Barbelko N, 2013, p. 245) identifies intercultural tolerance as one that directly interacts with cultural identity, culture of society, cultural stereotypes, and intercultural communication. Moreover, the formation of intercultural tolerance should take place in a multicultural environment, which allows not only to develop tolerant relations between different nationalities, but also to cultivate a culture of interethnic communication. The understanding of tolerance as a value of multiculturalism, practice and the principle of intercultural communication in the interaction of participants in the educational process has been taken as a background of the article.

State requirements for the level of education, development and upbringing of a child 6 (7) years old have been summarized in the Basic component of preschool education (Basic component, 2012). Its invariant component contains the following educational lines: "Child's personality", "Child in society", "Child in the natural environment", "Child in the world of culture", "Child's game", "Child in sensory-cognitive space", "Child's speech ». The variable component presents the lines - "Computer Literacy", "Foreign Language", "Choreography", "Chess".

Different programs are implemented in practice, updating in accordance with the development trend of the educational sector for example: "Baby", "Child", "Child in preschool age", "World of childhood", "Joy of creativity", "Ukrainian preschool", "Sure start", "I am in the world" etc.. Each program contains the following aspects:

- the self-worth recognition of preschool childhood, its special role in the development of personality;

- the creation of favorable conditions for the formation of personal maturity of the child, his basic qualities;

- the competence approach to personality development, balance of acquired knowledge, skills, abilities, formed desires, interests, intentions, personal qualities and volitional behavior of the child;

- to give the priority to the socio-moral development of the individual, the formation of children's ability to reconcile personal interests with public;

- the formation of a holistic, realistic picture of the world, the foundations of the worldview in children.

The content analysis of the regional program for the development of preschool children "Ukrainian preschool" shows the possibility of using the principle of cultural conformity in the process of its practical application. The program has been created by a team of authors (O. Bilan, L. Vozna, O. Maksymenko, others., 2012) in order to expand the content component of educational work with preschoolers from two to six years, taking into account the socio-cultural characteristics of the western region of Ukraine. The main feature of the program is the determination of ethnic and cultural traditions, taking into account the axiological component that follows European standards; on the other hand, it tries in every possible way to preserve its national character.

The satisfaction of preschooler cultural interests is provided in the maintenance of crosscutting educational lines "The child in a society", "The child in the world of culture", "Game of the child", "speech of the child" through mastering of universal values, world culture through ethnic culture - the culture of the Ukrainian people. Thus, the only direction of preserving the national culture when entering the world community through the national to the multicultural is clearly crystallized. The principle of multiculturalism provides a set of methodological techniques that form any area of social and mental life, including education, through the prism of system-forming, culturological concepts: culture, cultural patterns, norms and values, way of life, cultural activities, intercultural communication and interests, etc. At the same time, the evolution of education methodology is intensifying. After all, transforming in the process of globalization and integration, education is forced to update the essence and content of the basic principles of their extrapolation into modern open concepts (Sokol M., Tsaryk O., Rozlutska G. others 2020, p. 43-44). Multiculturalism serves as a guide in determining the relationship between the whole and its part, national and global, integrated and differentiated, unified and diverse, external and internal, conscious and unconscious, controlled and spontaneous, stable and changeable etc. As a principle of organization of educational space, multiculturalism determines the conformity degree of cultural diversity and components of education (content, means, tasks, etc.).

The program "Ukrainian preschool" in the context of the educational line "Child in society" focuses on the formation of relationships with peers from the third year of life. At this period, a child is growing the interest to the environment. Therefore, the work with preschoolers should include the learning of such topics as "Spiritual education", "Family", "Attitudes towards peers", "Communication", "Culture in everyday life", "Behavior in public places" (Program, p. 23-25). The choice of topics makes it possible to create an atmosphere of tolerance, openness, respect for each other and a sense of solidarity in the educational space of the preschool establishment.

An essential feature of this stage is that tolerance, developing initially as patience, i.e. the adaptive property of the individual, which allows to adapt to various environmental influences (including frustration), turns into tolerance as a form of social relations. The main characteristic of this stage is the transition from reflex to mental cognition of the world. The research interest is focused on the concept of competencies that are formed as a result of work on these topics and presented as follows:

1) positive perceptions of different people, including family members;

2) feelings of love and respect for the environment;

3) attentive, friendly, compassionate attitude towards people.

Thus, the structural formation of competencies corresponds to the psychological mechanism of tolerance formation, represented by cognitive, emotional and behavioral components.

Tolerance of the preschooler can be formed due to such preconditions: emotional attachment to an important person of child; high need for security and emotional contiguity with an adult; the formation of a reference image of another person; the development of communicative elements. These age characteristics of the preschooler have been taken into account in the content line "Child in the world of culture". The object of

knowledge for a preschooler is the activities and behavior of parents, older family members, close associates. Special attention should be paid to ethnically, religiously, socially, racially, etc., heterogeneous families or families that currently dominate in the social structure. The child as a universal value, which is manifested in moral attitudes, has assimilated tolerance as a practical norm of family relations.

Following the example of adults in national self-identification, manifestations of national nature, cultural expression, the preschooler gradually acquires the available skills and abilities, ie identifies the values of the native ethnic environment. The combination of cultural and related language and social competences of a preschool child is of particular importance. In perspective, these competences perform the function of precautionary measures of further inadequate associations regarding the uniqueness of various cultural manifestations. An important indicator of a child's competence is his assimilation of speech culture and communication, the basic rules of language usage in different life situations, expression in one's own vocabulary understanding of world multiculturalism, which depends on the experience gained in the process of joint activities and communication with adults and peers with whom the child identifies himself. Assimilation of universal values, world culture occurs through ethnic culture - the culture of the native blood ethnic group, the culture of the titular nation of country, the culture of people living in one space.

At this stage, an important addition to the development of communicative tolerance are the competencies of the preschooler developed by the educational line "Foreign language" with a variable component. The achievements of a preschool child are determined by learning a foreign language at a level that allows distinguishing the language, to pronounce simple lexical constructions, to know games, children's folklore, etiquette, life, traditions, crafts, national costumes and other cultural events. It should be noted that the insufficient level of communicative and speech competence formation of a preschooler in the future may cause difficulties in intercultural communication.

It has been expected that in the senior preschool age the system of individual features of the child is being in progresses. This action has been determined by intellectual decentralization, when cognitive processes begin to go beyond the experience, accelerates the development of motivational cognitive activity, and forms mechanisms that regulate communication as the basis of any human activity. The child does not simply assigns the information, but by means of communication or other activities, can check it, apply it, and, thus, form certain skills and basic competencies in a particular type of activity.

The logical continuation of the above mentioned competencies formation is possible in the state program for the development of senior preschool children "Sure Start". Its main feature is the reliance on personality-oriented, integrated, activity approaches to the development, education and training of preschoolers, to maximize the opportunities of childhood to form a culture of life in a multicultural environment (Andrietti O., Golubovich O., Dolinna O., 2013, p. 4). Senior preschool age as potentially sensitive to the formation of tolerance does not allow to limit the above three psychological components. However, personal dimension of tolerance should be added.

The basis for the formation of structural components of tolerance in senior preschoolers include the following components: special openness, high susceptibility of the child to social influences, sensitivity to the world of social relations; an intensive development of the ability to identify, empathize and reflect; the ability to understand and take into account the views of others; the development of emotional foresight; the development of arbitrary behavior, as well as various forms of communication with peers and adults. During this period the following mechanisms of tolerant behavior have been formed:

- the mechanisms of personal identification, decentralization, empathy;
- the mechanisms of personality development - the subordination of motives;
- the mechanisms of internal position formation, ie internal mechanisms of moral development - identification, separation, social perception;
- the mechanisms of prosocial behavior, covering the main indicators of tolerant behavior.

Conclusions and prospects for further studying. The above mentioned studies indicate a wide range of innovations in the organization of preschool educational space. Educational innovation involves an interdisciplinary synthesis of sociological, didactic, psychological, acmeological, cultural and other tasks. It reveals the deep application processes of multiculturalism principle to ensure the interaction of methodological techniques that form an innovative educational space through the prism of system-forming, culturological concepts. The multiculturalism principle provides a set of methodological techniques that form an innovative educational space through the prism of system-forming, culturological concepts. The

organizational effect of multiculturalism principle has been focused on the strategies of tolerant intercultural communication.

The analysis of the content of normative and methodological support of Ukrainian preschool education shows that it is emphatically expressed by the integration of information and interaction startup-environments of the educational space of tolerant intercultural communication. The social impact of intercultural communication in the information environment under the action of the multicultural principle determines the acquaintance of the preschooler with the existence of inoculture, a positive perception of the diversity of languages and cultures, understanding of interaction. It is activated in the period of 3-6 years, which is due to the activity of cognitive, emotional and behavioral components in the mechanism of psychological development and is extrapolated in the cultural, linguistic and social competence of the preschool child. The interaction environment enables the formation of new meanings and definitions of tolerance. Therefore, the intercultural communication appears as a personal property of the preschooler and is implemented in practice.

The prospects of the research are to be acquainted with the organizational and pedagogical experience of practical work on the formation of tolerance space in preschool, accumulated by other countries. At the same time, the described innovative approach in the organization of tolerant intercultural communication in the space of Ukrainian preschool can be creatively adapted in the conditions of any modern multicultural society.

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Effect of Pilates and Reformer Exercises on Body Composition

Ahmet Uzun[1] and Bahadır Demir[2]
[1]*Necmettin Erbakan University, Turkey.*
[2]*Serik İlçe MEB, Antalya, Turkey.*

Abstract

The aim of this study is to examine the effect of pilates and reformer exercises on body composition and anthropometric characteristics in sedentary women. Also, It is aimed to determine the regional effects of reformer and pilates in the body and to determine which type of exercise is more effective. 36 sedentary women with an average age of 30.1±0.5 participated in the study as volunteers. All participants are divided into two groups, pilates (n:17) and reformer (n:19). Participants were given 60 minutes of pilates and reformer exercises 2 days a week for 8 weeks. The Ethics Committee approved the study. In the study data, body composition was obtained by measuring waist, buttocks, arm, leg, chest, abdomen and anthropometric parameters in anatomical posture by measuring them with tape measure and recording them in centimetres. In the pretest and finaltest results comparisons in sedentary women who exercised pilates and reformer, differences in body weight, arm, chest, waist thickness, abdomen, hip, thigh, body mass index and waist/hip variables were found to be significant in the groups themselves, while no significant difference was found between the groups ($p>0,05$). However, in the leg variable, the difference in the last test values between the groups was found to be significant ($p=0,03$). As a result, pilates and reformer exercises have positive effects on body composition in women; It has been concluded that reformer is a more effective type of exercise than pilates, and that both types of exercise may vary their levels of impact in different regions of the body.
Keywords: Reformer, Pilates, Anthropometric, Women.

1. Introduction

It is popularly preferred by many people in developed countries in terms of physical exercise, healthy living and providing both a protective and healing effect for many diseases [8, 15, 20, 22, 39]. Many studies have been noted that there is a relationship between physical exercise and physical, psychological and social health [12, 20]. In recent research, it has been reported that the effect of exercise is particularly important in health components, body composition and body mass, volume of skin fold thickness, body mass index (BMI) and anthropometric parameters (waist/hip, etc.) [21, 41, 46]. Body composition studies relate to the ratios of structural components of the human body divided into specific tissues that make up the total body mass (fat and lean body mass) [19, 36]. Recently, it has been observed that the effects of exercise on anthropometric and body composition have focused on pilates and reformer from the types of exercise [4, 13, 18, 30, 39, 44].

Pilates is a body care method can be applied in different forms developed by Joseph H. Pilates 90 years ago, mat pilates (MP) and reformer pilates (RP) as a toolpilates [27]. Pilates is based on six basic principles such as centering, concentration, control, sensitivity, flow and breath. It develops fitness components such as muscle strength and durability, flexibility, balance and cardiorespiratory durability [34]. Pilates is popularly preferred by women especially worldwide with its mat Pilates application because of its application and the easy accessibility of the materials used. Matte pilates exercises include a range of low and high intensity exercises using body weight, providing breath control, providing flexibility, strengthening the body core region and improving body composition [6, 45]. Many results from the research suggest that Pilates causes positive changes in anthropometric, motor variables and body composition, and therefore is heavily applied by obese and overweight sedentary women [4, 12, 13, 18, 32].

The main purpose of reformer studies is to improve body resistance and flexibility, correct posture disorders and provide appropriate respiratory control during all these applications [10, 15]. The main reason reformer's work is popular in a short time is not gravity, but resistance to ropes and springs [43]. During the application, the participant's anatomical structure and muscles work structurally as a whole and increase the endurance and metabolic rate of the participants [31].

Although Reformer is a less severe exercise than other aerobic and dance exercises, it is an important exercise for a healthy body with concentration, control, centering, movement rhythm and sensitivity and breathing technique during practice. Studies have been reported to have positive effects on lean mass and body values [6, 16, 44]. Although the literature says that reformer has an effect on body composition and

body mass index, studies on this subject are not enough [30, 43]

The aim of this study is to investigate the effects of 8 weeks of pilates and reformer exercise programs performed regularly in sedentary women on body composition and anthropometric properties in women. It is also aimed to determine the regional effects of reformer and pilates in the body and to determine which type of exercise is more effective.

2. Method

Participants

36 sedentary women with an average age of 30.1±0.5 participated in the study as volunteers. All participants are divided into two groups, pilates (n:17) and reformer (n:19). Participants were given 60 minutes of pilates and reformer exercises 2 days a week for 8 weeks. All participants were informed about the study protocol and signed a voluntary participation information form. Those with pregnancy, cardiovascular and joint disease are not included in the study. Participants were told during the research period that no special diet and exercise program was implemented and that they should continue their routine lives. Research Necmettin Erbakan University Social and Humanities Research and the Editorial Ethics Board has been approved by the ethics committee no. 2020/23 dated 20.04.2020. ***Research Model;*** Data from the study were obtained in the form of an experimental research model, including preliminary testing and final testing.

Height, Weight, BMI and Body Composition Measurements

Participants were recorded in kilograms using a precalibrated electronic scale (SECA Alpha 882) with a sensitivity of 0.1 kilograms. Lengths were measured in centimeters by measuring the vertex of the head in anatomical posture with a sensitivity of 0.01 centimeters of distance between the base (SECA, Germany). Body mass index (BMI) is calculated with weight/height^2 (kg/m^2) formula (WHO, 2020). In anatomical posture, the body composition was obtained by measuring the anthropometric parameters of the waist (umbilical ity), hip (from the middle of the gluten), the lower part of the base (from the middle of the pocket), the leg (from the thickest part of the quadriceps), the chest (from the chest level under the arm), the abdominal (from the umbilical level alignment) measured by the tape measure.

Pilates and Reformer Workouts

Reformer and matte pilates basic exercise programs were applied in the form of a mat pilates exercise program group for 2 days a week [46] 60 minutes per week for 8 weeks to determine their effects on anthropometric and body composition, while the reformer pilates exercise program was implemented one-to-one. All participants before Pilates and reformer exercises were taught pelvic neutral position and pelvic floor muscle control to pay particular attention to the importance of maintaining body balance during applications and by specialist reformer and pilates professionals for breathing exchange. Pilates and reformer instructors are very important in terms of preventing adverse situations that may ocur [26] Throughout our study, all applications were implemented by professional instructors (licensed, certified and have 16 years of experience) in pilates and reformer. Participants were informed about all movements and instruments to prevent physical and physiological injuries before applications. In the first 10 minutes of exercise programs, the heating protocol was applied with breathing and basic flexibility exercises. At the end of the exercise, participants were cooled with 10 minutes of flexibility exercises. Pilates ball, hoop and elastic bands during matte pilates treatments; reformer and cadillac appliances were used in reformer exercises. The scope and intensity of the training is determined by the karvonen method [47].

Karvonen Fo: HRmax=220-Age / HR=HRmax-HR rest, %60 THR=(0.60 x HRR)+HR rest

In reformer applications, the resistance level is set individually for each participant participating in the program for each exercise. At the end of each movement, participants were taken into account the perceived exertion levels of 0-10 Borg scale [7] to control the level of resistance and gradually increase exercise intensity [24].

Reformer Protokol

Movements	1-2. Week	3-4. Week	5-6. Week	7-8. Week
Double Leg Pres Plantar Fleksiyon Double Leg Pres Dorsifleksiyon Calf Raise Abdominal Crunch Single Leg Kick Triceps Pres Froggie Bridge Standing Abduction Leg Circle Froggie Circle Rhomboid Squeeze Biceps Curl Triceps Extension Seated Row Chest Fly	Volume %50-60 Set number: 2 Motion Repetition:10	Volume %50-60 Setnumber: 2 Motion Repetition:12	Volume %50-60 Setnumber: 2 Motion Repetition:14	Volume %50-60 Setnumber: 2 Motion Repetition:16

Mat Pilates Protokol

Mat Pilates exercises are made of basic piltes movements that include joint movements in the breathing and upright position. Crisscross, Pushup series, Up town, Front back , One leg circle , Swimming prep, Roll-Up, Froggie, Butterfly, Spine Twist, Side Leg Lift, Staggered Legs, Triceps Extension, Heel Squeeze Prone, Prone Hip Extension, Prone Back Extension, Cat Stretch, Side Bend Prep, Spine Stretch, Rolling Like a Ball. As a final exercise, the Hundred, classic Pilates mat exercise was done. In the Hundred movement, the feet are kept in a standard position, away from the ground, while the knees are bent at a 90° angle, the arms are long and just above the abdominal base, with the head and shoulders curled off the ground. At the same time, during all pilates training, subjects were careful to actively use their abs to support their heads during fourand six breath repetitions and move their heads up and down energetically.

3. Results

The physical characteristics of sedentary women (pilates and reformer) participating in the study were also given table 1.

Table 1. *Physical Characteristics of Participants*

Variables	N	Avarage	Min.	Maks.	Ss.
Age	36	30,1±0,5	25,00	35,00	3,015
Height	36	165,4±0,7	158,00	175,00	4,384
Body Weight	36	67,9±2,1	49,20	119,20	13,131
BMI	36	24,7±0,7	17,72	38,92	3,978
Waist/Hip	36	0,79±0,1	,68	,98	,067

Table 2. *Comparing The Physical Characteristics of Participants by Groups*

Değişkenler	Group	N	Avarage	Ss.	t	p
Age (year)	Pilates	17	29,1±0,7	2,997	-2,003	,053
	Reformer	19	31,1±,0,6	2,798		
Height (cm)	Pilates	17	167,3±1,1	4,134	2,580	,014*
	Reformer	19	163,8±0,9	4,008		
Body Weight (kg)	Pilates	17	69,7±4,1	16,922	,746	,461
	Reformer	19	66,4±2	8,680		

BKİ (kg/height²)	Pilates	17	24,8±1,2	5,109	,024	,981
	Reformer	19	24,7±0,6	2,752		
Waist/Hip	Pilates	17	0,78	,045	-,634	,531
	Reformer	19	0,79	,082		

P<0,05

While there was no significant difference in age (year), Body Weight (kg), Body Mass Index (kg/height ²) and Waist/Hip variables (p>0.05), the difference between groups in the length of length (cm) was statistically significant (p=0.014) in comparing the physical characteristics of the participants according to the groups (Table2).

Table 3. *Pretest-final test results comparisons in sedentary women doing pilates exercise*

Variable N=17	Group	Avarage	Ss.	t	p
Weight (kg)	Pretest	69,7±4,1	16,922	3,850	,001**
	Finaltest	68,3±4	16,566		
Arm	Pretest	31,6±1,2	4,950	4,607	,000**
	Finaltest	29,1±1,3	5,453		
Chest	Pretest	96,6±2,9	10,621	2,725	,015*
	Finaltest	94,5±2,5	10,482		
Waist Thickness	Pretest	82,6±2,5	10,481	4,896	,000**
	Finaltest	79,1±2,5	10,425		
Abdomen	Pretest	90,2±3,2	13,295	5,290	,000**
	Finaltest	85,5±3,7	15,219		
Hip	Pretest	105,7±3	12,458	6,408	,000**
	Finaltest	101,7±2,8	11,746		
Basen(hip)	Pretest	101,1±2,4	9,778	4,771	,000**
	Finaltest	97,9±2,5	10,307		
Leg	Pretest	62,7±1,7	7,137	2,537	,022*
	Finaltest	60,9±1,8	7,266		
BKİ	Pretest	24,8±1,2	5,109	3,893	,001**
	Finaltest	24,2±1,2	4,978		
Waist/Hip	Pretest	0,78±0,1	,045	,685	,503
	Finaltest	0,77±0,1	,042		

*P<0,05 **p<0,001

In the preliminary test and final test comparison of sedentary women doing Pilates exercise, there was no significant difference in the Waist/Hip variable (p>0.05), a statistical decrease in body weight, arm, chest, waist thickness, abdomen, basen(hip), waist, hip, leg and body mass index (BMI) variables and the differences between measurements were determined to be significant (*P<0.05) (Table 3).

Table 4. *Pretest-finaltest results comparisons in sedentary women doing reformer exercise*

Variables N=19	Group	Avarage	Ss.	t	p
Weight (kg)	Pretest	66,4±1,9	8,680	3,983	,001**
	Finaltest	63,9±1,6	7,077		
Arm	Pretest	31,2±0,7	3,241	5,914	,000**
	Finaltest	28,2±0,6	2,657		
Chest	Pretest	95 ±1,8	8,027	6,968	,000**
	Finaltest	91,2±1,9	7,161		
Waist Thickness	Pretest	81,8±1,9	8,416	8,351	,000**
	Finaltest	76,6±1,9	8,277		

Abdomen	Pretest	91,6±1,9	8,668	10,45	,019*
	Finaltest	82,7±1,7	8,238		
Hip	Pretest	102,9±1,7	7,194	7,911	,000**
	Finaltest	96,8±1,4	5,678		
Basen(Hip)	Pretest	98,4±1,4	5,874	4,776	,000**
	Finaltest	93,8±1,2	5,230		
Leg	Pretest	60,5±1,3	5,470	8,802	,000**
	Finaltest	56,4±1,1	4,740		
BMI	Pretest	24,7±0,6	2,752	4,030	,001**
	Finaltest	23,8±0,5	2,317		
Waist/Hip	Pretest	0,79±0,2	,082	,750	,463
	Finaltest	0,79±0,2	,085		

*P<0,05 **p<0,001

In the preliminary test and final test comparison of sedentary women doing reformer exercise, there was no significant difference in the Waist/Hip variable (p>0.05), body weight, arm, chest, waist thickness, abdomen, basen(hip), waist, hip, leg and body mass index (BMI) variables were found to be statistically significant and differences between measurements were found to be significant (*P<0.05 **p.001) (Table 4).

Table 5. *Pretest-finaltest results comparisons in women who do Pilates and Reformer exercise*

Variables		**Group**	**N**	**Avarage**	**Ss.**	**t**	**p**
Weight (kg)	Pretest	Pilates	17	69,6±4,1	16,922	,746	,461
		Reformer	19	66,4±2	8,680		
	Finaltest	Pilates	17	68,3±4	16,566	1,043	,304
		Reformer	19	63,9±1,6	7,077		
Arm	Pretest	Pilates	17	31,6±1,2	4,950	,274	,786
		Reformer	19	31,2±0,7	3,241		
	Finaltest	Pilates	17	29,1±1,3	5,453	,645	,523
		Reformer	19	28,2±0,6	2,657		
Chest	Pretest	Pilates	17	96,8±2,6	10,621	,566	,575
		Reformer	19	95±1,8	8,027		
	Finaltest	Pilates	17	94,5±2,5	10,482	1,119	,271
		Reformer	19	91,2±1,6	7,161		
Waist Thickness	Pretest	Pilates	17	82,7±2,5	10,481	,272	,787
		Reformer	19	81,8±1,9	8,416		
	Finaltest	Pilates	17	79,1±2,5	10,425	,913	,368
		Reformer	19	76,2±1,9	8,277		
Abdomen	Pretest	Pilates	17	90,2±3,6	13,295	-,393	,697
		Reformer	19	91,6±2	8,668		
	Finaltest	Pilates	17	85,5±3,7	15,219	,695	,492
		Reformer	19	82,7±1,9	8,238		
Hip	Pretest	Pilates	17	105,7±3	12,458	,840	,407
		Reformer	19	102,9±1,7	7,194		
	Finaltest	Pilates	17	101,1±2,8	11,746	1,766	,086
		Reformer	19	96,4±1,3	5,678		
Basen(hip)	Pretest	Pilates	17	101,1±2,4	9,778	,877	,387
		Reformer	19	98,8±1,4	5,874		
	Finaltest	Pilates	17	97,9±2,5	10,307	1,507	,141
		Reformer	19	93,9±1,2	5,230		
Leg	Pretest	Pilates	17	62,8±1,7	7,137	1,063	,295

		Reformer	19	60,5±1,3	5,470		
	Finaltest	Pilates	17	60,9±1,8	7,266	2,260	0,03*
		Reformer	19	56,3±1,1	4,740		
BKİ	Pretest	Pilates	17	24,8±1,2	5,109	0,24	,981
		Reformer	19	24,7±0,6	2,752		
	Finaltest	Pilates	17	24,3±1,2	4,978	,335	,739
		Reformer	19	23,8±0,5	2,317		
Waist/Hip	Pretest	Pilates	17	0,78±0,1	,045	-,634	,531
		Reformer	19	0,79±0,2	,082		
	Finaltest	Pilates	17	0,77±0,1	,042	-,644	,524
		Reformer	19	0,79±0,2	,085		

*P<0,05

Pilates and Reformer exercise in sedentary women's pretest and final test results comparisons found no significant difference in body weight, arm, chest, waist thickness, abdomen, hip, waist, body mass index and waist/hip variables (p>0.05), while the difference in the final test values between groups in the leg variable was significant(p=0.03)(Table5).

4. Discussion and Conclusion

Recently, participation in physical exercise programs has increased to improve health and improve social relationships [17]. In the literature, pilates and reformer exercises are inconclusive studies involving effects on anthropometric properties such as body weight, body mass index (BMI) and body composition [33, 42] However, the literature has recently focused on studies on "the effects of mat pilates and reformer exercises on body composition in women".Pilates exercise has been reported in research espousing anthropometric variables and field writing, which causes positive changes in body composition [13, 18, 32, 40]. 6 weeks of pilates exercises, which are performed 3 days a week and 60 minutes a day, have an impact on the general health condition and body composition, where their physical fitness increases in sedentary women between the ages of 19 and 53 [1]. Pilates exercises are in the results of a study examining the effects of pilates exercises on anthropometric properties and body composition for sedentary obese women (mean age; 41.20±7.75); it has been found to cause significant reduction between the initial measurements and final measurements of body weight, shoulder, chest, arm, abdomen and hip circumference [14]. Pilates exercises performed for 6 weeks and 2 days a week for sedentary women with an average age of 35.1±9.7 provide significant reductions in body weight and body fat percentages [1], Pilates exercises performed 3 days a week for 8 weeks have been reported to decrease in body fat percentage and fat ratio, as well as significant change in BMI [18]. It has been stated that 12 weeks of pilates exercises in women between the ages of 15-65 can achieve a significant reduction in body weight, waist and hip circumference, body fat percentage, waist/height ratio and BMI values [38]. Unlike the results of this study, there are also studies with different results. Pilates exercises lasting 1 day and 6 months a week have no effect on body composition [42] and pilates exercises have no effect on body composition [37]. In another study, a total of 42 women, including a 28-person experiment and a 14-person control group, participated in 3 days per week mat pilates applications for 10 weeks as a result of the BMI pre-test results of the experimental group reported that the change does not make sense [23]. However, Rayes et al 2019 and Kate and Gibson said that 60 min pilates exercise sessions for 8 weeks have significant effects on body composition in women [18, 25, 35]. It is thought that these differences in Pilates are different in the duration, frequency and intensity of the training and that the characteristics of the participants may not be homogeneous. In the study, it was determined that all values other than the waist/hip ratio changed significantly and similar results were obtained from studies in the literature. Pilates exercises are the most effective areas of core regions. Waist/hip is the body part of the human organism that is fast-lubricated but reacts late in reducing fat metabolism, and since the study consists of a total activity of 16 units, it may be the result of a condition caused by the organism's "adaptation to exercise". The inclusion of longer-term studies for change/development in this regard will have different consequences.

Another type of exercise, in reformer, stated that 16 weeks of reformer exercises have a positive effect

on body composition and anthropometric parameters in women [46]. Reformer exercises, which are performed eight weeks and three days a week, provide significant differences in body weight in women [29], In women over the age of 30, they noted that reformer exercises significantly reduced the body mass index in their effects on their physical fitness [2]. 12 weeks of mat pilates and reformer exercises in women have positive effects on chest circumference, waist circumference, abdominal circumference, hip circumference, right arm circumference, right leg circumference, left leg circumference, body weight and BMI [3]. These studies support our study results. In our study, it was found that there were significant differences in all parameters except waist/hip ratio (body weight, arm, chest, waist thickness, abdomen, hip, hip, hip, leg and BMI). The reason for the change in waist/hip ratio is not meaningful because both parameters (waist and hip) decrease in similar proportions. Therefore, the change in waist/hip ratio is not meaningful. Pilates and reformer exercises are also a little researched. Multiple Sclerosis (MS) patients were divided into 3 different groups in a study, 8 weeks and 2 days a week and reformer exercises were done in 2 groups. At the end of the study, it was determined that patients in both groups outside the control group were on a tendency to improve and that they had significant improvement in central stability, balance and mobility [9]. Mat pilates and reformer exercises 25-50 years of age 58 sedentary (21 people mat group and 20 people reformer) women have been investigated for some physical and functional parameters, both exercise practices have been reported to have made changes to body composition[5]. When the results are examined, pilates and reformer exercise programs that we applied in our study have similar effects on participants' anthropometric and body composition. However, it is observed that the comparison of the regional effects of reformer and pilates in particular is not examined in detail. In addition, when the test results of BMI, abdomen, hip and body weight are examined numerically, it can be said that reformer exercises are more effective than pilates exercises. In our study, it is seen that the most important difference is in the change in leg values. This suggests that reformer leg thinning is more effective than pilates (Table 5). They noted that 20 weeks of pilates exercises provide positive changes in body composition [11] and reduce the body fat ratio, but there is no change in BMI, which is due to the intensity of the exercise and the lack of coverage [28]

As a result of the study, pilates and reformer exercises have positive effects on body composition, BMI and some anthropometric variables in women. When the pretest-finaltest results in the study are examined; It has been concluded that reformer is a more effective type of exercise than pilates. It can also be said that Pilates and reformer exercises have effects that vary physically by different regions in the body, especially reformer exercises are more effective than pilates exercise in leg thinning.

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Personality and Humor Styles of University Students

Serkan Çelik[1]
[1]*Faculty of Tourism, University of Kâtip Çelebi, İzmir, Turkey.*

Abstract

The purpose of this study is to measure the personality traits of the students studying at the Faculty of Sports Sciences at the Aegean University and the Turkish Music Conservatory, and to examine the relationship of personality with their humor styles.

In the study, 5-factor personality inventory was used, which was developed by Somer, Tatar and Korkmaz (2001) and, its short form was validated and found reliable by Tatar (2005). The Humor Styles Scale is a self-assessment scale developed by Martin et al. (2003) and adapted to Turkish by Yerlikaya (2003).

According to the results obtained from the humor styles and the subscale, females' self-enhancing humor style total scores are higher than males ($p < .05$). In addition, aggressive humor style total scores of males were higher than females ($p < .05$). Additionally, while the participant humor style total scores of the students of the faculty of sports sciences were higher than the students studying in the conservatory ($p < .05$), there was no significant difference in total scores of Humor Styles, Self-Enhancing Humor, Self-Destructive Humor according to gender, age, faculty, income status ($p > .05$). When we look at the general scales, no statistically significant relationship was found between the total scores of "Five factor personality scale" and the total scores of "Humor styles scale". These two scales have no effect on each other and they are independent of each other ($p > .05$).

In the future researches, it is suggested to evaluate the humor styles of the students of the other faculties and to investigate the effects of their personality on the humor, in the light of the humor styles and personality traits used by the students of the Faculty of Sports Sciences and State Turkish Music Conservatory.

Keywords: Personality, Humor, Faculty of Sport Sciences, State Turkish Music Conservatory, Communication.

1. Introduction

Personality has been one of the most interesting topics of psychology from past to present. The diversity of personality is a matter of curiosity for scientists. While some people are cowardly, timid, pessimistic, others can be aggressive, warm-blooded, cheerful. There is a wide range of personality traits such as cold-blooded, introverted, lively, cheerful, free, dependent, and moody (Kuru & Baştuğ, 2008). Personality is the whole of relationships that the person establishes with his environment and with himself, which distinguishes him from others (Cüceloğlu, 1998). Personaly can be defined as "relatively permanent features and tendencies that distinguish the individual from others" (Veccohio, 1988), or "a unique and relatively constant pattern behavior, thoughts and emotions exhibited by individuals" (Greenberg, 1999). Personality, in determining the causes of individuals' behavioral and cognitive structures which becomes permanent over time, is the characteristics of the individuals, carrying the traces of their psycological features that come together and showing who the individuals are (Mount et al., 2005). One aspect of personality is influenced by society and is based on the individual's positioning himself in society (Ayaş et al. 2017). In short, personality is defined as the whole of the individual's special and distinctive behaviors (Dalbudak et al. 2020). The five-factor personality model claims that personality consists of five basic dimensions / factors. The model was basically actualized as a result of factor analysis of the adjectives used in daily language, to define the personality structures of individuals. The five-factor personality model is attractive in terms of: integrating a wide range of personality structures, thereby facilitating communication between researchers with different orientations; allowing systematic examination of the relationships between personality traits and providing a general definition by basing its personality on five sub-factors (Girgin, 2007). The five-factor personality model represents the dominant personality structure theory in today's current literature. This model places the five major personality factors at the highest level of the personality hierarchy, which are emotional instability (neuroticism), extraversion, openness to experience, compatibility and responsibility. These factors are thought to cover the entire area of narrower personality traits at the lower level of the hierarchy (McCrae and Costa, 1997).

There is no field that doesn't need communication within social structure and communication is a reflection of humans unique socialization (Gacar et al., 2018). Communication is a skill that all living creatures have. However, the communication style used by every living species differs. The creature who has the broadest communication scale, is human. Communication can be established, sometimes by typing, talking, sometimes with signs, etc. However, people can react differently to the events they experience throughout their lives, while in communication. For instant, they react to some events by getting angry and some events by crying. People's laughing approach to the world is described as a "natural line of defense". The ability to respond to the world by laughing is also explained by humor (Dalbudak & Yaşar, 2020). When we look at the first usage areas of the concept of "humor" in English, we see that four different body fluids are called "humor" (blood, phlegm, black bile and yellow bile) in Ancient Greek culture (Ruch, 1998). Humor has been studied for centuries by many sciences and by many theoretician such as Aristo, Hobbes, Baudelaire, Voltaire, Kant, Schopenhauer, Spenser, Freud, Shaftesbury, Kierkegaard. All theoretician explained humor in his/her own way, but they have not made a single, universal definition of humor. Because, it is very difficult to define humor that varies from person to person and society to society. However, the intersection point of all humor definitions is the act of laughing resulting from humor (Yaşar, 2018). Humor is defined as the "entertainment" containing love and tolerance, which does not make fun of people's flaws and deficiencies and is realized without any benefit (Kuiper & Martin, 1998). It can be said that humor is a very comprehensive concept that people say or do, having fun elements in it, may have aim to make others laugh, is perceived as an entertaining stimulus by others, and uses cognitive and emotional processes while doing these things (Martin, 2007). From a more general perspective, humor can be expressed as all of the situations that mediate humorous laughter and making people laugh (Altınkurt & Yılmaz, 2011; Kara, 2014; Oruç, 2010). Humor is not a one-dimensional personality character and it is not valid in any case. Humor is evaluated as a very comprehensive personality element. The humor styles, which are collected under two main titles as compatible and incompatible humor, also differ within themselves. Of these, the ones "self-improbving humor" and "participatory humor" are compatible humor styles; "Aggressive humor" and "self-destructive humor" constitute incompatible humor styles (Martin et al., 2003). Self-improving humor style; in a way, from a humorous perspective on life, it is the size 0f humor that occurs in individual's mind that includes the tendency to have fun entertained quite often through the conflicts of life ,and maintains a funny perspective even in the troubled and stressful times of life (Hampes, 2006). Participatory humor style; it is a type of compatible humor that realized between people, in order to cheer and comfort other people by using the ability of humor such as joking, telling jokes, telling funny things, making smart tricks (Hampes, 2006; Kazarian & Martin, 2004). Aggressive humor style; it is a humor style that contains hostile behaviors such as mocking, bullying, kidding, humiliation that bothers and stresses the others, and it creates an environment where other people can get into negative affect at the expense of one's own entertainment (Hampes, 2006). Self-destructive humor style; It is a type of unhealthy incompatible humor style that has a low self-perception level. It has an intriguing feature among individuals, it damages self-acceptance, rejects its own self, and wants social acceptance (Kuiper & Martin, 1993).

The word sports originates from Latin, but in the sense that it spreads around the world, sports come from English. Sport which was derived from the Latin word "disportare", has lost its first syllable since the seventeenth century and started to be used as it is today. Sport is the use of relatively complex physical skills of individuals motivated by internal and external factors, or institutionalized competitive activities that require physical effort (Coakley, 1986). In a different definition, sport is optional physical movements which are marked by dominant values and norms (Voigt, 1998). Considering all the definitions of sport, with its pleasure and entertainment elements are being the first place, it can be said that sport is a whole bodily activities that are shaped by individual and social values and sanctions, based on taking pleasure and / or showing performance and, aiming to create and overcome obstacles consciously (Amman and İkizler, 2000). Sports is an important tool in terms of getting the to know the environment and the world by individual. It is thought that the individual who develops himself in the social field together with sports, is also advantageous in terms of psychology (Özdinç, 2005). Among the reasons that push people to do sports is not only the need to act and enjoy individually. The fear of loneliness, with the need to relate to others, pushes human as a social entity to operate in sportive areas (Bauman, 1994). The sport, which also triggers the need to be active, allows people to express their attitudes, likes and values through behavior (Çakmakçı, 2001). In short, sports are important both physically and psychologically in individuals.

The first artistic values generated with the formation of the human are music, dance and instrument instruments (Koçkar, 1990). The structure and functioning of the human body carries elements of rhythm and harmony as in music (İlyasoğlu, 2013). Among the art branches, music is accepted as an art that enables human to express feelings and thoughts by leaving the deepest impact on emotions on the human spirit (Biber Öz, 2001). Uçan (1997) expressed music as; "It is an aesthetic whole that processes and explains emotions, thoughts, designs and impressions with sounds that are combined with a specific purpose and method, according to a certain understanding of beauty." Music supports the student not only in being successful but also in the development of the student more than any other field (Özmenteş, 2005). The place of music education is very important for the individual, to be creative, conscious and act with this awareness in the society in which he is in and lives (Uçan, 1993). Through the music education, the individuals can express themselves, their creativity improves and, their rhythmic abilities and aesthetic feelings arise, as well as cultural accumulation, cognitive thinking and social skills of them develop (Özmenteş, 2005). It is possible to say that the functions of music have individual, social, cultural, economic and educational qualities (Uçan, 1997). While teaching music teachers, they also evaluate all dimensions of education, personality development, and their effects on the development of the individual in social and emotional sense (Çilden, 2001). In short, education is the most obvious tool for developing societies (Yaşar, 2017). According to Aktaş (1999), "dance is a physical and emotional behavior that is the result of an aesthetic and rhythmic creativity created by the community of movements that makes sense so that people can express their own feelings and thoughts and communicate with the society. "According to Aktaş (1999), "Dance, in order people to express their own feelings and thoughts and communicate with the society, is the physical and emotional behaviors of them, as a result of the creativity having aesthetic and rhythmic feature which is created by a group of meaningful movements". Instrument is a device made to produce musical sounds with certain features of shape, usage and timbre (Say, 2001). In short, we can say that music, dance and instrument are effective on the personality development of individuals.

As the concepts of personality and humor affect people deeply, the main purpose of this study is the effort of finding the necessary information with the studies needed to better understand the students of Sports Sciences and Turkish State Music Conservatory. The aim of this study is to measure the personality characteristics of the students, studying in the Faculty of Sports Sciences and the Turkish Music Conservatory at Ege University, and to examine the relationship between the personality and humor styles.

2. Material and Method

In obtaining the data, "Personal Information Form" which was prepared by the researcher regarding the demographic features, and "Humor Styles Scale" were used, and consists of three parts. In the first part, there is a personal information form (age, gender, department, sports branch, income status) of the students.

In the second part, the five-factor personality inventory developed by Tatar (2005) was used to evaluate the personality. This inventory was designed to evaluate five main personality traits. In the inventory, there are the items that questioning the Extraversion factor, the softness factor, the Self-Control factor, the Emotional Inconsistency factor, and the Openness to Development factor. These items are emotional, behavioral, and intellectual characteristics in which the person evaluates himself / herself with expressions as short as possible. Inventory items consist of 85 items with 5-digit items in Likert type. These are; Completely Appropriate (CA), Slightly Appropriate (SA), Unstable (?), Not Very Appropriate (NVA), Not Appropriate (NA).

The Humor Styles Scale used in the third section is a self-assessment scale, which was developed by Martin et al. (2003), and adapted to Turkish by Yerlikaya (2003). It is a 7-point Likert type self-assessment scale consisting of a total of 32 questions. The scale sorts humor into genres by classifying humor styles into four sub-dimensions. And there are four sub-scales in these four dimensions that aim to measure four different types of humor: compatible-positive humor (self-developing and participatory humor) and incompatible-negative humor (self-destructive and aggressive humor). Each sub-dimension consists of 8 items. While scoring the scale, 1-7-9-15-16-17-22-23- 25-29-31, items are scored in the opposite direction. Points between 7 and 56 can be obtained from each sub-dimension. The rising scores in each sub-dimension indicate the frequency of use of that humor style. The items included in sub-dimensions are; Participatory (Social) Humor: 1, 5, 9, 13, 17, 21, 25, 29; Self-Enhancing Humor: 2, 6, 10, 14, 18, 22, 26, 30; Aggressive Humor: 3, 7, 11, 15, 19, 23, 27, 31 and Self-Destructive Humor: 4, 8, 12, 16, 20, 24, 28, 32.

3. Analysis of Data

Demographic Findings

Table 1. *Data distribution by demographic features.*

Group	Frequency	Percentage (%)	Cumulative Percentage (%)
Gender			
Female	88	40.0	40.0
Male	132	60.0	100.0
Total	220	100	
Age			
17 – 19	27	12.3	12.3
20 – 22	93	42.3	54.6
23 – 25	48	21.8	76.4
26 and over	52	23.6	100.0
Total	220	12.3	12.3
Faculty			
Physical Education and Sport Department	112	50.9	50.9
Conservatory	108	49.1	100.0
Total	220	100	
Income Status			
500-1000 tl	97	44.1	44.1
1001-2000 tl	68	30.Eyl	75.0
≥ 2001	55	25.0	100.0
Total	220	100	

From 220 people who participated in the survey;

• 88 (40.0%) are women and 132 (60.0%) are men.

• 28 (6.9%) are between 0 and 19 years old, 345 (84.6%) are between 20 and 23 years old, 21 (5.1%) are between 24 and 29 years old, and 14 (3.4%) are 30 or older age,

• 27 of them (12.3%) are 17-19 years old, 93 (42.3%) are 20-22 years old, 48 (21.8%) are 23-25 years old and 52 (23.6%) are 26 years old or older.

• 112 (50.9%) are at the faculty of sports sciences, 108 (49.1%) are at the conservatory faculty.

• The income status of 97 (44.1%) is between 500-1000 TL, income of 68 (30.9%) is between 1001-2000 TL, and the income of 55 is ⩾2001 TL.

3.1. Five Factor Personality Scale

• 1 to 5 scores can be obtained from each question in the Five Factor Personality Scale. Therefore, the smallest score that can be taken from 85 questions is 85 and the largest score is 425. The lowest score among 220 people is 181 and the highest score is 314. The average of the total scores is 242.9000, the standard deviation is 22.5191 and the skewness is -0.0511.

Table 2. *Summary statistics on five factor personality scale total scores.*

	Minimum	Maksimum	Average	Standard Deviation	Skewness	Cronbach's Alpha
Five Factor Personality Scale	181	314	242.9000	22.5191	-0.0511	0.695

• Cronbach's Alpha value of 5 Factor Personality Scale, which was applied to 220 people and consist of 85 items, was found 0.695.

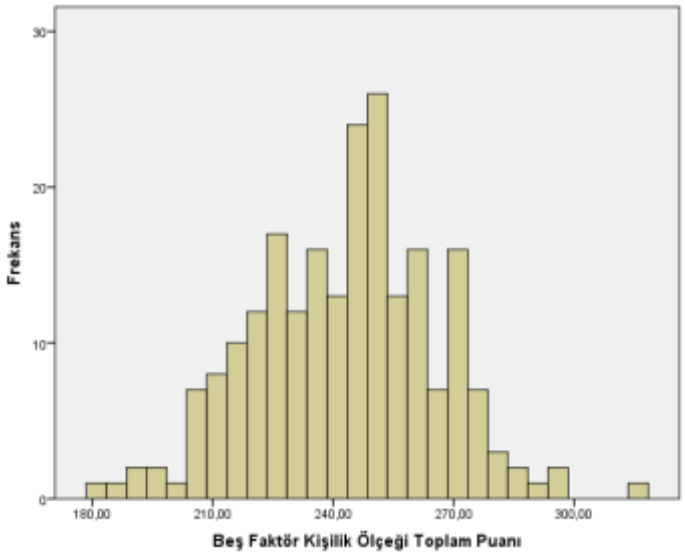

Figure 1. *Histogram related to five factor personality scale total scores.*

• Looking at the histogram of the Five Factor Personality Scale total scores, it can be said that the scores have a normal distribution. However, the Kolmogorov-Smirnov and Shapiro-Wilk tests, which are the normality tests, were used for a definitive result. The p-value of the Kolmogorov-Smirnov test was 0.093, and the p-value of the Shapiro-Wilk test was 0.651. As the p-value is greater than 0.05 in 95% confidence level within two tests, it was concluded that the total scores fit the normal distribution.

3.1.1. Relationships Between Five Factor Personality Scale and Demographic Findings

• In order to use ANOVA for findings containing three or more groups and, independent-test among findings containing two groups, the scale total scores should conform to the normal distribution. In the table below, the changes of the Five Factor Personality Scale total scores according to each demographic finding are given.

Table 3. *The relationship between five factor personality scale and demographic findings.*

Five Factor Personality Scale			
	Average	Std. Deviation	p-value (Sig.)
Gender			
Female	241.2273	20.8258	0.370
Male	244.0152	23.5922	
Age			
17-19	240.0370	25.5997	0.479
20-22	243.5591	25.0523	
23-25	246.3542	19.1483	
26+	240.0192	18.6710	
Faculty			
Physical Education and Sport Department	242.1875	23.0238	0.634
Conservatory	243.6389	22.0663	
Income status			
500-1000 tl	239.0722	22.8893	0.043
1001-2000 tl	240.0722	23.6244	
≥ 2001 tl	249.8364	22.5191	

• There was no statistically significant difference in the 95% confidence level between the five Factor Personality Scale total scores according to gender (p = 0.370), age (p = 0.479) and faculty (0.634) findings.

• Looking at the income level (p = 0.043), there was a significant difference between the total scores. The five-factor personality scale total scores of people with an income level of 2001 TL or more were higher than those with lower income.

3.2. Scale of Humor Styles

• 1 to 7 scores can be obtained from each question in Humor styles scale. Therefore, the smallest score that can be taken from 32 questions is 32 and the largest score is 224. The lowest score among 220 people is 181 and the highest score is 314. The average of the total scores is 242.9000, the standard deviation is 22.5191 and the skewness is -0.0511. In addition, each subscale consists of 8 items. Therefore, the smallest score that can be obtained from the subscales is 8 and the highest score is 56.

Table 4. *Summary statistics on humor styles scale and sub-scales total scores.*

	Minimum	Maximum	Average	Standard Deviation	Skewness	Cronbach's Alpha
Five Factor Personality Scale	94	173	133.1636	14.6736	-0.0299	0.798
Participatory Humor	16	56	37.4136	8.9863	0.0215	0.538
Self Enhancing Humor	17	56	36.7545	7.4198	0.1493	0.511
Aggressive Humor	8	47	27.6045	8.3869	-0.4187	0.676
Self-Destructive Humor	11	50	31.3909	7.4712	-0.2301	0.708

• Cronbach's Alpha value of 5 Factor Personality Scale, which was applied to 220 people and consist of 85 items, was found 0.695. In addition, Cronbach's Alpha value was found 0.538 for participant humor subscale, 0.511 for self-developing humor subscale, 0.676 for aggressive humor subscale, and 0.708 for self-destructive humor subscale.

• Histograms of total scores related to Humor Styles Scale and its subscales are given below. However, the Kolmogorov-Smirnov and Shapiro-Wilk tests, which are the normality tests, were applied for a definitive result. The test results are given in the table below.

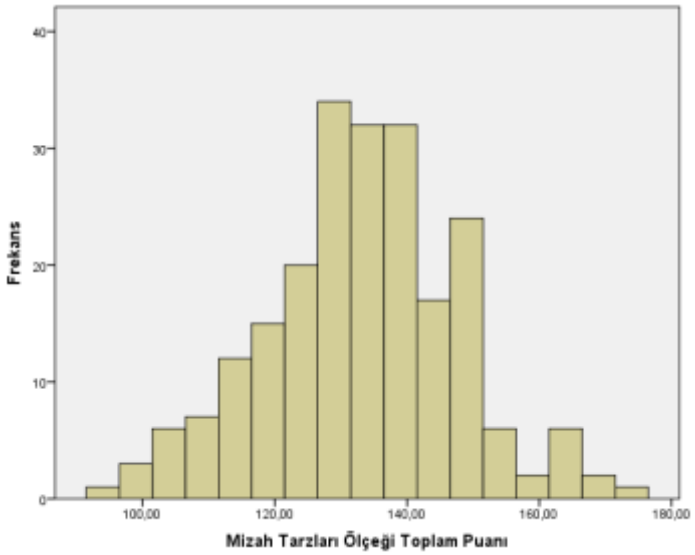

Figure 1. *Histogram of total points related to humor styles scale.*

Table 5. *Relationship between subscale of humor styles and demographic findings.*

	Gender	Age	Faculty	Income Status
Participatory Humor *	0.348	0.650	0.007	0.808
Self Enhancing Humor *	0.022	0.051	0.262	0.071
Aggressive Humor *	0.000	0.390	0.981	0.542
Self-Destructive Humor *	0.060	0.197	0.087	0.730
Humor Styles Scale **	0.121	0.434	0.669	0.517

*Kruskal Wallis **ANOVA ve t-tesi

• The ones shown in red in the table are variables with a statistically significant difference between 95% confidence level. According to the results obtained, females' self-improving humor total scores were higher than males. In addition, aggressive humor total scores of men were higher than women. Besides this, the participant humor total scores of the students of the The Faculty of Physical Education and Sport Department were higher than those of the Faculty of Conservatory.

3.3. Relationship Between Five Factor Personality Scale And Humor Style Scale

• The Pearson Correlation coefficient takes values ranging from -1 to +1. A positive value indicates the same directional relationship between the two variables, and a negative value indicates an inverse relationship between the two variables. As the correlation value gets closer to -1 and +1, the severity of the relationship between them increases. A correlation coefficient of 0 indicates that there is no relationship between the two variables. As you get closer to 0, the severity of the relationship decreases. A correlation coefficient of 0 indicates that there is no relationship between the two variables. As you get closer to 0, the severity of the relationship decreases.

3.3.1. Relationship between Humor Styles Sub-scales

Table 6. *Bilateral pearson correlation coefficient values of the relationship between the subscales of the humor styles scale.*

	Participatory Humor	Self-Enhancing Humor	Aggressive Humor	Self-Destructive Humor
Participatory Humor	1.000	0.351** (0.000)	-0.511** (0.000)	-0.275** (0.000)
Self-Enhancing Humor	0.351** (0.000)	1.000	-0.228** (0.001)	0.018 (0.786)
Aggressive Humor	-0.511** (0.000)	-0.228** (0.001)	1.000	0.373** (0.000)
Self-Destructive Humor	-0.275** (0.000)	0.018 (0.786)	0.373** (0.000)	1.000

** Correlation is significant at the 0.01 level.

• According to the table, there was a positive relationship (0.351) between participant humor styles and self-developing humor styles, while a negative relationship between aggressive humor styles (-0.511) and self-destructive humor styles (-0.275) were statistically significant at the 99% confidence level. In addition, a negative relationship was found between self-developing humor styles and aggressive humor styles (-0.228). No statistically significant relationship was found between self-improving humor styles and self-destructive humor styles (0.018). Finally, a positive correlation was found between self-destructive

humor styles and aggressive humor styles (0.373). To summarize, in the survey participants, humor styles with the good effect have a positive relationship between them and humor styles with bad effect have a positive relationship between them. But good-humor styles (participant, self-developers) and bad-humor styles (aggressive, self-destructive) have a negative relationship.

3.3.2. The Relationship Between Total Scores of Five Factor Personality Scale and Total Scores of Humor Style Scale Total Scores

Table 7. *Relationship between five factor personality scale and humor styles scale.*

	Five Factor Personality Scale	Humor Styles Scale
Five Factor Personality Scale	1.000	-0.022 (0.748)
Humor Styles Scale	-0.022 (0.748)	1.000

• When looking at the general scales, no statistically significant relationship was found between the total scores of "Five factor personality scale" and the "Humor styles scale" total scores. The correlation value is -0.022 and it is very close to zero and p-value = greater than 0.01 at 0.748. These two scales have no effect on each other and are independent of each other.

4. Discussion Results

According to gender, humor styles and its subscale results, females have higher self-improving humor scores than males ($p < .05$). In addition, aggressive humor total scores of males were higher than females ($p < .05$). In total Humor Styles, Self-Enhancing Humor and Self-Destructive Humor do not differ significantly by gender ($p > .05$). Chen and Martin (2007) investigated the relationship between Chinese and Canadian college students' mental health, coping with humor, and humor styles. According to the findings obtained as a result of this research; Canadian male students were observed to use aggressive humor style more than female students. While no gender differences were observed among Canadian students in terms of coping with humor, Chinese male students scored higher than female students. It has been observed that Chinese and Canadian university students use aggressive and participatory humor style more. There was no significant difference in general humor. In his research, Akkaya (2006) found that male students use self-improving humor style more. In the study conducted by Aslan (2006), it was found that gender did not make a significant difference in the study in which the humor styles of the teachers working in secondary education institutions were examined according to their gender. As well as the findings that support our study have been reached, there are also findings that do not support our study. We can say that the reason for the differences in the study we have done is that the students of the conservatory and sports science have the same feeling and thought.

When the results of Humor Styles Scale and its subscale were analyzed, it is seen that there is no significant difference ($p > 0.05$). Özdemir and Recepoğlu (2010), in their study on teachers, did not find any relation between age and seniority variables and humor styles. Akandere et al. (2015) found that there was no difference according to age groups. In the study in which Dalbudak and Yaşar (2020) investigated the sub-factors according to the age groups of visually impaired athletes, it was determined that there was no difference according to participant humor age groups and there was a difference in aggressive humor and self-destructive humor. It was found that there was no significant difference in general humor. We can say that the difference with the work we have done is due to the fact that there are individuals with disabilities. Findings to support our study have been reached. We can say that humor styles and the subscales are not effective on students of different ages.

When examined the scores according to the faculties, the participant humor total scores of the students in the faculty of sports sciences were higher than the students who studied conservatory ($p < .05$). In total humor styles, self-improving humor and self-destructive humor do not differ significantly according to the faculties ($p > .05$). We think that, the reason of the difference of participant humor style of the students studying in the sport sciences than the conservatory students; is due to the fact that they are more social and,

the different perspective of life they have because of their characteristic they gained through the sport. Participatory sense of humor; is a type of compatible humor that takes place in person and includes the ability to use humor (such as joking, telling jokes, telling funny things, smart tricks) to cheer and relax other people (Hampes, 2006; Kazarian & Martin, 2004). As a reason why there is no difference in other sub-dimensions of humor between students studying in sports sciences and conservatory; We can say it's because of the positive effects on their feelings such as anxiety, personality, self-efficacy, positive perspective of life, struggling and coping with stress.

There is no significant difference in humor styles and subscale results according to income status ($p > .05$). In the study of Açıkgöz (2016), when the relationship between socioeconomic level and humor styles and subscale was examined, no statistically significant change was found. In Dinç and Cemaloğlu's (2018) study, there is no statistically significant difference between socioeconomic level, humor styles and subscale. Findings supporting our study have been reached. We can say that humor styles and subscale do not affect income level. Since there are no studies similar to our study, findings to support our study could not be reached.

While there was a positive correlation between the participant humor styles and self-developing humor styles (0.351), a negative relationship between the aggressive humor styles (-0.511) and self-destructive humor styles (-0.275) was found statistically significant at the 99% confidence level. Additionally, a negative relationship was found between self-developing humor styles and aggressive humor styles (-0.228). No statistically significant relationship was found between self-improving humor styles and self-destructive humor styles (0.018). Finally, a positive correlation was found between self-destructive humor styles and aggressive humor styles (0.373). As a summarizing generally, in the surveyed people, good humor styles have a positive relationship among themselves, and bad humor styles have a positive relationship among themselves. But good-humor styles (participant, self-developers) and bad-humor styles (aggressive, self-destructive) have a negative relationship. Positive humor and negative humor are opposite. We can say that the results on the individuals participating in the study are positive. Since there are no studies similar to the study we have done, findings to support our study could not be reached.

No statistically significant relationship was found between the total scores of five-factor personality scale and the the total scores of humor styles scale. These two scales have no effect on each other and are independent of each other ($p > .05$). We can say that personality does not affect humor, it is a very independent feature. Again, since there are no studies similar to the study we have done, findings to support could not be reached.

Eventually, it is suggested for future studies that to evaluate the humor styles and personality traits used by the students of Faculty of Sports Sciences and State Turkish Music Conservatory and to investigate the effects of personality on humor. Additionally, a new research is recommended to evaluate that how humor is used by the students of other faculties and how they are affected by humor and whether their personality is effective on humor.

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The Examination of Occupational Ethical Principles and Psychological Capital Levels of Physical Education Teachers

Ahmet Dinç
Assist. Prof., School of Physical Education and Sport, Iğdır University, Iğdır, Turkey.

Abstract

The aim of this study is to examine the occupational ethics principles and psychological capital levels of physical education teachers. The descriptive method was used in the research. The research population is composed of 31.976 physical education teachers who work in the years 2018-2019 under the Ministry of National Education in schools and vocational schools in 81 provinces in Turkey while the sample is composed of 384 Physical Education Teachers. The positive psychological capital scale developed by Tösten and Özgan (2014) and the occupational ethics scale developed by Özbek (2018) were used to collect the data of the study. The psychological capital scale and the occupational ethics scale are 5-point Likert type scales. Since the data was found to be distributed normally, t-test and ANOVA test were used among parametric tests. In the study, the Pearson Correlation analysis was used to determine the relationship between the dependent and independent variables obtained by the measurement. In the evaluation of the data, the significance level was accepted as $p<0.05$. Considering the findings of the study, it was determined that physical education teachers' positive psychological capital (X=4.49) and competence to comply with occupational ethical principles (X=4.68) were found to be high. When the comparison of the personal descriptive characteristics of the physical education teachers with the positive psychological capital scale (PSCS) total score averages is examined; It was determined that the physical education teachers aged 33 and over, female, married, with postgraduate education level, 11 years and more professional experience while working in metropolitan areas have higher positive psychological capital competencies, however, there was no statistically significant difference between physical education teachers' age, gender, marital status, education level, professional experience period-seniority, and the city they work in and their positive psychological capital adequacy.

Keywords: Occupational ethics, physical education teacher, psychological capital.

1. Introduction

Teaching is defined as "Teaching has been described as a specialized profession that takes over all management and coordination of the state regarding education" by the law numbered 1739 on national education, which was introduced into force in 1973 (MEB, Milli Eğitim Temel Kanunu1739 S.K. md. 43., 1973). Teaching is a profession that plays an important role in the education process and requires expertise (Alkan, 2000). In addition to being a profession that requires expertise, teaching is also a sacred profession. Physical education teaching, on the other hand, is a field of expertise which is a profession and field knowledge and general culture that can apply the curriculum of the physical education lesson, adhering to the principles of Turkish national education, and assigned in school and out-of-school activities (Özbek O. , 2008). There are 18,108,860 students(MEB, 2020)and 31,976 physical education teachers in our country (Dinç & Özbek, 2019) . In order for teachers to provide quality education, the opinion of meeting their psychological needs at a high level has gained importance (Harichandan & Pandya, 2012). In order to get more efficiency from teachers, their psychological capital (self-efficacy, optimism, trust, extroversion, psychological resilience, hope) should be high. In this context, the question of at what level the psychological capital develops of teachers who comply and do not comply with occupational ethics rules (professionalism, responsibility, honesty, respect) constitutes the theme of our study.

Since education takes place with the relationship between two or more people, ethical issues in education will always be on the agenda (Kuçuradi, 2014). Ethics is a philosophical discipline that discusses the principles represented by the ideal human character. As a philosophical discipline, ethics focuses on the reasons why behavior is deemed right or wrong (Aydın, 2016). The Turkish language institution defines ethics as "Ethics is the set of behaviors that people should obey or avoid" (TDK, 2020). The ethics of teaching profession, on the other hand, is "The set of responsibilities, rules and principles to be followed in the relations with students, society and colleagues" (Erdem & Şimşek, 2013). Professions that determine and

apply the principles of occupational ethics give confidence to the people who receive services from them while ensuring professionalization and independence of the profession (Belinova, Bicheva, Kolesova, Khanova, & Khizhnaya, 2017). Teachers should gain the competence to identify and solve problems with their pre-service training. However, the subject of ethics is not sufficiently included in teacher training programs (Boon & Bruce Maxwell, 2016). Physical education teachers make ethical decisions while teaching students the values they should have in school and sports fields (Harrison & Blakemore, 1992). Physical education teachers should act in accordance with occupational ethics (professionalism, responsibility, honesty, respect) to increase the quality of education. The individual is seen as a resource in contemporary thought. Achieving corporate goals will be possible with human resources (Gratton & Ghoshal, 2003). Considering the dimensions that make up human capital, psychological capital is the most important capital of humans and it is expressed in terms of optimism, hope, resilience and self-efficacy (Avey, Tara, & Luthans, 2008). Psychological capital has been defined as hope, self-efficacy, resilience and optimism (Gooty, Gavin, Johnson, & F.D, 2009). According to the definition made by Luthans et al., psychological capital is defined as the positive psychological state of a person's development (Luthans, Youssef, & Avolio, 2007). The fact that teachers directly affect teaching in the field of education has increased the investment and interest in teacher education (Kilimci, 2006). In order for teachers to provide quality education, the opinion of meeting their psychological and social needs at the highest level has gained importance (Harichandan & Pandya, 2012). Teachers' psychology and work ethics are important to achieve goals in the field of education. In this sense, it is important to examine and investigate occupational ethics, which is a set of rules and principles that must be followed in the profession, and psychological capital, which is seen as the most important capital of human beings. The aim of this research is to examine the occupational ethics and psychological capital levels of physical education teachers in terms of various variables.

2. Method

2.1. Participants

In this study, the quantitative research method was used. Quantitative research is based on "realist philosophy" and "positive understanding of science". According to this idea, there is an order in the universe and man can understand and control this order; because the brain and the universe are of the same origin. In quantitative research, the "truth" is concrete facts that we perceive with sense organs. According to the positive understanding of science on which quantitative research is based, knowledge is obtained by experiment and observation (Sönmez & Alacapınar, 2013). The research population is composed of 31.976 physical education teachers who work in the years 2018-2019 under the Ministry of National Education in schools and vocational schools in 81 provinces in Turkey while the sample is composed of 384 (94 women, 290 men) physical education teachers.

2.2. Materials

Positive Psychological Capital Scale

Positive Psychological Capital scale was developed by Tösten and Özgan (2014). Cronbach's alpha coefficient of the scale was calculated as 0.92. It is a 5-point Likert-type scale.

Codes of Occupational Ethics

The occupational ethics scale was developed by Özbek (2018). Cronbach's alpha coefficient of the scale was calculated as 0.91. It is a 5-point Likert-type scale.

2.3. Procedure

SPSS (24.0) program was used to evaluate the research data. Whether the data were normally distributed was determined by the Kolmogorov-Smirnov (K-S) test. Cronbach's alpha internal consistency coefficient of the positive psychological capital scale and the occupational ethics scale and its sub-dimensions were calculated. In order to determine a significant difference between the scale mean score and the independent variables from the obtained data, on the data that fit the normal distribution independent samples t-test and ANOVA analysis were performed. In the study, the Pearson Correlation analysis was used to determine the relationship between the dependent and independent variables obtained by the measurement. In the evaluation of the data, the significance level was accepted as $p<0.05$.

3. Results

Table 1. *Positive psychological capital adequacy levels of physical education teachers*

Positive Psychological Capital Scale (PPCS) and Sub-Dimensions	n	Number of Items	Mean±Sd	Median	Min.-Max.
Self-efficacy	384	4	4.51±0.52	4.75	1.75-5.00
Optimism	384	5	4.24±0.66	4.40	1.40-5.00
Confidence	384	4	4.65±0.45	4.75	2.75-5.00
Extroversion	384	5	4.55±0.49	4.80	2.80-5.00
Psychological Resilience	384	5	4.50±0.51	4.60	3.00-5.00
Hope	384	3	4.53±0.52	4.66	2.67-5.00
PPCS Final Total	384	26	4.49±0.42	4.59	2.96-5.00

According to the data in Table 1, it was determined that physical education teachers got a total of 4.49±0.42 points from the positive psychological capital scale (PPCS) and their positive psychological capital adequacy was very good. The average score they got from PPCS's sub-dimensions were determined as 4.51±0.52 from the self-efficacy sub-dimension, 4.24±0.66 from the Optimism sub-dimension, 4.65±0.45 from the Confidence sub-dimension, 4.55±0.49 from the Extroversion sub-dimension, 4.50±0.51 from the Psychological Resilience sub-dimension, and 14.53±0.52 from the Hope sub-dimension. It was determined that physical education teachers have high self-efficacy, optimism, trust, extroversion, psychological resilience and hope competencies in positive psychological capital.

Table 2. *Level of compliance of physical education teachers to occupational ethics principles*

Occupational Ethics Principles scale (OEPS) and Sub-dimensions	n	Number of Items	Mean±Sd	Median	Min.-Max.
Professionalism	384	14	65.27±5.52	67	42-70
Responsibility	384	8	37.69±3.37	39	12-40
Honesty	384	5	23.46±2.34	25	5-25
Respect	384	5	23.56±2.51	25	5-25
OEPS Final Total	384	32	149.99±12.56	154	80-160

Table 2 shows the levels of physical education teachers' compliance with occupational ethical principles.

According to the data in Table 2, it was determined that physical education teachers got a total score of 149.99±12.56 from the scale of occupational ethics principles (OEPS) and their level of compliance with occupational ethics principles was high. The average score they got from the sub-dimensions of OEPS was determined as 65.27±5.52 from the Professionalism sub-dimension, 37.69±3.37 from the Responsibility sub-dimension, 23.46±2.34 from the Honesty sub-dimension, and 23.56±2.51 from the Respect sub-dimension. It was determined that physical education teachers have high levels of professionalism, responsibility, honesty and respect in complying with occupational ethics principles.

Table 3. *The relationship between physical education teachers' level of compliance with occupational ethics principles and their positive psychological capital adequacy*

Compliance level with Occupational Ethics Principles	N	Positive Psychological Capital Adequacy Level	
OEPS Final Total	384	**r[a]**	0.536
		p	**0.000***

[a] *Pearson's correlation analysis was applied, *p <0.001.*

Table 3 shows the relationship between physical education teachers' level of compliance with occupational ethics principles and their positive psychological capital adequacy. It was determined that there is a moderate positive (r=0.536; p=0.000) significant relationship between physical education teachers' level of compliance with occupational ethics principles and their positive psychological capital adequacy **(p <0.001).**

Table 4. *Comparison of the personal descriptive characteristics of physical education teachers with the positive psychological capital scale and occupational ethics scale total score averages*

Personal Descriptive Characteristics	n	PPCS Total Mean±Sd	OEPS Total Mean±Sd
Age			
24-32 years old	191	4.49±0.43	149.91±13.17
33 years and older	193	4.48±0.41	150.07±11.96
Test value		[a]t=-0.271	[a]t=-0.122
Significance level		p=0.786	p=0.903
Gender			
Male	290	4.51±0.40	149.99±13.21
Female	94	4.42±0.46	150.39±10.39
Test value		[a]t=-1.882	[a]t=0.005
Significance level		p=0.061	p=0.996
Marital status			
Married	215	4.49±0.41	150.25±11.84
Single	169	4.49±0.44	149.66±13.34
Test value		[a]t=0.041	[a]t=-0.450
Significance level		p=0.968	p=0.653
Educational Background			
Bachelor's Degree	328	4.50±0.42	150.48±12.50
Graduate (postgraduate)	56	4.42±0.41	147.10±12.66
Test value		[a]t=-1.313	[a]t=-1.867
Significance level		p=0.190	p=0.063
Duration of occupational experience-seniority			
1-5 years	180	4.49±0.43	150.62±12.24
6-10 years	74	4.52±0.41	149.18±13.60
11 years and above	130	4.47±0.42	149.57±12.44
Test value		[b]F=0.389	[b]F=0.451
Significance level		p=0.678	p=0.637
City they work in			
Large city	202	4.45±0.42	149.28±13.13
Small City	182	4.53±0.41	150.78±11.88
Test value		[a]t=1.643	[a]t=1.163
Significance level		p=0.101	p=0.246

[a]*T test in independent groups,* [b]*ANOVA Analysis of Variance, *p <0.05.*

According to the data in Table 4, when the comparison of physical education teachers' personal descriptive characteristics and positive psychological capital scale total score averages is examined; It was determined that physical education teachers between the ages of 24-32, married, undergraduate, 6-10 years of occupational experience and working in small cities, have higher positive psychological capital competencies, however, there was no statistically significant difference between physical education teachers' age, gender, marital status, education level, occupational experience period-seniority, and the city they work in and their positive psychological capital adequacy ($p > 0.05$).

When the comparison of the personal descriptive characteristics of physical education teachers and the total score averages of the scale of occupational ethics is examined; it was determined that physical education teachers who work in small cities who are 33 years old and over, female, married, undergraduate, have occupational experience-seniority of 1-5 years, have a high level of compliance with occupational ethical principles, however, that there was no statistically significant difference between the physical education teachers' age, gender, marital status, education level, duration of occupational experience-seniority, and the city where they work and their level of compliance with occupational ethics principles ($p > 0.05$).

4. Discussion and Conclusion

Considering the research findings, it was determined that physical education teachers have high self-efficacy, optimism, trust, extroversion, psychological resilience and hope competencies in positive psychological capital. When the literature was examined, it was seen that the psychological capital levels of teachers were found to be high in the studies of Li and He (2011), Boamah and Laschinger (2015), Dinç and Özbek (2019). Akçay (2012), Abbas and Raja (2010) stated in their studies that psychological capital has a direct effect on variables such as productivity, performance, job satisfaction, job stress level and organizational commitment. In this context, it is thought that the high psychological capital of physical education teachers will make a positive contribution to teachers' performance, productivity and job satisfaction. Because variables related to job satisfaction such as performance, productivity, organizational commitment depend on the employees' human capital consisting of education, experience, skills and knowledge, as well as social capital consisting of social relations and connections and their positive psychology, which affects the quality and quantity of their work, constitutes an aspect of their personality and is related to their mentality (Akçay, 2012).

In our study, physical education teachers' psychological capital and occupational ethics principles were examined according to different demographic variables (gender, education, marital status, seniority) and no significant difference was found. While, in their studies, Barut (2017) and Büyükgöze (2014) did not find a significant difference in terms of gender, Çimen (2015) observed that the psychological perceptions of teachers showed a significant difference according to the gender variable. In Özbek's (2003) study, it was observed that physical education teachers' level of compliance with occupational ethics principles showed a significant result only with the gender variable.

Considering the findings of the study, it was determined that physical education teachers have high levels of professionalism, responsibility, honesty and respect in complying with occupational ethics principles. In the studies of Fisher (2013), Ömür and Nartgün (2013), the level of compliance with occupational ethics principles was found to be low. In the studies of Özbek (2003) and Mabagala (2015), which are similar to our study, the level of compliance with occupational ethics principles was found to be high. In the study conducted by İşgüden and Çabuk (2006), they concluded that if the principles of occupational ethics are not followed, unity and order cannot be established among colleagues and professional life is negatively affected.

As a result, it was observed that the levels of psychological capital and occupational ethics compliance of physical education teachers were high. In addition, it was determined that there is a moderately significant positive correlation between physical education teachers' level of compliance with occupational ethics principles and their positive psychological capital adequacy. In-house and online education can be organized for physical education teachers to increase their level of compliance with occupational ethics principles in order to keep their psychological capital capacities high.

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The Effect of Innovative Approach on Performance Management in Soccer Clubs

Ayşe Demir[1*], Kürşad Sertbaş[2], Kenan Sivrikaya[3] and Betül Bayazit[4]
[1]*PhD Student, Kocaeli University, Faculty of Sports Sciences,Turkey.*
[2,4]*PhD, Associate Professor, Kocaeli University, Faculty of Sports Sciences,Turkey.*
[3]*PhD, Associate Professor, Istanbul Aydın University, Faculty of Sports Sciences, Turkey.*
**Corresponding Author*

Abstract
The aim of this research was to uncover the effect of innovative approaches of managers and employees of soccer clubs playing in the Turkish Football Federation's Super League on performance management. The research was a descriptive study employing correlational design. The sample was composed of a total of 155 managers and employees, among whom 9 were females and 146 were males, of soccer clubs playing in Super League: Fenerbahce Sports Club, Galatasaray Sports Club, Beşiktaş Gymnastic Club, Medipol Başakşehir Football Club, Kasımpaşa, BTC Türk Yeni Malatyaspor, Demir Grup Sivasspor, and Hes Kablo Kayserispor. In data analysis, the distribution of demographic characteristics and responses to the questionnaire questions were examined with frequency analysis. Three regression and path analyses, where the sub-scales of the Innovation in Sports Scale were considered independent variables and the sub-scales of the Performance Management Scale were taken as dependent variables, were performed via AMOS software to uncover the effect of innovation on performance management in sports clubs. The relevant analyses were carried out at a 95% confidence interval.
Keywords: Innovation in Sports, Performance Management, Super League.

1. Introduction

Improvements in technology and competitiveness thanks to globalization have mandated the businesses to make innovation to survive [8]. The relevant emphasis is placed on organizational innovation, employees, and creative ideas in businesses thanks to realizing the importance of innovation by businesses and today's society. What is critical is the integration of applications that will increase the performance of businesses with the innovation culture [15]. Such developments have brought innovative approaches and made it important to make more innovations in sports businesses as well as in different sectors.

The concept of innovation has critical importance in terms of ensuring the businesses maintain their' existence in the market where they operate and to effectively achieve their goals and objectives [14]. Innovation, which is closely linked to the words "new" and "novelty," refers to the applications generating some changes and new configurations in the businesses within the conditions that urging reforms at the maximum or minimum level [10]. Innovation in sports, on the other hand, is related to novel methods and planning aimed at obtaining life-oriented and useful results for people [7]. Innovative approaches in sports emerge as an essential element that brings "success, profit, and reputation" to managers and employees, as well as countries and institutions [20].

In the literature, sports innovation is defined as any change, new idea, or novelty in the context of sports. Employing such a perspective on sports innovation means adopting a versatile and interdisciplinary approach to highlight how innovation is created and used in sports, which includes, but is not limited to, the concepts, such as product and service innovation, process innovation, corporate innovation, policy innovation, and social innovation [17].

Sports, which is a part of economic and cultural organizations, has become a focus of spotlights in recent years, making it necessary to re-evaluate the economic and social conditions in this field. Sports has also taken its share from the intense competition in the international arena and the world's becoming a single market [18]. Utilizing innovation methods is only what makes it possible to provide sports training, to develop techniques to ensure the adoption of a specific sports culture, to develop practices for popularizing sports, and to improve sports in terms of performance, health, and management by utilizing innovation methods in sports.

Performance management is defined as a process that provides a proactive closed-loop control system where strategies are applied to all business processes and feedback is received through a performance

measurement system to make appropriate management decisions. This definition does not consider the effects of the external environment but notes the interdependence of the processes and activities carried out by an organization. This definition also considers individuals who direct organizational processes and use feedbacks from performance measurement to provide information [4].

Sports clubs should work on performance measurements in the fields of innovation, diversity, quality, human resources, and service, just like other businesses, and make creative and innovative investments in line with feedback in order to adapt to change and to sustain innovation at the same time.

Therefore, it is not prudent to assert that the effect of innovation on performance management in sports clubs is important. However, there is no study in the literature that has dealt with the impact of innovative approaches of soccer club managers and employees on performance management. Ultimately, this study aimed to investigate the effect of innovative approaches of soccer club managers and employees on performance management with some demographic variables.

2. Method

It was aimed to determine innovative approaches of managers and employees of soccer clubs playing in the Turkish Football Federation's Super League on performance management; therefore, correlational design was employed in this study. The sample was selected using the stratified sampling method.

2.1. Population and Sample

The population of the research was managers and employees of soccer clubs playing in the Turkish Football Federation's Super League in the 2019-2020 season. In the research, the sample was selected using the stratified sampling method. The sample was composed of a total of 155 managers and employees, among whom 5.8% (9) were females and 94.2% (146) were males, of soccer clubs playing in Super League: Fenerbahce Sports Club, Galatasaray Sports Club, Beşiktaş Gymnastic Club, Medipol Başakşehir Football Club, Kasımpaşa, BTC Türk Yeni Malatyaspor, Demir Grup Sivasspor, and Hes Kablo Kayserispor. The data were gathered through face-to-face interviews.

2.2. Data Collection Tools

In the study, the "Innovation in Sports Scale," which was developed by Kanario (2017) and adapted to Turkish by Demir, Sertbaş, and Sivrikaya (2020), was used to assess the innovation perceptions of the participants. Moreover, the "Performance Management Scale," which was developed by Beeri, Uste, and Gadot (2018) and adapted to Turkish by Demir, Sertbaş, and Sivrikaya (2020), was used to determine the effects of such perceptions on performance management.

Innovation in Sports Scale (ISS). The ISS, developed by Kanario (2017) and adapted to Turkish by Demir, Sertbaş, and Sivrikaya (2020), is a 3-factor 5-point Likert-type scale with 30 items. The first 10 items are clustered under the "Sports Innovation in Clubs" sub-scale, the next 10 items are under the "Challenges of Innovation in Sports in Clubs" sub-scale, and the last 10 items generate the "Strategies for Facilitating the Adoption of Sports Innovation in Clubs" sub-scale. The Cronbach's Alpha reliability coefficient was calculated as .92 for the "Sports Innovation in Clubs" sub-scale, .93 for the "Challenges of Sports Innovation in Clubs" sub-scale, and .90 for the "Strategies for Facilitating the Adoption of Sports Innovation in Clubs" sub-scale.

Performance Management Scale (PMS). The PMS, developed by Beeri, Uster, and Gadot (2018) and adapted to Turkish by Demir, Sertbaş, and Sivrikaya (2020), is a 3-factor 5-point Likert-type scale with 24 items. The first 5 items are clustered under the "Strategic Planning" sub-scale, the next 9 items are under the "Monitoring Phase" sub-scale, and the last 10 items generate the "Process of Review and Learning Lessons" sub-scale. The Cronbach's alpha reliability coefficient was calculated as .90 for the "Strategic Planning" sub-scale, .86 for the "Monitoring" sub-scale, and .90 for the "Process of Review and Learning Lessons" sub-scale.

2.3. Data Analysis

In data analysis, the distribution of demographic characteristics and responses to the questionnaire questions were examined by frequency analysis. Three regression and path analyses, where the sub-scales of the ISS were considered independent variables and the sub-scales of the PMS were taken as dependent variables, were performed via AMOS software to uncover the effect of innovation on performance management in sports clubs. The relevant analyses were carried out at a 95% confidence interval.

3. Findings

Demographic Characteristics of the Participants

It was found that the oldest participant was aged 61, while the youngest participant was 20 years old. The mean age was found to be 34.9.

Table 1. *Distribution of the Participants by Gender, Educational Attainment, and Professional Experience*

		n	%
Gender	Female	9	5.8
	Male	146	94.2
	Total	155	100.0
Educational Attainment	High School	47	30.5
	Bachelor	85	55.2
	Master	21	13.6
	Doctorate	1	.6
	Total	154	100.0
Professional Experience	Less than 1 year	26	17.0
	1-4 years	57	37.3
	4-8 years	31	20.3
	More than 8 years	39	25.5
	Total	153	100.0

While 5.8% of the participants were female, 94.2% were male. In terms of educational attainment, 30.5%, of the participants were high school graduates, 55.2% held a bachelor's degree, and only 0.6% held a PhD degree. Finally, 17% of them had less than a year of professional experience, 37.3% had 1-4 years of experience, 20.3% had 4-8 years of experience, and 25.5% served more than 8 years.

Table 2. *Distribution of the Participants' Knowledge on Innovation*

		n	%
Have you heard the concepts of "Innovation, Novelty, Innovative" before?	Yes	133	85.8
	No	22	14.2
	Total	155	100.0
Does your club offer any projects or training related to innovation in sports?	Yes	99	63.9
	No	56	36.1
	Total	155	100.0
How do you evaluate your club's perspective on innovation in sports?	Rather Low	2	1.3
	Low	17	11.2
	Moderate	46	30.3
	High	64	42.1
	Rather High	23	15.1
	Total	152	100.0
How does innovative approach in sports affect your performance?	Not effective at all	2	1.3
	Not effective	11	7.1
	Undecided	28	17.9
	Effective	67	42.9
	Rather effective	48	30.8
	Total	156	100.0

The majority of the participants (85.8%) stated that they had heard the concepts of "Innovation, Novelty, Innovative" before, while 63.9% of them stated that their clubs offered projects or training related to innovation in sports. The participants evaluated their clubs' perceptions of innovation in sports as rather low (1.3%), low (11.2%), moderate (30.3%), high (42.1%), and rather high (15.1%), respectively. In terms of the effect of innovative approach on performance, 1.3% of the participants stated that it was not effective at all, 7.1% stated that it was not effective, 17.9% remained undecided, 42.9 stated that it was effective, and 30.8% stated that it was rather effective.

Three regression and path analyses, where the sub-scales of the ISS were considered independent variables and the sub-scales of the PMS were taken as dependent variables, were performed via AMOS software to uncover the effect of innovation on performance management in sports clubs.

Table 3. *Model Coefficients, Standard Errors, and p Values of the Scales*

			Coefficient	Standardized Coefficient	SE	p
Process of Review and Learning Lessons	<---	Challenges of Innovation in Sports in Clubs	-0.104	-0.080	0.073	0.152
Monitoring	<---	Challenges of Innovation in Sports in Clubs	-0.07	-0.067	0.059	0.235
Strategic Planning	<---	Challenges of Innovation in Sports in Clubs	-0.057	-0.079	0.039	0.149
Process of Review and Learning Lessons	<---	Sports Innovation in Clubs	0.69	0.569	0.093	***
Monitoring	<---	Sports Innovation in Clubs	0.564	0.575	0.075	***
Strategic Planning	<---	Sports Innovation in Clubs	0.433	0.644	0.05	***
Process of Review and Learning Lessons	<---	Strategies for Facilitating the Adoption of Sports Innovation in Clubs	0.243	0.211	0.088	0.006
Monitoring	<---	Strategies for Facilitating the Adoption of Sports Innovation in Clubs	0.186	0.200	0.072	0.009
Strategic Planning	<---	Strategies for Facilitating the Adoption of Sports Innovation in Clubs	0.087	0.136	0.048	0.069

*p<0.05

In terms of the model coefficients and significance levels, it was concluded that the "Challenges of Innovation in Sports in Clubs" sub-scale did not significantly predict performance management (p> 0.05). It was also found that the sub-scales "Sports Innovation in Clubs" and "Strategies for Facilitating the Adoption of Sports Innovation in Clubs" significantly predicted the sub-scales "Process of Review and Learning Lessons," "Monitoring," and "Strategic Planning" (p< 0.05)

While the "Strategies for Facilitating the Adoption of Sports Innovation in Clubs" sub-scale had a weak, positive, and significant effect on all performance management sub-scales (r (process of review and learning lessons) = 0.211; r (monitoring) = 0.200; r (strategic planning) = 0.136) (p <0.051), the "Sports Innovation in Clubs" sub-scale had a moderate, positive, and significant effect on performance management sub-scales (r (process of review and learning lessons) = 0.569; r (monitoring) = 0.575; r (strategic planning) = 0.644), (p < 0.001).

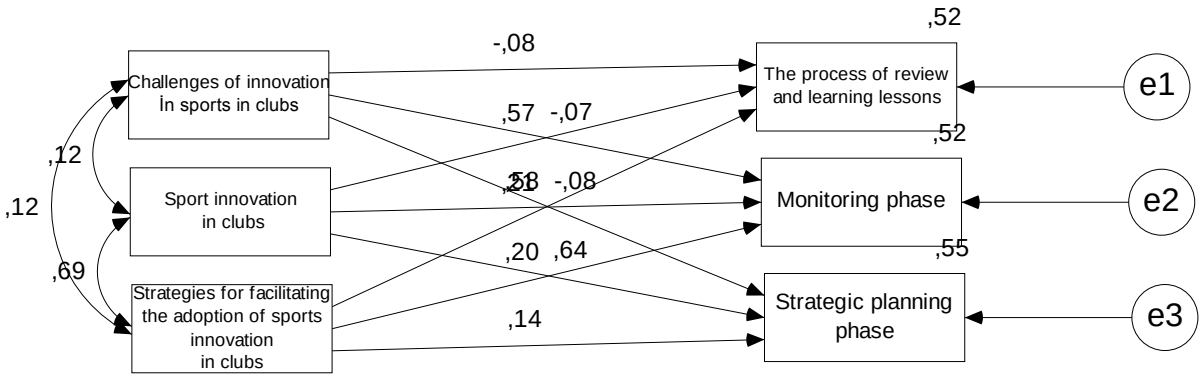

Figure 1. *Path coefficients of the model*

4. Discussion and Conclusion

The performances of managers and employees directly affect the performance levels of sports clubs. One of the factors that affect the performance of managers and employees is innovative approaches. In other words, innovative approaches positively affect the performance of managers and employees, as well as ensuring the survival of businesses by providing a competitive advantage to them [16]. In this study, it was aimed to examine whether the innovative approaches of managers and employees of clubs playing in the Turkish Football Federation's Super League have any effect on performance management together with some demographic variables. For this purpose, the survey method, one of the data collection techniques, was used to gather data from the participating managers and employees. This study, in which the quantitative analysis method was utilized, employed correlational research design. The demographic characteristics of the participants were identified and their responses to the questions in the relevant questionnaires were analyzed via the AMOS program. In the study, where all the statistical analyses were performed at a 95% confidence interval, it was noted that the majority of the participants were male (94.2%).

The majority of the participants (85.8%) were found to have heard the concepts of "innovation, novelty, and innovative" before and to have participated in sports projects or training oriented to these concepts. In a study conducted [6], it was stated that the majority of the sports managers and employees (71.1%) had heard the concepts of "innovation, novelty, and innovative" before. [19] concluded in their study that 59% of the participants had heard the concept of "innovation" before. In a study conducted on students [12], it was determined that the majority of the participants had heard about the concept of "innovation" before.

In another finding in the study, it was determined that the participants adopted a high level of a positive perspective on innovative approaches in sports. In another study, it was found that the participants adopted positive approaches to innovation in sports [6].

Businesses often need innovative approaches for the effective execution of organizational processes to ensure customer satisfaction and to fulfill organizational goals and objectives. Such approaches also have a critical value in increasing the performance of employees [1]. Moreover, innovative approaches ensure soccer clubs that appeal to large masses to meet the demands of their fans and positively affect the performance levels of their employees [6].

Accordingly, the results of the analyses revealed that innovative approaches in sports had a significant effect on performance. In addition, the "Challenges of Innovation in Sports in Clubs" sub-scale was found not to predict performance management, while sub-scales "Sports Innovation in Clubs" and "Strategies for Facilitating the Adoption of Sports Innovation in Clubs" were found to significantly predict the sub-scales "Process of Review and Learning Lessons," "Monitoring," and "Strategic Planning." In a study conducted [11], it was concluded that employees' rational use of creative and innovative approaches, as well as their physical characteristics, played an essential role in their high-level performance and works. In their study, [9] stated that it was necessary to adopt the innovative organizational approaches in sports and to establish a systematic and practical innovation system in order to achieve the desired achievement in sports.

Overall, it was concluded that innovative approaches in sports had an effect on performance. On the other hand, it was determined that the challenges of innovation in sports in clubs did not predict performance.

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Only Swiss Ball Core Exercises Can Improve of Functional Movement Screen Score and Core Muscle Endurance?

Hikmet Vurgun[1] and Çağlar Edis[2]
[1]*Celal Bayar University, Faculty of Sport Science.*
[2]*Trabzon University, Faculty of Sport Science.*

Abstract

It was to examine the development of handball athletes' functional movement screen (FMS) and muscle endurance of the core strength training applied on the unstable ground, which is included in the warm-up sessions for 6 weeks (Week/3 Days) during the season. Method: 16 young handball players who played 5 training sessions and 1 official competition a week participated in the study (age: 18.31±0.47, height: 177±0.96 cm, weight: 64.3±10.42 kg, BMI: 20.28±2.79 kg/m2). Before and after 6 weeks of training, the athletes were tested with FMS tests (deep squat, in-line lunge, hurdle step, rotate stability and trunk stability), and the endurance values of the core area at 4 different angles. Results: According to statistical analysis results, while FMS total scores (p =, 001, Es = 0.61), deep squat (p= .003, Es= 0.50) hurdle step (p= .008, Es= 0.38, p=, 0.20, Es= 0.33), significant improvements after 6 weeks core training (p> 0.05), no statistical significance was found in core endurance with other FMS measurements. Result: Unstable floor static core training, which will be applied only after the warm-up session during the season, can help the athletes to correct and protect their basic movement practices. Core exercises, which will be applied only in the warm-up session, can protect the athletes from injury risks and save the trainers' core training sessions without spending an extra training session, allowing athletes to do different technical-tactical training.
Keyword: Core training, FMS, Handball.

Introduction

The strength levels of the central region muscles (abdomen, back, legs) have a very important place in the performance of athletes. These muscles are located in the center of the body and therefore they ensure the coordination of messages during the transfer of energy to the upper and lower muscle groups (1, 2). The muscles in the central region are divided into two as local and global, and these two muscle groups have different tasks (16). Local muscles are located in the area of the pelvic and spine therefore these muscles are also called deep muscles and they provide stabilization of the body (17). Global muscles are large muscle groups on the surface and are involved in revealing movements that require high power productions (17). The fact that the central region has an appropriate level of strength feature protects the athletes from injury risks (3), revealing a more balanced and more accurate posture structure and helping the athletes to achieve a more successful performance by ensuring inter-muscular coordination in movements. In the studies conducted on this subject, it is known that the central region strength training is a very important form of training in terms of change of direction (4), jumping performance (5), and maintaining postural control after jumping and reducing the risk of injury. Static and dynamic exercises are applied in the application processes of these trainings. It has been stated that statically applied exercises work deep muscle groups (local), that these exercises affect the coordination of nerve messages passing through the spinal cord positively and at the same time can positively affect postural control and kinesthetic difference, while dynamically applied central area strengthening exercises work the muscles on the larger surface and the effect is more powerful. They state that they have effects on performance ability such as speed, change of direction and jumping (6). In addition to performing movements that require performance, athletes must be at an appropriate level at different physical fitness levels in order to reveal the correct movement patterns. In this respect, core training is often applied in terms of improving basic movement patterns. In recent studies on this subject, functional movement screen tests are used to determine the deficiencies of the basic movement practices of athletes, and after this test, corrective exercises and trainings to improve the basic movement practices of the athletes are carried out. Increasing the range of motion, core strength and functional strength trainings are performed respectively among corrective exercises (18, 19, 20). In correlation studies conducted in terms of improving FMS scores and determining the relationship between physical fitness levels and basic movement levels, it is observed that there are positive correlations between

core strength and FMS total scores (21). In order to apply the basic movement patterns correctly, it is very important to have the core force in the center of the mobility and extremity force work in terms of revealing sportive performance. In this respect, the development of the lumbo-pelvic regions of athletes is supported by the swiss ball equipment used in core training (22, 23). Core training with swiss ball provides more positive improvements in neuromuscular functions, strength, proprioception, and balance abilities than conventional core training (24). Therefore, studies performed with swiss ball are generally preferred for both athletic therapy and performance improvement (25, 26, 27, 28). However, there are few studies examining the development of basic movement patterns by evaluating the FMS scores of athletes in the middle of the season and then placing the core trainings applied statically on the unstable ground into the warm-up sessions (29). At this point, this research was carried out in order to reveal the effect of static core training on the swiss ball, which will be applied in the last 6 weeks of the first competition season, on FMS scores and core endurance development.

Method

Participants and Anthropometric Measurement

The 16 young handball players who played 5 training sessions and 1 official competition a week participated in the study. The measurements required determining the height, body mass, body mass index (BMI) and body fat ratio of the athletes were applied some day before the study. In addition, on the same day, information was given about the test batteries to be applied to athletes over the age of 18 and the possible harms and benefits of the tests. In order to get better information about the health and sports background of the athletes, the athletes were surveyed and the volunteer consent forms were signed by the athletes.

The height and body mass of the athletes were measured with a calibrated Seca brand stadiometer without shoes and with shorts - t-shirt clothing. BMI was calculated as "mass (kg) / height (m) 2. Body fat ratio was estimated with Harpender caliper using skinfold measurement and taking data from the right side only. In this measurement, the estimated body density (mm) obtained from the 7-region of the body (mm) including "triceps, subscapular, axilla, chest, suprailiac, abdomen and thigh" was calculated using the equation created for men (11), and the data to be obtained from here were used in Siri equation (12) body fat ratios were determined.

Functional Movement Screen Test

This test is generally used to determine the limitations and asymmetries of basic motion profiles (19, 20). The test consists of 5 basic movement applications. The tests consist of deep squat, hurdle step, in-line lunge, trunk stability and rotary stability. These movements are evaluated with a scoring system between 0 and 3. From these scores; while 0 points are given as the lowest score in case of pain sensation during movement, 3 points are given if the movement is performed perfectly. At the application stage of the athletes' movements; 2 points are given if movement is attempted by using other muscle groups, and 1 point is given if there is loss of balance (right-left or front-back deviations) during movement. In order to determine the asymmetries in the movements, the right and left parts of the body are evaluated separately and separate scores are given for each body part. Two trainers with at least 3 years of practical experience performed the test.

Core Endurance Test

With this test, the central zone isometric strength, of the athletes was measured (15). The test consists of 4 movements in total. The test was performed in the form of bridging the position between the feet and elbows, reaching back and bridging the feet and elbows, and creating a bridge between the right arm-left arm and feet. The test period was started as soon as the athlete felt ready on a flat mat. During the test, the duration of the movement was recorded so that the athletes would not fall below the face level. The test was applied as 2 sets and 3-minute rest periods were used between each set.

Core Strength Training Program

Static core trainings applied to the athletes were performed within the warm-up sessions with the swiss ball immediately after the first week of testing (table 1 show the training exercises). During the 5-day training period, this training application was carried out 3 times a week, every other day. During the warm-

up session, the athletes performed the same dynamic warm-up between 8-10 minutes as a team, with a tempo below 13 on the borg scale. And then, 2-3 minutes dynamic streaching was applied and athletes were recruited to the core training part. After each core training, the athletes applied dynamic stretching movements again and switched to their work in the main circuit.

	Egzersizler		Set&Süre	Dinlenme
Swiss Ball Statik Core Exercises	1	Prone Plank (arm on swiss ball)	First two weeks 3 sets 15 second 3. and 4. Week 3 sets. 30 second 5. and 6. Weeks 3 sets. 45 second	Rest time equal with working time
	2	Right Plank (right arm on swiss ball)		
	3	Left Plank (left arm on swiss ball)		
	4	Supine Plank (lat and head on swiss ball and arm full open lateral side)		
	5	Left arm and right leg straight to the floor on the supine positions (abdominal core region on the swiss ball)		
	6	Lumbar and thoracic region on swiss ball and double leg raises		
	7	Supine position static exercises when quadriceps and abdominals region on swiss ball (hands on cervical region)		

Statistical Analysis

The distribution of data was examined using Shapiro-Wilks normality test. Comparative analysis of the data of the athletes' pre-test and post-test values was evaluated according to their suitability for normal distribution. Since FMS total scores and core endurance tests showed normal distribution, Pair Sample T-test was used for these tests. At the stage of evaluating the FMS tests separately, Wilcoxon signed-rank test and expressed in median values were applied because the data did not comply with the normal distribution. In order to reveal the statistical differences more clearly, the effect sizes of each comparison data were calculated with a mathematical formula (Effect sizes were calculated as follows: $= Z/\sqrt{N}$). Statistical analyzes were performed using PASW Statistics 25 (SPSS Inc, Chicago, IL) software and alpha levels were set at $p < 0.05$.

Results

Table 1. *Descriptive statistics for first and last test data.*

	N	Minimum	Maximum	Mean	Std. Deviation
Prone plank first test (second)	16	80.00	195.00	130.93	40.04
Prone plank last test (second)		72.00	248.00	137.93	50.95
Supine plank first test (second)		25.00	155.00	98.81	31.20
Supine plank last test (second)		30.00	183.00	104.75	46.90
Right plank first test (second)		30.00	138.00	80.93	25.03
Right plank last test (second)		33.00	120.00	73.06	20.10

Left plank first test (second)		40.00	125.00	80.68	22.01
Left plank last test (second)		33.00	135.00	74.31	29.44
FMS total first test (number)		12.00	20.00	16.00	2.309
FMS total last test (number)		13.00	21.00	17.50	2.489

In the statistical analysis of the FMS total scores without table between the pre-test and the post-test, the effect size of the FMS total score was at the level of 0.61. It was determined that in 61% of the total number of the group applying the study, FMS total scores were realized even more correctly after training (t = -4.234, df = 15, p = .001, Es = 0.61). In table 2, it was found statistically that there was no improvement in the 6-week training results of the tests except deep squat and hurdle step among the FMS tests. While there was an improvement in 0.50 of the total number of subjects in the deep squat tests values, it was revealed that the total number of subjects in the hurdle step tests values was 0.33 and 0.38. In table 3, statistical results are revealed that there is no improvement in the endurance of core muscles.

Tablo 2. *Statistical relationship analysis results between first and last tests of FMS tests.*

	Deep Squat	Hurdle Step		In-line Lunge		Shoulder		Rotary Stability		Trunk Stability	Active Straight Leg	
		L	R	L	R	L	R	L	R		L	R
z	-3,017	-2,640	-2,333	-1,249	-1,300	,000	-1,000	-1,667	,000	,000	-,816	-1,000
p	**,003**	**,008**	**,020**	,212	,194	1,000	,317	,096	1,000	1,000	,414	,317
ES	**0,50**	**0,38**	**0,33**	0,18	0,18	0,00	0,14	0,24	0,00	0,00	0,11	0,14

p<0.05*

Table 3. *Statistical analysis of core muscle endurance times between the first and the last test*

Core Muscle Endurance Test (second)	t	df	Sig. (2-tailed)
Prone plank	-.627	15	.540
Supine plank	-.523	15	.609
Right plank	1.041	15	.314
Left plank	.733	15	.475

p<0.05*

Discussion

In this study, it was found that static core training applied to handball athletes on unstable ground for 6 weeks during the competition season had a positive effect on FMS scores, deep squat application and hurdle step applications, but it was found that they did not have an effect on the endurance of the central region muscles. Improving the activation of core muscles in FMS corrective exercises enables the application of functional movement patterns at a more appropriate level (30). In the previous studies in the literature, it was revealed that the subjects had an increase in the star excursion balance test results as a result of pilates training (31). Considering pilates training, it is known that it generally occurs on the strength of the central region muscles. Similarly, it has been stated that the exercises to correct basic movement patterns (joint range of motion, central zone strength and extremity strength) applied for 7 weeks in the off-season provided improvements in the FMS scores of the athletes. It has been stated that with the development of the central region muscles, the FMS scores were improved and the core movement patterns were applied at a more

appropriate level with the development of core training and core strength (20). In this study, improvements were found in FMS total scores, deep squat and hurdle step test results as a result of 6-weeks of static core training with swiss ball, while improvements were not observed in other FMS test scores. Improvements in FMS total, deep squat and hurdle-step movements with only the center region strength training have revealed parallel results with the literature of our research.

In addition to partial area measurements (core muscle strength, lower extremity and upper extremity), the FMS tests test whether the squat, hurdle step and in-line lunges that test both the upper and lower parts at the same time are working properly. However, in the emergence of movement patterns, the central region has an important place in the emergence of every movement. In studies on squat movement, biceps femoris muscle is active at the level of 63-77%, while the external oblique muscles inside the core muscles become active at the level of 58-62% during squat movement (32). In another study, they stated that during the 6-repetations back squat, the erector spine and external oblique muscles actively performed the movement during the squat movement (33). This relation with the biomechanics of the movement is especially stated that the core muscles should work at an appropriate level in order to create a forward tilt to support the direction of the squat movement of the hip during the squat movement and to support the posture of the trunk by moving opposite to the starting position and prevent the trunk from flexing (34). In our research, it is concluded that the development of core muscles leads to a more effective application of the deep squat movement. In our research, although the application of static core training on the unstable floor did not produce a statistically effective result on the development of core muscles, it was found to have a positive effect on deep squat and hurdle step movements, which are dynamic movements. In a study similar to our study, they stated that core training applied on a sedentary surface for 8 weeks improved FMS total and hurdle step scores (35). In addition, it is clearly stated that the development of the external abdominal oblique and other core muscle groups is achieved more with the swiss ball compared to the classical core training (37). A similar development was observed in our study.

Among the 7 movements applied in the FMS test, in-line lunge and rotary stability movements as well as hurdle-step movements are used to measure the strength, balance and coordination ability of the athletes at the same time. Especially in hurdle-step movement, athletes have to stay in balance while applying the movement, and they have to apply the movement with appropriate muscle strength and coordination. The movement applied by staying in balance, on the other hand, should help the muscles of the central region at an appropriate level to maintain the balance by maintaining stable contraction and provide a more accurate movement pattern by ensuring coordination. In this sense, in the literature, Rutherford and Jones (17) mention when the coordination of the stabilizer muscles reaches the upper levels as a result of the Swiss ball exercises. In hurdle step movement, as seen in the literature, swiss ball exercises provide the development of core muscles and increase the coordination of stabilizer and synergist muscles, which explains the positive effect on the hurdle-step test in our study. In our study in terms of the endurance properties of the central region muscles, it was revealed that there was no statistically significant improvement in the strength of the athletes at the end of 6 weeks. In the studies in the literature, it has been revealed that swiss ball core training, which is applied twice a week for 30 minutes for 10 weeks in sedentary people, improved the back muscle endurance of the subjects (36). Similarly, it is that swiss ball exercises applied in sedentary people improves the endurance properties in the muscles of the central region (26). However, the subjects in this study consisted of people who train regularly and are not sedentary. The fact that the result of the study did not appear in a similar way to the literature can be thought to be due to the fact that the subjects are actively engaged in performance sports and the number of subjects.

Result

Especially during the season, the core exercises on the unstable ground, which will be applied to the athletes immediately after the warm-up sessions, ensure that the basic movement practices of the athletes are more positive. Considering FMS corrective exercises, joint range of motion, core muscles activation and extremity strength exercises will take a long time, so only core training will help athletes reveal their basic movement patterns more accurately. In addition, the fact that athletes do not work on other physical fitness levels with only core exercises can eliminate the loss of time during the competition season and more technical-tactical training can be provided.

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Investigation of Self-Competence and Anxiety Levels in the 2019-2020 Season Bursaspor Infrastructure Football Players

Selçuk Erdoğan[1] and Fatma İlke Kerkez[2]
[1]*Muğla Sıtkı Koçman University, Graduate School of Medical Sciences, Muğla.*
[2]*Faculty Of Sport Sciences, Faculty Of Sport Sciences, Muğla.*
**Corresponding author*

Abstract

The aim of the study is to investigate the self-efficacy and anxiety levels of the 2019-2020 Season Bursaspor Football Academy Players (U13, U14, U15, U16, U17, U19). The sample of the study is within 146 football players (average age = 15.56 ± 1.4 years) for Bursaspor Football Academy Players in 2019-2020 season. Data is collected with descriptive information form, Self-Efficacy Scale and State-Trait Anxiety Inventory (STAI). The self-efficacy average of the footballers is 36.5 ± 4.7 and there is no statistically significant difference in the self-efficacy score according to the player positions (x2 = 1,531; sd = 3; p> .0,05). The state anxiety averages of footballers are 43.2 ± 7.5 and their mean anxiety level is 42.8 ± 6.8 and there is no statistically significant difference according to the positions (p> 0.05). A negative relationship was determined between self-efficacy score and state anxiety score and trait anxiety score at p <.05 level. A statistically significant positive relationship was determined between the state anxiety score and the trait anxiety score at the level of p <.05. 21.2% of football players declared that they think of good events to deal with when they feel anxious and 17.1% will try to calm down. It is up to many factors that the players playing in the academy level can be successfully promoted to the Professional Team and the success is permanent. Therefore, it is an issue that needs to be examined in many ways. Regular follow-up of performance determinants such as self-efficacy and anxiety as well as following the physical characteristics of athletes such as height, weight and football-specific technical skills will provide coaches with reference.

Keywords: Football, Academy, Self-efficacy, Anxiety.

1. Introduction

According to Turkish Language Society dictionary, the word "infrastructure" is defined as "the whole installation that is required for a place or a building such as roads, sewage, water and electricity" or as "the knowledge and experience individuals acquire." When it comes to football infrastructure, it is meant the system in which footballer candidates with high potential are selected and trained in order to ensure a systematic and regular transition of players to professional football teams. The infrastructures of football clubs are accepted as an important factor in training successful players since the chance of professional success of the players trained in clubs having modern and well-equipped facilities is higher (Araújo et.al 2014).

Marins and Paoli (2010) have determined four main components for a club infrastructure; (1) Physical opportunities, main training facility, auxiliary training facilities, administrative spaces, support departments and recreation areas, (2) Opportunities of medical, nutritional and physiotherapy facilities, (3) human resources, trainers and clinic / administrative staff, (4) Logistics, access to training centers and distance from important places such as stadium or airport (NARR: Araújo et.al 2014).

Athletes going through trainings and playing in competitions in young age groups take place in the 1st team depending on their skills and potentials. Another method is to hire and sell athletes to other teams in order them to gain more experience (Çevik and Onağ, 2019).

It is stated that football infrastructure, which requires a long process and a sizeable investment, is not ideal in Turkey due to short term achievement goals, but it is codified in Europe (Altunkılıç, 2019). Sunay and Kaya (2018) indicated that one of the reasons of that Turkey was not able to participate in the World Cup 2006, 2010, 2014, 2018 and European championships 2004 and 2012 at the level of national teams was infrastructure deficiencies. Contrary to this suggestion, Aslan et.al (2015) stated that teams in Turkey 1st League constituted approximately 25% of their teams from the footballers who they trained in their infrastructure. They added that the main problem was not to train players in infrastructures, but these

players did not have enough chance to play in A teams when the number of the players trained in infrastructures and the rates of the placement of these players in teams are examined.

Children who have certain ability in football infrastructure and are considered open for improvement are subjected to football-specific skill training and technical training, and their test results are recorded constantly. According to Bayraktar (2017), clubs having a voice in the world about player improvement suggest that field training is not enough to train a good player, players who will have to manage a serious career in and out the pitch need to have different trainings, that is to say such clubs give importance to focusing on holistic trainings of players (NARR: Çevik and Onağ, 2019). Holistic improvement includes also the skill learning, technical performance and psychological skills of an athlete. Considering that performance is a "technique + decision making" skill, starting from skill learning level to elite match environment, one of the important factors that can affect the success of an athlete is the perception of self-efficacy and the other is the level of anxiety. Self-efficacy is the judgment of an individual about his/her own efficacy related to producing certain results. Bandura (1986, 1997), who has leaded defining of self-efficacy concept, defines the belief of self-efficacy as the belief of an individual related to performing the actions given, choosing the appropriate way of behavior, taking action and putting in required effort. Self-efficacy beliefs are the indicators of the effort that individuals will put in for an activity and their resistance against difficulties. Individuals having a high level of self-efficacy have a more positive point of view to difficult work and activities, and they approach problems more calmly (Bandura, 1997). Roberts et.al (1981) state that the young having a high level of self-efficacy can choose sports activities in which they can show these abilities. It has been found that individuals having a higher level of self-efficacy make more effort in the presence of obstacles and when they fail, and they are more abiding, but those having less self-efficacy make less effort (Wood and Bandura, 1989; Bandura, 1997). The positive relationships between self-efficacy and effort, and between perseverance and performance have been consistently recorded in a great variety of contexts, including sports (Bandura, 1986, 1997; Feltz, 1988; Schunk, 1995; Feltz and Chase, 1998; Moritz et.al, 2000; Altundağ et al. 2019;). As it can be understood from here, it is important for the young in football infrastructure to have a high level of self-efficacy perception in terms of their football performances.

Anxiety is defined by Spielberger (1972) as unpleasant emotional and observable reactions such as sadness, perception and tension that are generated by the situations creating stress. While state anxiety is a temporary emotional state characterized by the emotions of subjective tension and fear, trait anxiety indicates the anxiety tendency individuals relatively have, and it is the state of intensifying and gaining continuity of state anxiety (Yıldız et.al, 2019). It is stated that anxiety decreases football player's sportive performances by affecting their adaptabilities, attention and concentration (Koç, 2004; Aka et al. 2019) as well as decreasing their physical endurance parameters such as strength, velocity and endurance (Aktuğ et al. 2018; Aka and Altundağ, 2020). Knowing the self-efficacy perception and state – trait anxiety levels of talented athletes who are selected among many enthusiasts and started to train in the infrastructure can be a guide for the trainers to turn the experiences gained in the infrastructure into positive. This study was conducted to investigate the self-efficacy perceptions and state-trait anxiety levels of the football player in U13 Infrastructure Team in the 2019-2020 season.

2. Method

2.1. Participants

The study is a descriptive research in cross sectional survey model. Descriptive researches are conducted to describe events and states in detail by answering the questions of 'what' and 'how' systematically (Başol, 2008). **Sample:** 146 football players in Bursaspor infrastructure in the 2019-2020 season participated in the study voluntarily. Descriptive information of the players is presented in Table 1.

***Table 1**: Descriptive information of the players*

	Minimum	Maximum	Average	Ss
Age (year)	14	19	15,56	1,4
Height (cm)	1,43	1,93	1,71	0,10
Weight (kg)	31,0	89,0	62,06	11,25
BMI	15,16	25,95	20,87	2,06
			%	**n**

BMI-Group	Underweight	2,1	3
	Healty	93,2	136
	Overweight	4,8	7
Who will be the happiest if you become a good football player?	Me	46,6	68
	My family	21,2	31
	My father	11,6	17
	My mother	5,5	8
	No answer	15,1	22
To whom would you feel most responsible if you fail in the match?	To me	51,4	75
	To my trainer	24,7	36
	To my team mates	5,5	8
	To my father	2,1	3
	No answer	16,4	24
The sport you do other than football	Basketball	11,6	17
	Table tennis	2,7	4
	Orienteering	2,1	3
	Swimming	1,4	2
	Fitness	,7	1
	None	81,5	119
	Total	100	146

2.2. Materials

Data collection tools

Questions including descriptive information (9 items), Self Efficacy Scale and State-Trait Anxiety Inventory (STAI) were used as data collection tools.

Self Efficacy Scale

The scale, which was developed by Riggs, Warka, Babasa, Betancourt and Hooker (1994) to measure individuals' belief in their own capacities, was adapted into Turkish by Öcel (2002). The scale includes 10 items (e.g. "I'm sure of my own abilities as an athlete"). The subjects evaluate how much they agree with the statements in the items on a 5-point scale (1=Strongly disagree, 5= Strongly agree), and a self-efficacy score was obtained by adding up the numerical values marked for the items. There are negative items scored reversely in the scale (2, 3, 4, 6, 8 and 10). The lowest score that can be obtained from the scale is 10, and the highest is 50. The internal consistency coefficient of the scale was calculated as .61.

State-Trait Anxiety Inventory (STAI)

It was developed by Spielberger et. al (1970). This is a psychological inventory including 40 questions on the base of self-report, and it is based on 4-point Likert scale. The adaptation in to Turkish and validity and reliability study of the State-Trait Anxiety Inventory was carried out by Öner and Le Compte (1983). The inventory can be practiced only on individuals over 14. The state anxiety subscale (20 items) determines what an individual feel a certain moment and under certain circumstances, and trait anxiety subscale (20 items) determines what an individual feel independently from the circumstances and conditions the individual is in. There are "direct" and "reversed" statements in the subscales (in State Anxiety Scale; the 1st, 2nd, 5th, 8th, 10th, 11th, 15th, 16th, 19th and 20th; in Trait Anxiety Scale; 21st, 26th, 27th, 30th, 33rd, 36th and 39th items are reversed). Total score obtained from both scales differs in the range of 20 and 80. High score indicates a high anxiety level, and low score a low anxiety level. A special education is not required to carry out the test.

Statistical Analysis

Descriptive statistics was used for data analysis, and Kolmogorov-Smirnov test, Kruskal Wallis-H Test and Spearman Rank-Difference Correlation Analysis for the test of normality

4. Results

In this chapter, there are the anxiety and self-efficacy levels' findings of the football players of Bursaspor Infrastructure Teams in the 2019-2020 season in addition to some of their descriptive information.

Self-efficacy level averages of the footballers and the statistics of their state-trait anxiety levels are presented in Table 2.

Table 2: *Descriptive Statistics.*

	Goalkeeper(n=17)	**Defender**(n=41)	**Forward**(n=33)	**Midfielder** (n=55)	**Total** (n=146)		
					Min	**Max**	**Avg (Ss)**
Self-efficacy Score	37,17±2,8	36,92±4,7	36,33±4,5	36,18±5,4	24,00	48,00	36,5±4,7
State Anxiety Score	42,94±7,1	43,95±8,5	42,54±7,3	43,30±7,0	30,00	65,00	43,2±7,5
Trait Anxiety Score	43,23±6,8	43,43±7,0	41,78±6,2	42,98±7,2	30,00	67,00	42,8±6,8

Kruskal Wallis-H Test results revealed that, in terms of positions, the differences in self-efficacy scores (x2=1,531; sd=3; p>.0,05), state anxiety scores (x2=,634; sd=3; p>.0,05) and trait anxiety scores (x2=,371; sd=3; p>.0,05) were not statistically significant.

The results of the Spearman Rank-Difference Correlation Analysis, which was practiced to determine the relationship between the self-efficacy level and anxiety level of the footballers, are presented in Table 3. As can be understood from Table 3, while a statistically significant positive relationship was found between state anxiety score and trait anxiety score at the level of p<.05, a statistically significant negative relationship was detected between self-efficacy score and state anxiety score and trait anxiety score at the level of p<.05.

Table 3: *Correlation values of the variables*

Variable	1	2	3
1-State Anxiety Score	1		
2-Trait Anxiety Score	,672**	1	
3-Self-Efficacy Score	-,225**	-,436**	1
**p<0,01			

Dealing ways of the footballers when they feel anxious are presented in Table 4.

Table 4: *Dealing ways of the footballers when they feel anxious*

Dealing ways with anxiety	**% (n)**
No answer	28,8 (42)
Think about good events	21,2 (31)
Try to calm down	17,1 (25)
Listen to music	8,2 (12)
Press the issue	4,1 (6)
Talk to my friends	3,4 (5)
Talk to my family	3,4 (5)
Stand alone	2,7 (4)
Pray	2,7 (4)
Take deep breaths	2,7 (4)
Watch TV series	1,4 (2)
Do not feel anxiety	0,7 (1)
Smile	0,7 (1)

Spend time with my mother	0,7 (1)
Apologize	0,7 (1)
Defecate	0,7 (1)
Dribble	0,7 (1)
Total	100 (146)

5. Discussion and Conclusion

Within the scope of the study, the self-efficacy and anxiety levels of the players of Bursaspor Infrastructure in the 2019-2020 Season were examined. Self-efficacy score average was determined as 36,5±4,7; State Anxiety Score average as 43,2±7,5 and Trait Anxiety Score average as 42,8±6,8. In terms of positions, the differences in self-efficacy scores (x2=1,531; sd=3; p>.0,05), state anxiety scores (x2=,634; sd=3; p>.0,05) and trait anxiety scores (x2=,371; sd=3; p>.0,05) were not statistically significant. State Anxiety Score ranging between 30,00 and 65,00 and Trait Anxiety Score ranging between 30,00 and 67,00 reveals that footballers had an optimum individual anxiety levels. While a statistically significant positive relationship was found between state anxiety score and trait anxiety score at the level of p<.05, a statistically significant negative relationship was detected between self-efficacy score and state anxiety score and trait anxiety score at the level of p<.05.

Çetinoğlu (2016) searched self-efficacy in football players, and it is stated that self-efficacy levels of amateur players in terms of their playing periods and income state did not differ, and self-efficacy had a negative relation with venturous aggression. In the stated study, the self-efficacy level of the amateur players was recorded as 31.23 ±3.7. This value is lower than the one found in our study (36,5±4,7).

In the study conducted by Tezcan Kardaş (2018), it was stated that state anxiety levels of the infrastructure footballers between the ages of 13-16 during competition period did not differ in terms of the variables of age, family, income state and the person felt responsible before the competition, but there was a difference only in terms of the person felt responsible after the competition. It was also recorded that the responsibility that the footballers felt towards their families was higher in the cases of success or failure after the competition. In our study, state-trait anxiety level did not differ in terms of the person felt responsibility after the competition (p>0,05). This difference could arise from that the data was collected during the competition period in the study mentioned above. Doğan et.al (2004) noted that 30% of B and C young team players in Bursaspor Football Club Youth Team failed since they were anxious about the critics they would get from their trainers after the match, and noted that goalkeepers and defenders were the most anxious in term of position. In our study, self-efficacy score, state anxiety score and trait anxiety score did not differ at statistically significant level in terms of positions (midfielder, defender, forward and goalkeeper).

The successful promotion of football players in the infrastructure to the 1st team and a permanent success depends on many factors. Thus, this is an issue required to be studied in many ways. It may not be adequate to measure the physical characteristics such as height and weight or technical skills special to football. In this study, self-efficacy and anxiety levels of the footballers playing in infrastructure have been investigated. The limitations of the study were that the sample size was small and the study was conducted in cross sectional model. Longitudinal studies with more samples can provide trainers more data

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The Effects of Sport Massage Applied after Acute Whole Body Vibration Intervention on Balance and Jump Performances

Özgür Özdemir[1*], Neşe Toktaş[2], Nihat Ayçeman[3] and Süreyya C. Karakaş [4]
[1,2,3] Akdeniz University, Faculty of Sport Sciences, Campus, Antalya, Turkey.
[4]Anatolian High School of Natural Sciences, Antalya, Turkey.
**Corresponding Author*

Abstract

Acute whole body vibration interventions (AWBV) have been a focus in the literature and field applications, particularly in the field of health and sports sciences, and their effects on performance and fitness components still have been discussed. The aim of this study was to investigate the effects of sports massage and passive resting applications for recovery following acute whole body vibration loads on static-dynamic balance and vertical jump performances. A total of 15 active individuals (22.8 ± 0.8 years) performed 3 sets of calf raise and squat exercises in the range of 30-50 Hz (± 4 mm) on the vibration platform. Lower extremity sports massage (SM) was applied to the participants for 20 minutes immediately after the vibration excercises. Measurements were taken at three time points as follows; before the vibration, after the vibration and after SM or PR application. The same participants performed passive resting (PR) instead of SM with the same loading and measuremetns protocol after a week. According to the findings, there is a significant difference in the dynamic two leg balance performance between pre and post AWBV measurements ($p < 0.05$). There is a statistically significant difference between static two-leg balance and static right-leg balance values before and after SM application ($p < 0.05$). In addition, statistically significant differences are determined between the measurements before AWBV and at the end of PR ($p < 0.05$). No statistically significant difference is noted among all vertical jump measurements in both applications ($p > 0.05$). In this study, AWBV improved dynamic two leg balance, while AWBV and PR improved dynamic left leg balance performance. In addition, SM application after AWBV positively improved static two legs and right leg balance performances. As a result, vibration interventions can contribute to dynamic balance positively in recreational sports, and recovery massage can positively affect the static balance.

Keywords: Whole-body vibration, Sports massage, Balance, Vertical jump.

1. Introduction

Balance and proprioception are skills involved in the processes of perception, transmission and response to a stimulus in the neuromuscular system concerning the sense of body positon in the space (1,2). Both terms are strongly related to postural control, joint kinesthesia, sense of position and muscle reaction time through visual, vestibular and somatosensory receptors. Through the optimal processing in the system of postural control and neuromuscular structure, postural sway decreases and the position of standing is ensured while impaired posture and balance are tried to be corrected constantly in the background (3,4). Impairments in posture and balance affect performance negatively, decrease movement efficiency and increase the risk of injury.

Vibration is defined as the mechanical oscillations occuring through regular or irregular periodical motions of an object (5,6). Vibration interventions are applied to any particular muscle groups via specific devices. Furthermore, there are other platforms creating sinusoidal waves and transmitting them to the whole body starting from the feet (7). Signals, which result from the vibrations following the mechanical ascillations, are transmitted to tendons and then activate alpha motor neurons. This sequence leads to muscle contraction, and this process is defined as "tonic vibration reflex (TRV)". These contractions increase gradually and last till the end of vibrations (8,9). Vibration practices are suggested to enable the activation of unused motor units; furthermore, they increase neurotransmitter release through mechanoreceptors and ease the neuromuscular signal transduction (5). Recently, whole body vibration interventions are widely discussed as mechanical ergogenic aids in the literature (10).

Several studies have presented acute and chronic effects of the load (training and exercise loads) on motoric features (fitness components), physical fitness and hormonal systems. Positive results and developments in coordination (e.g., balance, agility) and flexibility through sensory and neuromuscular

effects have been reported in the relevant literature. Studies examining chronic effects of whole body vibration interventions lasting between 2 and 24 weeks present supporting results of improvements in strength, power, speed and balance (11,12,13,14). Similarly, positive acute effects in performance parameters like jump height, isometric strength and balance are suggested as a result of vibration interventions. Moreover, acute improvements in neural excitability, neuromuscular response and hormonal release have also been stated (10). However, there are other studies pointing out no acute or chronic improvements, even considerable deteriorations in performance on the contrary. Different loading frequencies and intensities can be suggested as the underlying reasons of these contradictory findings (9).

Different techniques and tools are used for an effective recovery after exercise such as sport massage. For several thousand years, massage have been used for improvements in physical health and athletic performance. The primary (acute) and secondary (chronic) effects of massage are strongly related to physiological and mental improvements (15). The direct and/or indirect effects of massage therapy on skin, skeletal , muscular, nervous, circulatory, urinary and hormonal systems are widely known (16). Increases in skin and muscle temperature, blood and lymphatic circulation and parasympathetic activities are potential effects of massage. Massage is also believed to stimulate sensory receptors and to reduce neuromuscular excitability by changes in the Hoffman reflex (H-reflex) amplitude. Thus, it decreases muscle tension, stiffness and fatigue. Effects of massage on joint range of motion and mental fatigue are also known in the literature (15,17,18).

Effects of sport massage interventions on extreme fatigue and exhaustion in several sports have been investigated in the relevant literature. In addition, sport massage is widely used in delayed onset muscle soreness (DOMS) experiences and exhaustion after sportive activities for a better recovery (19,20,21). However, the effects of sport massage on recovery is stated to known less and/or partially. Potential benefits for recovery after combined training loads are stated. There might be the mentioned discussions, yet sport massage is widely used among competitive athletes for a better recovery process (22, 23). Thus, there is an obvious need for further research considering the gap in the relevant literature.

The purpose of the present study is to investigate static- dinamic kinesthetic balance and vertical jump performances of sedantary individuals to whom sport massage is applied for recovery after acute whole body vibration intervention.

2. Method

2.1. Participants

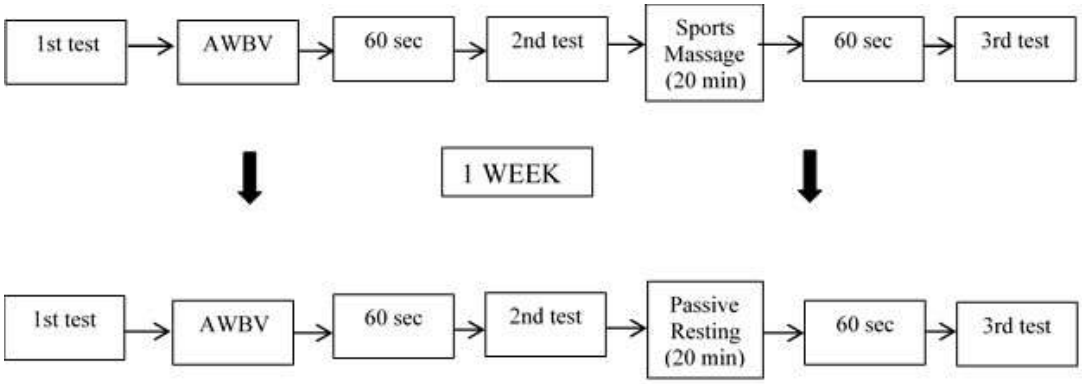
Twenty-five individuals expressed their voluntary participation to the study. However, a total of 15 individuals (age: 22,8±0,8 years; height: 181,4±7,3 cm; body mass: 77,7±12 kg) participated in the current study considering the attendence to each measurement, health issues and ACSM (American College of Sports Medicine) risk factor (24,25). Informed consent form explaining the details of the study and possible risks and benefits was taken from each participant.

2.2. Study Design

Before acute whole body vibration (AWBV) intervention, eyes open and closed one leg stance, static and dynamic kinesthetic balance and vertical jump performances of participants were measured. Following that, AWBV was applied to participants. Sixty seconds after the end of this application, the same measurements were repeated. Then, the participants received 20 min of sport massage to their lower extremity for recovery. Sixty seconds after the end of sport massage, the same measurements were repeated again.

One week of break was allowed to participants in order to ensure full recovery, and they are asked not to do any physically demanding exercise. After a week, the same procedures for exercise and measurements were repeated in the second session except for the sport massage application. In this session, participants were asked to rest for 20 min in supine position instead of sport massage.

Table 1. *Sudy Design of Acute Whole Body Vibration Exercise , Sports Massage and Passive Resting*



Acute whole body vibration (AWBV) Exercise Protocol: Participants were informed and familiarized with the process by an experienced trainer 3 days before the first session. Following 5 min run for warm-up, participants do stretching for ankle, knee and hip flexor and extensor muscles for two sets of 20 seconds each. Participants were instructed to stand on the vibration platform with their feet shoulder width apart and knees bended for the first set of exercise. They practiced calf rise exercises at 30 hz frequency for 60 seconds in tiptoe position. Then, they were asked to position their knees to 90^0 bended squat position as measured with a standard goniometer and instructed to do squat exercises at 50 hz for 60 seconds. In the third set, the same exercise was repeated at 50 hz for 30 seconds. Between each sets, 60 seconds of passive recovery was allowed to participants. During the exercises, participants are checked and instructed regarding their position on the platform and breathing to avoid valsalva maneuver.

Table 2. *Protocol of Acute Whole Body Vibration (AWBV)*

Set	*Exercises*	*Movement type*	*Frequency*	*Duration*
1.	Calf rises	Dynamic	30 Hz	60 sec.
		60 second resting		
2.	Squat	Dynamic	50 Hz	60 sec.
		60 second resting		
3.	Squat	Dynamic	50 Hz	30 sec.

Sports Massage(SM) Protocol after AWBV Exercise: An experienced sport massage practitioner, who is also one of the researchers of this study, applied the sport massage to participants. After AWBV exercises, participants were asked to lied on a standard massage bench in supine position. Popliteal region of participants were supported and the determined massage plan was applied. A total of 20 min (10 min for each lower extremity) sport massage was applied to the following regions; 5 min for instep, crural regions, anterior compartment of the thigh and 5 min for calf and posterior compartment of the thigh. In order of effleurage, petrissage, friction, shaking and vibration manipulations aiming major muscle groups were used during the massage practice. The massage began and ended with effleurage, and it was practiced between each manipulation as well. Effleurage was used to increase capillary and lymphatic activation and to stimulate parasympathetic nervous system through reflex effects.

The massage practice began with a general effleurage in leg and anterior compartment of the thigh region (60s). Soft and deep manipulations were practiced aiming Tibialis anterior (30s), M. Proneus longus-brevis (30s), M. Quadriceps femoris (120s) and hip adductor muscles (30s) respectively. For calf and posterior compartment of the thigh regions, the participants were asked to lie down in supine position with knee flexion. Firstly, effleurage was applied and then yüzeysel ve derin manipulations were practiced aiming M. Gastrosoleus (60s), M. Biceps femoris (60s), M. Semitendinosus and M. Semimembronosus (60s), hip abductor muscles (60sn) respectively. The same procedure was repeted for each lower extremity.

Passive Resting (PR) Protocol after AWBV Exercise: After demanding AWBV exercises, participants were instructed to lie down on a standard massage bench in supine position for 20 min, and the body was covered to preserve body temperature.

2.3. Data Collection Method

Necessary information was given to the participants three days before the measurement and intervention day and all measurements were applied by independent experienced staff at the same time of the day (26). The participants were asked not to consume alcohol and not to do any physically demanding exercises two days before the tests and practices.

Eyes open and closed one leg stance test (EO-EC OLST): The participant was asked to stand with a bare foot on a hard and flat surface by lifting one foot with the knee in a 90-degree bent position. The stance time was evaluated by using Casio digital stopwatch. With the deterioration of stance (bending of the trunk and knee and the other foot touching to the ground), the time was stopped and recorded. The measurement was repeated three times, with eyes open and closed, and the best values were recorded (27, 28).

Kinesthetic balance measurements (kinesthetic ability trainer-KAT 2000): Kinesthetic Ability Trainer (KAT 2000) was used for measurements of postural balance performance. KAT 2000, is a balance platform designed for functional testing of the neuromuscular control system. Measurements were performed in a bright and quite environment with controlling any possible cause of fatigue, distraction and illness (29). Participants were informed about the process beforehand and instructed to fix their arms in the cross chest position. Participants were asked to position their feet apart from each other around 1/10 of their height with their knees flexed at 20 degree angle. They were instructed to keep the stabiliometer platform in a horizontal/balanced position considering the central point in the monitor. Any sway and deviation from the center was recorded as failure score. For dynamic balance measurements, pressure level of stabiliometer was adjusted according to participants' body mass in three levels of difficulty. They were instructed to follow the circular path shown on the monitor by moving the platform accordingly (30, 31). Each participant was allowed to practice 2-4 min on the platform for familiarization. They did 2 trials for measurements and 2 min rest was allowed between tests. When the participant could not maintain her/his balance and/or touch to the trainer with her/his hand or foot, the measurement was repeated. Two leg static score (TLSS), Right leg static balance score (RLSBS), Left leg static balance score (LLSBS), Two leg dynamic Score (TLDS), Right leg dynamic balance score (RLDBS), Left leg dynamic balance score (LLDBS) were recorded for analyses.

Vertical Jump Measurement(VJ) **:** Takei "Physical Fitness Test JUMP-MD TKK 5106" was used for vertical jump measurements. The tool was aligned to participants' iliac crest, attached to them and reset in the standing position. Participants were instructed to position their knees flexed at 90 degree angle with their hands placed on the pelvis with their thumbs located in a belt around the waist. Three jumps were performed and the best one was used for analyses.

2.4. Data Analysis

Normality was checked with Shapiro-Wilk test. Repeated measures analysis of variance was used for analyses of normally distributed data, and Friedman test was used for the others. In the case of any statistical significance in Friedman test, Wilcoxon Test was conducted for comparisons, and the Bonferroni adjustment was used to consider statistical significance. SPSS 18 was used for statistical analyses.

3. Results

In table 3, 4 and 5, comparisons between measurements are presented. In the Sport Massage group (MG), statistically significant differences were determined in Friedman test between three measurements in Two leg static score (TLSS), Right leg static balance score (RLSBS) and Two leg dynamic Score (TLDS) ($p<0,05$) while no statistically significant difference was noted in Eyes open one leg stance test(EO-OLTS), Eyes open one leg stance test (EC-OLTS), Left leg dynamic balance score (LLDBS) and Right leg dynamic balance score (RLDBS) ($p>0,05$). The follow up statistical analyses revealed that in TLSS and RLSBS, statistically significat difference was found between second (389,6±121; 182,7±70 respectively) and third (323,3±95,1; 128,6±50,1 respectively) measurements (figure 1 and 2); in TLDS statistical significance was noted between first (1618,2±401) and second (1483,4±400) measurements (figure 3).

Comparison of Kinesthetic Balance Performances between massage and passive resting applications

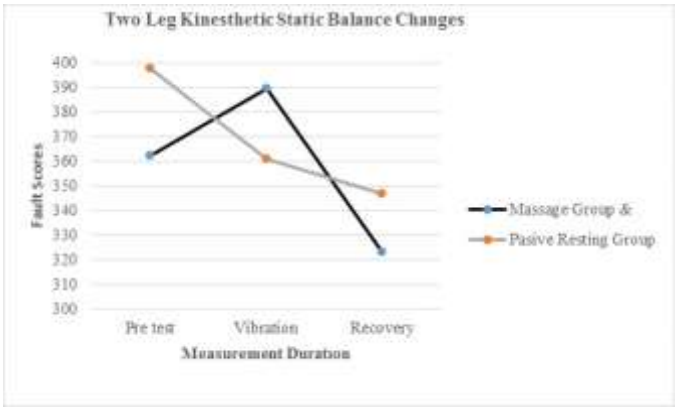


Figure 1. *TLSS Parameters Comparison According to Different Application Groups*

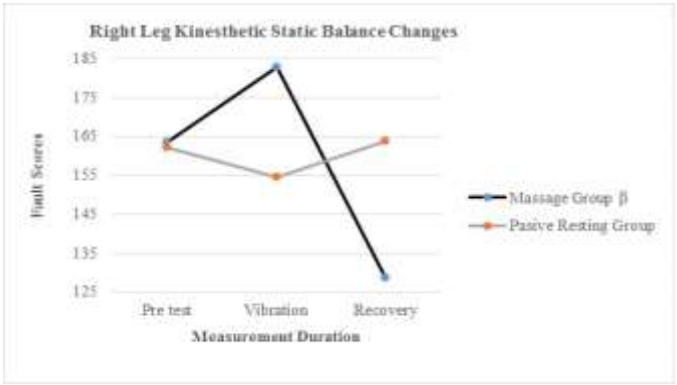


Figure 2. *RLSBS Parameters Comparison According to Different Application Groups*

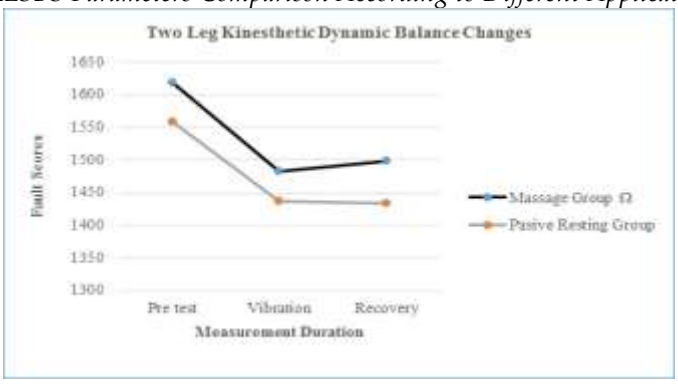


Figure 3. *TLDS Parameters Comparison According to Different Application Groups*

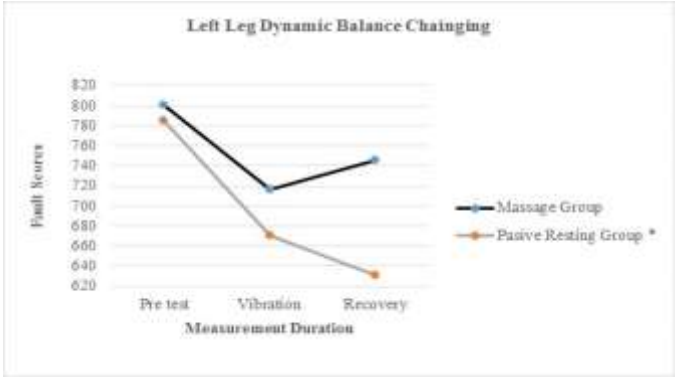


Figure 4. *LLDBS Parameters Comparison According to Different Application Groups*

In passive resting group (PRG), no statistically significant difference was noted between three measurements in Eyes open one leg stance test(EO-OLTS), Eyes open one leg stance test (EC-OLTS), Two leg static score (TLSS), Right leg static balance score (RLSBS), Two leg dynamic Score (TLDS) and Right leg dynamic balance score (RLDBS) while three measurements were differed significantly in Left leg dynamic balance score (LLDBS) ($p<0,05$). The follow-up test revealed statistically significant difference between the first (784,87±275,1) and third (631,3±248,1) measurements ($p<0,05$) (figure 4). Furthermore, normally distributed data on vertical jump performances and Left leg static balance score (LLSBS) performances are presented in table 5 and 6. In each application, no statistically significant difference was determined between these measurements ($p>0,05$). There was no time and application related difference.

Table 3. *The comparison of the Eyes open one leg stance test (EO-OLST), eyes closed one leg stance test(EC-OLST) and kinesthetic balance performances of participants of massage group according to application times.*

n=15	1. Measurement			2. Measurement			3. Measurement			χ^2	p
	Mean ± SD	Median	Min-Max	*Mean ± SD*	Median	Min-Max	*Mean ± SD*	Median	Min-Max		
EO-OLTS (sec)	42,7±18,3	40,0	16,8-73,6	37,5±22,3	33,2	10,0-88,0	47,5±24,9	41,8	14,0-88,9	2,80	0,23
EC-OLTS (sec)	19,7±8,9	15,5	11,2-38,6	16,4±6,6	14,0	8,0-33,6	19,3±5,9	19,0	11,0-31,4	3,33	0,19
TLSS (Score)	362,1±135,9^{ab}	353,0	180,0-659,0	389,6±121,2^{a}	341,0	237,0-644,0	323,3±95,1^{b}	281,0	194,0-554,0	8,93	0,01 &
RLSBS (Score)	163,5±110,4^{ab}	167,0	43,0-469,0	182,7±70,3^{a}	161,0	92,0-296,0	128,6±50,1^{b}	138,0	22,0-222,0	6,81	0,03 β
TLDS (Score)	1618,2±401,3^{a}	1503,0	1124,0-2459,0	1483,4±400,9^{b}	1390,0	1010,0-2610,0	1498,8±373,4^{ab}	1368,0	1079,0-2156,0	8,93	0,01 Ω
LLDBS (Score)	800,6±245,9	711,0	528,0-1427,0	716,1±259,3	653,0	426,0-1469,0	745,1±225,1	720,0	412,0-1149,0	2,13	0,34
RLDBS (Score)	810,8±233,1	790,0	467,0-1484,0	767,3±171,2	725,0	518,0-1142,0	753,7±179,4	685,0	538,0-1117,0	2,80	0,23

EO-OLTS: Eyes open one leg stance test, EC-OLTS: Eyes open one leg stance test, TLSS:Two leg static score, RLSBS: Right leg static balance score,

TLDS: Two leg dynamic Score, LLDBS: Left leg dynamic balance score, RLDBS: Right leg dynamic balance score.

Mean.±SD: Mean .± standard deviation; p value was obtained from Friedman test; statistical significance was set at 0,05. Values with different characters on the same line are statistically different from each other (Bonferroni adjustments were applied and statistical significance was accepted as $\alpha = 0.017$)

Table 4. *The comparison of the Eyes open one leg stance test (EO-OLST), eyes closed one leg stance test(EC-OLST) and kinesthetic balance performances of participants of passive resting group according to application times.*

n=15	1. Measurement			2. Measurement			3. Measurement			χ^2	p
	Mean ± SD	Median	Min-Max	*Mean ± SD*	Median	Min-Max	*Mean ± SD*	Median	Min-Max		
EO-OLTS (sec)	28,9±10,3	28,3	13,4-50,9	24,3±9,3	21,0	11,8-43,1	27,8±13,1	24,9	10,9-46,5	2,53	0,28
EC-OLTS (sec)	17,2±5,4	16,2	10,0-28,9	14,7±6,3	15,8	5,5-27,2	14,4±4,4	13,7	9,5-25,3	4,93	0,08
TLSS (Score)	397,5±156,9	323,0	185,0-627,0	360,8±131,9	305,0	208,0-635,0	346,6±129,8	293,0	151,0-539,0	2,53	0,28
RLSBS (Score)	162,2±126,6	126,0	18,0-413,0	154,6±110,5	149,0	13,0-371,0	163,9±103,6	148,0	14,0-332,0	1,00	0,61
TLDS (Score)	1558,6±377,3	1418,0	1167,0-2676,0	1436,3±384,9	1289,0	1032,0-2441,0	1433,7±306,4	1414,0	974,0-1984,0	4,13	0,13
LLDBS (Score)	784,87±275,1[a]	775,0	484,0-1450,0	671,07±272,4[ab]	571,0	461,0-1467,0	631,3±248,1[b]	653,0	109,0-1121,0	6,53	0,04*
RLDBS (Score)	807,2±179,3	790,0	603,0-1226,0	763,5±158,9	766,0	486,0-976,0	742,4±145,6	769,0	519,0-1029,0	1,73	0,42

EO-OLTS: Eyes open one leg stance test, EC-OLTS: Eyes open one leg stance test, TLSS:Two leg static score, RLSBS: Right leg static balance score,

TLDS: Two leg dynamic Score, LLDBS: Left leg dynamic balance score, RLDBS: Right leg dynamic balance score.

Mean.±SD: Mean .± standard deviation; p value was obtained from Friedman test; statistical significance was set at 0,05. Values with different characters on the same line are statistically different from each other (Bonferroni adjustments were applied and statistical significance was accepted as α = 0.017)

Table 5. *1st, 2nd and 3rd Measurements of Vertical Jump*

	1. Measurement	2.Measurement	3.Measurement
	Mean ± SD	*Mean ± SD*	*Mean ± SD*
Sports Massage	44,87±5,9	44,20±5,6	43,53±5,4
Passive Resting	43,27±5,4	42,93±6,5	42,67±5,9
Time	$F_{(2,56)}$ =1,43 p=0,25 η^2=0,048		
Time X Application	$F_{(2,56)}$ = 0,21 p= 0,82 η^2=0,007		

Table 6. *1st, 2nd and 3rd Measurements of Left Leg Static Balance (LLSBS)*

	1. Measurement	2. Measurement	3. Measurement
	Mean ± SD	*Mean ± SD*	*Mean ± SD*
Sports Massage	211,53±73,3	219,73±81,7	194,7±93,9
Passive Resting	249,53±118,3	216,27±92,2	189,20±57,5
Time	$F_{(2,56)}$ =2,62 p=0,08 η^2=0,086		
Time X Application	$F_{(2,56)}$ =1,02 p= 0,37 η^2=0,035		

4. Discussion

In recent years, vibration interventions have become popular in the fields of health and sports as treatment and/ or training (exercise) method. While positive acute and chronic adaptations have been reported, several research have also suggested no or negative effects of vibration (9). Particularly, studies on acute physiological effects of whole body vibration exercises have stated that decreases in cardiovascular, neural and muscular performance are results of fatigue followed by excessive loading. For instance, Maffiuletti et al. (2013) reported 23 % performance decrease in the case of WBV application and squat exercise performed with extra load (50 % of the participants' body mass). Similarly, Erskine et al. (2007) and Colson et al. (2009) reported 9% and 7% performance decreases respectively in the application of WBV and half squat with no extra load (32, 33, 34, 35). However, different perspectives have been discussed in the relevant literature on acute effects of whole body vibration practices on neuromuscular performance. Notably, power and strength performances may differ from each other with WBV practices (9,32).

The Effect of Acute Whole Body Vibration (AWBV) Exercises on Balance and Vertical Jump

In this research, the effects of AWBV exercises on balance and vertical jump performances and the effects of Spor massage (SM) and Passive Resting(PR) in this context were investigated. Balance was measured with Eyes open and closed one leg stance test (EO-EC OLST) and Static and Dynamic Kinesthetic Dynamic Balance tests. According to the results of EO-EC OLST, which is the earliest measurement technique and have been used commonly in the relevant studies, AWBV exercises have resulted in performance deteriorations slightly in both SM and PR groups, but this difference is not statistically significant.

Similar results were reported in the listerature by Pollock et al. (2011) who investigated the effects of vibration exercises on balance and sense of joint position. In this study, 5 loads lasting for a minute each were practiced with 30 seconds rests. Eyes open and closed one leg stances were measured before, 15 min and 30 min after the intervention, and it was determined that AWBV exercises did affect neither balance nor sense of joint position. Only after 30 min was minimal difference reported (36).

According to the results of static balance measurements on dynamic platform with pneumatic cushion, two leg static balance score (TLSS) deteriorated with vibration although it was not statistically significant. In SM group, right leg static balance scores (RLSBS) bore resemblance to two leg static balance scores (TLSS). Similarly, AWBV did not affect static balance scores and even deteriorated the performance altough it was not statistically significant. Left leg static balance measurements did not differ significantly in the three measurements, and no time related difference was noted too. In SM group, error score increased while in PR group positive results were noted with less error scores. Kaçoğlu (2019)'s research on active healthy participants aged between 18 and 22 with 2 sets of AWBV exercises show similarities with our study. According to this, the intervention is not effective on static balance performance tested with kineshthetic balance tool. Furthermore, it was specified that most of the studies reporting improvements on balance with vibration exercises were conducted with elderly individuals (8).

In SM group, acute vibration intervention significantly improved two leg dynamic balance performance. However, in both SM and PR groups, AWBV exercises did not affect single leg dynamic measurement results significantly for both right and left leg. Cloak et al. (2016) also investigated dynamic balance performances after AWBV and reported similar results. In this study, 22 elite and 22 amateur soccer players did 3 sets of vibration exercises in squat position lasting for 60 sec each and at 40 hz. Before this intervention, Y balance and postural stability index measurements were conducted. Elite soccer players' postural stability index scores were determined significantly low. Additionally, both groups improved their performance in Y balance test anterior (37)

In both SM and PR groups, AWBV did not lead to any significant difference in vertical jump performances. On the contrary, Cochrane and Stannard reported that in elite women hockey players, AWBV exercises led to 8.1% performance improvements in vertical jump tests performed 5 min after the AWBV exercises **(38). Dabbs et al. (2015) investigated vertical jump, peak power output and relative ground reaction forces performances of 8 college and 8 recreational women athletes after 4 sets of 30 sec AWBV exercises. In this study, statistically significant differences were determined between vibration and control groups. College athletes outperformed recreational athletes in vertical jump and peak power output measurements** (39). Dallas et al. (2017) also conducted research on physical education students, and

determined positive differences in static balance and explosive strength (40). Moreover, acute neuromuscular differences after exhausting squat and whole body vibration exercises were investigated in another research, and differences in jump height, ground contact time and isometric torque were noted (41). These contradictory results may be exlained by different acute loadings, amplitudes and frequencies.

The Effects of Sports Massgae and Passive Resting on Balance and Vertical Jump

As aforementioned, massage applications have physiological effects on circulatory, musculoskeletal and nervous systems by reflexes and mechanical effects. With this recovery method, delayed onset muscle soreness and fatigue were tried to be decreased (15,17,18, 19,20,21).

In this study, SM application after SWBV exercises caused to deteriorations in EO- OLST balance performance. However, this result did not mean statistical significance. The same result was determined for PR group too. In both groups, acute vibration did not lead significant difference in balance performance as determined with EC- OLST result, and sport massage and passive resting, which were practiced for recovery, were determined as not significant moderators. According to the two leg static balance measurement performed with the kinesthetic test battery, sports massage (SM) improved the two leg static balance performance and caused statistical changes, even better than the pre-test score. Similar results were observed in PR group too. Vibration and resting were determined to improve balance, but not significantly. In SM group, RLSBS and TLSS showed similarities. Additionally, sport massage improved balance, which was deteriorated due to AWBV exercises, even better than the pre-test result. However, passive resting did not affect significantly. Also, Left leg static balance score (LLSBS) revealed no effect of sport massage. Similarly, no time related difference was observed. While error score increased negatively in SM group, it decreased positively in PR group. SM and PR did not result in difference in score after AWBV exercises.

In this study, according to TLDS results from kinesthetic dynamic balance measurements, SM application did not cause significant changes after AWBV. According to the results of the dynamic test performed with a single leg, the balance improvements of SM and PR applied to the participants after vibration exercises did not cause statisticaly significant differences except for LLDBS. Thus, these two recovery method lead to different results in different parameters. In a nutshell, SM led to improvements in TLSS and RLSBS. Furthermore, AWBV and PR led to improvements in LLDBS. However, Kaçoğlu (2019) stated that passive resting at 3rd and 5th min after AWBV exercises did not bring about effective results (8). Hemmati et al (2016) investigated the effects of stretching only and combined massage-stretching applications on plantar flexor muscle on postural balance in individuals aged between 50 and 65 years. Statistically significant increases in mediolateral center-of-pressure difference and speed were determined after stretching only and stretching-massage combination when participants were measured with eyes closed. According to this results, combined application seemed better compared to stretching only (42).

Lastly, SM and PR applications after AWBV exercises did not result in significant differences in vertical jump performances. However, Arabacı (2008) investigated the effects of massage and passive resting. He looked for the effects of Swedish massage applied to lower extremity of 24 males just before competition on fitness components, and reported the negative effects of this application on jump performance, speed and reaction time. (43). Similarly, Hopper et al. (2005), Shin et al. (2015) and Bender et al. (2019) stated that massage did not lead to expected results in perceived fatigue, flexibility, strength and jump performances (21,44,45). However, some research suggested short recovery massage was effective in certain performance parameters (5-12 min). Thus, massage lasting more than 15 min was reported as decreasing the performance. Also, the time between the massage application and post-test was thought as a critical determinant (22,43,46).

The effects of massage and passive resting on neuro-motor system after fatigue and strenuous exercise were discussed in the literature from different perspectives. According to a meta analysis of randomized controlled trials on the effects of massage on performance recovery, the effect of massage was noted as rather small and partly unclear. However, massage was suggested as effective in short-term recovery from fatigue following intensive mixed training (22). Kaplan et al (2014) reported that acute eccentric exercise resulted in hypoalgesic response in dominant upper arm and local deep tissue massage decreased this response in athletes. Moreover, a possible role of mechanical stimulation on pain tolerance in athletes following eccentric exercise was mentioned too (47). In another research, the effects of 30 min massage following excercise on muscular fatigue, recovery, physiological regenesis and physical performance were investigated. Male body

building athletes participated in this study, and four measurements were taken in four different time points as follows; 0, 24, 48 and 78 hours after the massage application. As a result, recovery after strenuous excercise was determined better in massage group. Additionally, it was suggested that massage application after excercise might improve excercise performance and revcovery (48). In Bender et al. (2019)'s research, a total of 78 athletes ran 10 km at as hard as they could, and their pre-tests were completed. Following measurements, a group received sport massage and the control group received sham hip and knee joint mobilisationsfrom by the same therapist, and post-tests were performed. Then, other measurements were taken after 24, 48 and 72 hours. As a result, massage therapy was determined to be more effective in decreasing pain level compared to resting, but the effect size was not large (21). Furthermore, in a meta-analysis, Dupuy et al. (2018) stated that massage was the most effective technique for recovery after strenuous exercise with regard to delayed onset muscle soreness and perceived fatigue. In addition, compression and water applications were stated as other techniques to be used for perceived fatigue (49). Edge et al. (2009), who used vibration massage for recovery, stated that AWBV aiming recovery did not increase blood circulation, remove electrolytes and stimulate sensory receptors as thought so (50). However, sport massage therapy for recovery have been commonly practiced among competitive athletes (22).

5. Conclusion

In this study, acute vibration exercise affaceted only two leg dynamic balance performance positively. Following vibration application, SM improved two leg static balance and left leg static balance. However, no such results were noted in dynamic measurements in SM. Notwithstanding, acute vibration exercise and passive resting together improved right leg dynamic balance. In future studies, different measurements could be taken at different time points after AWBV to investigate time related recovery process. Additionally, different methods such as stretching and cryotherapy could be suggested for acute recovery.

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The Accute Effects of Foot Reflexology on Kinesthetic Balance and One Leg Stability for Heathy Individuals

Özgür Özdemir[1]
[1]*Akdeniz University, Faculty of Sport Sciences, Campus, Antalya, Turkey.*

Abstract

Reflexology (R) which is one of the most frequently used conventional and complementary health practices is used as sustaining application in healthcare fields. It aims to provide hemostasis, to recover and to get relaxed. Nevertheless there was not any related research study about acute effects of reflexology for health individuals in the literature. The purpose of this study is to research the acute effects on kinesthetic balance and one leg stability by using 20-minute foot reflexology application for healthy people. 20-minute "The tone-up workout" foot reflexology application performed on active 20 participants (age:21,40 years, height: 176,60cm, weight: 73.35kg). Kinesthetic balance and eyes open one leg stance test were conducted before the application and after 3 minutes of application. According to result of analysis, there was a meaningful difference statistically between before and after measurements of reflexology application in the values of dynamic score (DS) and dynamic back failure score (DBFS) which come from two leg dynamic kinesthetic balance performances($p<0,05$). There was not any differences statistically amongst eyes open one leg stance test (EO-OLTS) and eyes closed one leg stance test (EC-OLTS) performances that tested two leg static kinesthetic balance variables and postural static stance ($p>0,05$). As a result of this study, it was seen that only-one-time reflexology application as acute effect disrupted negatively DS and DBFS performances which come from two leg dynamic kinesthetic balance tests but it did not have any impact on two leg static kinesthetic balance test, EO-OLTS and EC-OLTS performances.

Keywords: Reflexology, Foot massage, Balance, Postural control, Kinesthetic balance.

1. Introduction

Conventional and complementary health practices are commonly used for preventing, diagnosing and curing the diseases throughout history (1). One of the most frequently used applications in the world is massage and its other form called reflexology. Massage has been preferred to develop body heath and to increase the performance for thousands of years. Reflexology has an ancient history and it is considered as a complementary application by World Health Organization (WHO). It is thought that this healing method has its origins from China and Egypt. Reflexology is practiced by Incas from South America and Indians from North America (2,3). It has been developed on historical background and used as longitudinal and horizontal zone therapy (4, 5, 6). According to Reflexology it is thought that hands, foot and ears represent organs and other tissue areas on the human body. Reflexology is a method in which particular reflex points are stimulated by hands and efficacious tools. The aim of this method is to support homeostasis and to provide free energy flowing (4, 7, 8). Thuswise physical, mental and physiological balance are secured by stimulating self-rehabilitation mechanism of the person and so it aims at sigh of relief (9, 10). There are some theories about mechanism of action for reflexology. Some of these are energy, lactic acid, gate control, neural impulse, endorphins and placebo effects theories. In regard to energy theory, there are relationship between organs and electromagnetic field. It depends on clearing away the energy channels which had been blocked. According to the second opinion of this theory, lactic acid accumulates as microcrystals on the areas that are believed to represent organs and body parts. It is thought that energy flow returns to normal by massage and pressure techniques (4,11, 12, 13, 14). In other respects it is thought that there are thousands of reseptor which are in relation with whole body and they can create stimulation under the feet. In other words, electrochemical messages are occurred by the pressures applied on the reflex points. Cellular impulse that begins from peripheral nerve system reaches to the central nervous system with neurologic pathway. Autonomic nervous system responds to the cells, the tissues and the organs for re-convalescing. Endocrine, immune and neuropeptide systems are effected by this autonomous response. The effect of massage of reflexology leads to release of endorphin and other brain secretions. This helps to wear off the pain and increase the feeling of well-being (2, 7, 13, 15, 16). As a result, rehabilitation or healing mechanisms are catalysed by both reflex and neurochemical pathway (7, 11).

Reflexology has recenltly been used as a supportive care which aims at analgesic and psychologic relief in the medical world especially in nursing care. Besides, there are studies about cardiovascular disease, intensive care patients, cancer, hormonal, neuropathic disease, musculoskeletal system, gastrointestinal system disorder and quality of life vardır (4, 11, 12, 17, 18, 19, 20, 21). Reflexology is commonly applied for both protection of health and relief of some disorders. Especially it helps to regulate sympathetic and parasympathetic nervous system; to reduce discomfort, panic attack, migraine, headache and musculoskeletal pain; to ease depression; to reduce nausea, vomiting and chemotherapeutic side effects; to fix immunity; to remove dermatological problems; to solve problems which are intrinsic to women such as menopause and gynecologic diseases; to repair neurologic problems and to ease symptoms in conjuction with modern medicine (22, 23, 24, 25).

The balance and proprioception of a person are the abilities in which the sense of body posture against gravitation under the active or stable conditions in daily life is perceived in neuromuscular system (26, 27). These concepts cover balance and postural control, joint kinesthesia, position sense and muscle reaction time with the contributions of visual, vestibular and somatosensorial receptors. Postural sway is decreased by impeccable work of neuromuscular structure and upright posture occurs against gravitation. Failing posture and balance are tinkered (28, 29). Bad posture and loss of balance especially affects negatively. They decrease the productivity of their actions and increase the risk of accidents and injuries. Balance losses and postural control problems depend on many reasons. Irregular lifestyle and tiredness are some of them. A lot of modern medicine methods are tried to get rid of tiredness after the activity of daily life; to renew the life energy and recovery. But there are not any studies about direct or indirect effects of reflexology on balance of healthy individuals. Therefore, the aim of this study is to investigate the effects of 20-minute reflexology application on balance and postural stabilization for healthy people.

2. Method

2.1. Participants

Twenty-eight individuals expressed their voluntary participation to the study. However, a total of 20 individuals (age: 21,40±0,754 years; height: 176,60±6,50 cm; body mass: 73,35±9,61 kg) participated in the current study considering the attendance to each measurement, health issues and ACSM (American College of Sports Medicine) risk factor (30, 31). Informed consent form explaining the details of the study and possible risks and benefits was taken from each participant.

Inclusive and Exclusion Criteria: a) If the participant is not exposed to any injuries for the last 12 months, b). if the participant does not have any acute infection, acute pyretic diseases, deep venous thrombosis and open infected ulcer on feet and c). if the participant fills in the consent form voluntarily, they are included the study (22, 23). If the participant does not want to accept the participation, they are missed out of the study.

2.2. Study Design

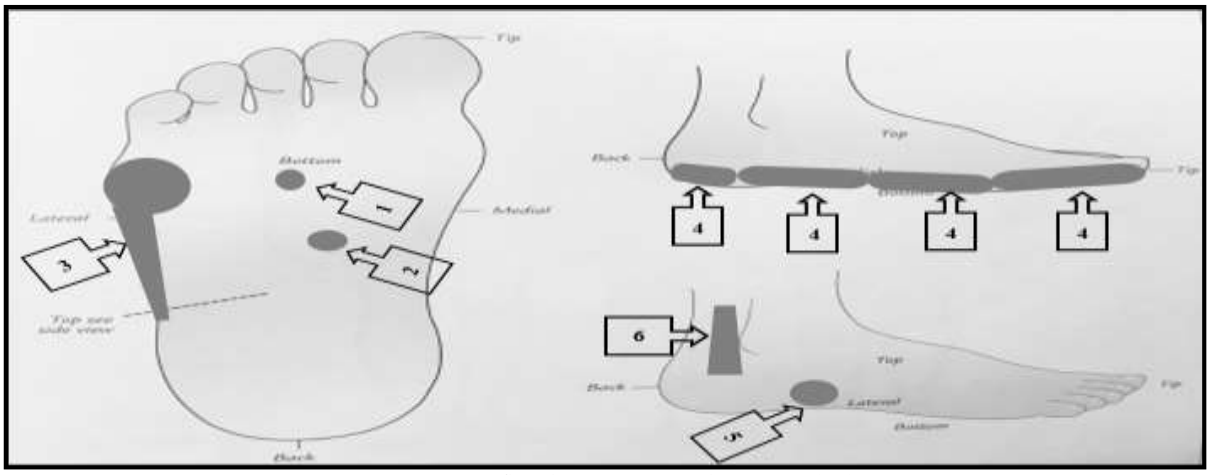
Before the application of reflexology, Two Leg Static and Dynamic Kinesthetic Balance Tests and Eyes Open One Leg Stance Test (EO-OLTS) and Eyes Closed One Leg Stance Test (EC-OLTS) measurements were carried out. After 3 minutes, reflexology was applied on feet for 20 minutes. Second measurements were re-executed after 3 minutes of application.

Table 1. *Sudy Design of Reflexology (R) and Pre-post Measurements*

Protocol of reflexology application: The application was carried out by an experienced and trained practitioner of reflexology. Participant lied down supine position on a folding massage bench and cervical,

lumbal, popliteal regions were supported. Reflexology process were applied by getting the leg level's of participant to the chest level's of practitioner. Effleurage for 5 minutes was implemented on dorsal region, plantar region, M.Tibialis anterior, M. Proneus longus-brevis and M. Gastrosoleus. The work for target reflex region is shown on Table 2 and Picture 3. Preparatory effleurage before the application and calmative effleurage after the application were practiced. Effleurage was used for capillaries and the increase of lymphatic activity and also to activate reflex mechanism of action and autonomic nervous system. While one leg got the application the other leg was covered by a towel. The order of planned manipulation was superficial and deep.

Picture 2: *Application of Reflexology done by Practitioner*



Picture 3: *Reflexology Zones and Regions (38).*

Table 2. *Reflexology Application Protocol*

o	Reflex Area	Foot Zone	Application	Effects of Reflex Points
	The Solar Plexus and Diaphragm Reflexes	Bottom (Plantar)	7 X 2 (Left and right foot)	Trigger these parts to set up a strong breathing pattern and stimulate all the nerves in the abdominal area.
	The Adrenal Gland Reflexes	Bottom (Plantar)	7 X 2 (Left and right foot)	Stimulate the adrenals to secrete hormones that are essential to the metabolic functions in the muscles and nerves.
	The Arm and Shoulder Reflexes	Bottom (lateral side)	7 X 2 (Left and right foot)	Stimulate the muscles and nerves of the upper limbs, and increase blood circulation in the arms, the shoulders, the elbows,and the wrist.

	The Spine Reflexes	İnner foot (medial side)	7 X 2 (Left and right foot)	Prompt the spine and spinal cord to align nervous responses and enhance spinal flexibility.
	The Hip, Thigh and Leg Reflexes	Outher foot (lateral side)	7 X 2 (Left and right foot)	Stimulate the muscles and nerves of the lower limbs and increase blood circulation in the thighs, legs, hips, knees and ankles.
	The Sciatic Nerve Reflexes	Outher foot (Malleolar)	7 X 2 (Left and right foot)	Trigger the sciatic nerves to stimulate the muscles and nerves used in standing, walking and balancing.
	The Solar Plexus and Diaphragm Reflexes	Bottom (Plantar)	7 X 2 (Left and right foot)	Prompt this nerve bundle to put the body into an aware, coordinated state.

2.3. Data collection method

This scientific study was carried out by independent experienced researchers. It is because of the intention to reduce possible biases. Necessary information was given to the participants one day before the measurement and the participants were enabled to try test battery 3 times. All the measurements were performed at the same time of the days (32). The participants were asked not to consume alcohol and not to do any physically demanding exercises two days before the tests and practices.

Height (H) and weight (W): Hight measurements were applied with a stadiometer branded as "Holtain LTD, UK". Weight measurements were applied with digital weighing machine branded as "Seca, Vogel & Hakle, Hamburg".

Kinesthetic balance measurements: Kinesthetic Ability Trainer (KAT 2000) was used for measurements of postural balance performance. Measurements were performed in a bright and quite environment with controlling any possible cause of fatigue, distraction and illness (33). Participants were informed about the process beforehand and instructed to fix their arms in the crosschest position. Participants were asked to position their feet apart from each other around 1/10 of their height with their knees flexed at 20 degree angle. They were instructed to keep the stabiliometer platform in a horizontal/balanced position considering the central point in the monitor. Any sway and deviation from the center was recorded as failure score. For dynamic balance measurements, pressure level of stabiliometer was adjusted according to participants' body mass in three levels of difficulty. They were instructed to follow the circular path shown on the monitor by moving the platform accordingly. The test was stopped by the computer when the time was up (34,35). Each participant was allowed to practice 2-4 min on the platform for familiarization. They did 2 trials for measurements and 2 min rest was allowed between tests. When the participant could not maintain her/his balance and/or touch to the trainer with her/his hand or foot, the measurement was repeated. Static score (SS), Static left failure score (SLFS), Static right failure score (SRFS), Static front failure score (SFFS), Static back failure score (SBFS), Dynamic score (DS), Dynamic left failure score (DLFS), Dynamic right failure score (DRFS), Dynamic front failure score (DFFS), Dynamic back failure score (DBFS) were recorded for analyses.

Picture1. *Kinesthetic balance measurements (Kinesthetic Ability Trainer - KAT 2000)*

Eyes open and closed one leg stance test (EO-EC OLST): The participant was asked to stand with a bare foot on a hard and flat surface by lifting one foot with the knee in a 90-degree bent position. The stance time was evaluated by using Casio digital stopwatch. With the deterioration of stance (bending of the trunk and knee and the other foot touching to the ground), the time was stopped and recorded. The measurement was repeated three times for both legs. The best value was recorded. Two tests were conducted with eyes open and closed (36, 37).

2.4. Data Analysis

Data analysis was performed using statistical evaluation program SPSS 230.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics for numerical variables were expressed as mean ± standard deviation. Variance homogeneity was evaluated for statistics. Paired-sample t test was used to analyse the mean differences of measurements which belongs to two separate qualifications in one dependent group.

3. Results

Table 2. *Features of Participants*

	N	*MEAN ± SD* (MIN-MAX)
AGE (YEAR)	20	21,40±0,754 (20-22)
HEIGHT (CM)	20	176,60±6,50 (165-188)
WEIGHT (KG)	20	73,35±9,61 (54-95)

Average height (176,60±6,50cm) and average weight (73,35±9,61 kg) of participants whom had an age range between 20-22 (21,40±0,754) were given on Table 2.

Table 3. *The results of Kinesthetic and Eyes Open-Closed One Leg Stance Test Before and After Reflexology*

	N=20	BEFORE REFLEXOLOGY (MEAN ± SD)	AFTER REFLEXOLOGY (MEAN ± SD)	T	P
TWO LEG STATİC BALANCE	SS (Score)	275,75±109,26	297,55±86,92	-1,175	0,255
	SLFS (Score)	128,10±60,60	145,65±64,59	-0,917	0,370
	SRFS (Score)	147,40±90,84	151,95±100,92	-0,234	0,817
	SFFS (Score)	122,65±94,54	114,05±80,54	0,366	0,719
	SBFS (Score)	152,80±57,58	183,50±97,66	-1,446	0,164
TWO LEG DYNAMIC BALANCE	DS (Score)	1171,80±120,65	1308,60±168,70	-3,132	0,005 *
	DLFS (Score)	586,35±112,07	628,55±114,67	-1,582	0,130
	DRFS (Score)	585,35±74,19	638,55±146,68	-1,370	0,187
	DFFS (Score)	587,80±118,87	594,10±114,97	-0,168	0,868
	DBFS (Score)	564,05±110,75	671,05±153,86	-3,169	0,005 β
ONE LEG STATİC BALANCE	EO-OLTS (sec)	56,50±9,57	58,80±4,33	-0,948	0,355
	EC-OLTS (sec)	32,95±19,28	35,80±22,83	-0,666	0,514

SS: Static score, SLFS: Static left failure score, SRFS: Static right failure score, SFFS: Static front failure score SBFS: Static back failure score, DS: Dynamic score, DLFS: Dynamic left failure score, DRFS: Dynamic right failure score , DFFS: Dynamic front failure score, DBFS: Static back failure score, EO-OLTS: Eyes open one leg stance test, EC-OLTS: Eyes closed one leg stance test

Figure 1. *DS changes according to pre- post tests*

Figure 2. *DBFS changes according to pre- post* ***tests***

In consequence of static balance measurement, the value of SS post-test (297,55±86,92) negatively increased than pre-test (275,75±109,26) without any significant difference (p=0,255). Likewise, the results of SLFS pre-test (128,10±60,60), post-test(145,65±64,59), SRFS pre-test (147,40±90,84), post-test (151,95±100,92) and SBFS pre-test (152,80±57,58), post-test (183,50±97,66) revealed that the measurement value negatively increased. The performance slightly increased in the measurement of SFFS pre-test (122,65±94,54) and post-test (114,05±80,54). Yet there was not statistical discrepancy between the values of SLFS, SRFS, SFFS, SBFS before and after Reflexology application shown in Table 3 (p>0,05).

The results of Dynamic Kinesthetic Balance Tests were given in Table 3. Hereunder, according to the result of post-test of DS (1308,60±168,70) that was carried out after the application of reflexology which was after DS pre-test (1171,80±120,65), there was statistically a performance loss at meaningful level (Figure 1). Likewise there was a significant increase (Figure 2) for error score (p=0,005) between DBFS pre-test (564,05±110,75) and post-test (671,05±153,86). Nevertheless there was not any negatively increase between the results of DLFS pre-test (586,35±112,07), post-test (628,55±114,67), DRFS pre-test (585,35±74,19), post-test (638,55±146,68) and DFFS pre-test (587,80±118,87), post-test (594,10±114,97). When it comes to the values of DLFS, DRFS, DFFS, there was not any differences statistically before and after the application of reflexology (p>0,05).

Eyes open one leg stance test (EO-OLTS) and Eyes closed one leg stance test (EC-OLTS) for Postural Static Balance Test is given in Table 3. According to this table it can be seen that the result of post-test of EO-OLTS (58,80±4,33) that was carried out after the application of reflexology which was after EO-OLTS pre-test (56,50±9,57), there was statistically a performance loss at insignificant level (p= 0,355). There was not statistically and negatively a meaningless increase between the results of EC-OLTS pre-test (32,95±19,28) and post-test (35,80±22,83) for participants (p= 0,514).

4. Discussion

During the recent years, the studies about reflexology that has been used as a supportive treatment have been increased. The majority of these researches has been in the field of medicine and nursing. Especially, supportive treatment effect that aims at analgesic and psychological relief for people who have health issues has been investigated. This is the first study that searched the primer effects of reflexology on balance for heathy individuals. The tone-up workout reflexology application which is refreshing and body energy enhancer was used (38). It is recommended that reflexology should be applied 3 times and 7 minutes per week for the chronic effects but in our study the application performed once and 20 minutes to research into the acute effects. In other words, the acute effect on Kinesthetic Balance Tests and Eyes Open-Close One Leg Stance Test (EO/EC-OLTS) was investigated with the help of new research setup. Thereafter the application which took 20 minutes and that was carried out only once did not cause any difference of Static Kinesthetic Balance Performance. Although the performance values of SFFS partially high, the performance

values of SS, SLFS, SRFS, SFFS, SBFS was partially low. When the values of Dynamic Kinesthetic Balance were analysed, it was observed that reflexology application affected DS and DBFS performances negatively. However reflexology application slightly decreased the performance of DLFS, DRFS, DFFS meaninglessly. EO-OLTS ve EC-OLTS tests are frequently used for the evaluation of the balance of One Leg Stance in the literature of the field. The reason of this is the standard and easily practicality of the tests. According to EO-OLTS and EC-OLTS test measurements, it was found that the application of foot reflexology did not effect One Leg Static Stance. In fact, partial meaningless performance decline was observed. As for that the results of all measurement, balance performances did not develop and even it was partially deteriorated as an acute effect of reflexology. The reason may be originated from the parasympathetic effects of touching reflex and from the participant whom lied down for 20 minutes. Physiological processes began with the help of acetylcholine as neurotransmitter while the body of the participants was in motionless and relax position and there was relaxation of neurological system and musculoskeletal system. Besides the other theories of application of reflexology there may perceptively be a relief on entire body (39). The performance of postural stability and balance could be deteriorated against gravitation with the relief.

In recent years, the studies the application of reflexology were generally conducted with ill and elderly individuals. The chronic effects have been investigated in many studies. So, there is not many studies that focus on different acute effects after application. Present studies concentrate on problems of acute alteration of cardiovascular system (blood pressure, pulse rate), ache which were physiological or psychological, stress etc. For example, Rollinson and et al. (2016) mentioned in their study which was about the arterial compliance of reflexology for health volunteers that transient reflexology application did not contribute to acute haemodynamic parameters. Stimulation of reflex system for people who is not in a good heath may not give any respond that concerns entire body. It may be the reason to have similar results in our study. Perhaps the applications that are planned and long dated provide expected alteration and contribution in theory (40).

Generally the studies were performed at the time that symptoms were active or at the time in which the participants were on a resting position. Whereas Chen and et al. (2019) did research about acute effect on autonomic nerve system after the development of fatigue. In their study, the effects of foot reflexology on autonomic nerve system were researched after the short period of increasing sprint and repetitive interval running. As a result of their study, it was mentioned that the foot reflexology that was applied after the repetitive exhausting exercises on trained college football player increases the parasympathetic activity and sympatho-vagal balance instantly. Therefore it is said that it can be benefited from the application which has an acute effect on cardiac parasympathetic activity and sympatho-vagal balance as a strategy of recovery on the playfields (41). The result of this study shows that foot reflexology after increased sympathetic activation stept in as a balanced element. Although our study was on resting position, it shows similarity in terms of stimulating parasympathetic system and affecting the balance negatively with relaxation.

There are limitation about the application of reflexology on falling and balance researches in geriatric studies. Only Khoda and et al. (2014) researched into 6-week reflexology application that had an effect on postural stability and postural sway for 40 participants whom aged between 60 and 80. As a result, it was seen that 6-week reflexology application which was for elderly women and it was 3 times per week increased the performance of postural stability and postural sway. They also mentioned that this situation may decrease the posibility of falling risks for elderly. There was a contrast in terms of the results between ours and their studies. Thereby, one-time foot reflexology affected the balance negatively but the balance improved with the help of 6-week cronic adaptations (42).

Different foot reflexology is used in different cultures around the world. Classical massage, reflexology, Thai massage, sports massage and therapeutic massage have been interacted with each other in time. Acute and cronic effect of modern classical massage has been mentioned in literature and field application. For instance, The direct and/or indirect effects of massage therapy on skin, neuromuscular, cardiopulmonary and hormonal systems are widely known (43). It is thought that these effects provide physiological and mental contribution with mechanic, reflex and psychologic alteration (44). Increases in skin and muscle temperature, blood and lymphatic circulation and parasympathetic activities are potential effects of massage. Massage is also believed to stimulate sensory receptors and to reduce neuromuscular stimulability by changes in the Hoffman reflex (H-reflex) amplitude. Thus, it decreases muscle tension,

stiffness and fatigue. Effects on physical and mental tiredness are known (43, 44, 45, 46). Effects of sport massage interventions on extreme fatigue and exhaustion in sports sciences have been investigated in the relevant literature (47, 48, 49, 50, 51).

Some effects of reflexology and other types of massage applications on foot show similarity. So, foot applications in literature and the acute effects on postural stability and balance can be discussed together. Hemmati and et al. (2016) performed applications of stretching on flexor muscle and comprehensive massage-streching together. Subsequently, the effect on postural stability was researched. After the application of only statical streching and comprehensive massage-streching together with closed eyes, they said that there was a meaningful increase in mediolateral pressure centre changes and speeds. They also mentioned that bigger values may be achieved with comprehensive application but deep massage on the sole of the feet may have an negative affect on postural balance (52). The study of Hemmati and et al. (2016) was similar to our study. In spite of these studies, LeClaire and Wikstrom (2012) carried out a research which included 18 participants whom had cronic ankle instability. During their application, 5-minute planter and calf massage were given. Before and after the massages, force plate, open-closed eyes postural control and balance performance were tested. According to this, 5-minute planter massage application increased the open eyes static postural control values of participants whom had ankle instability immediately but neither the result of plantar massage nor calf massage with closed eye postural control test there was not any changes. As a result, plantar massage was effective for whom had ankle instability during open eye performances (53)

5. Conclusion

In this study, Only 20-minute Reflexology application was not effective on two leg static kinesthetic balance and eyes open and closed one leg stance performances but this application negatively deteriorated two leg dynamic score and dynamic back failure score performances which come from two leg dynamic kinesthetic balance tests. The absence of acute effects of reflexology for healthy individuals is felt in the literature. For this reason, it is advised to plan in consideration of foot reflexology, foot sports massage and control groups for future researches. Besides, the number of the participants can be increased. In this way, acute effects of foot massage types in similar standards for healthy people can be searched in more details.

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Investigation of the Relationship between Psychological Resilience and Social Problem Solving: A Research on Individuals Receiving Postgraduate Education in the Field of Sport Sciences

Tuba Fatma Karadağ[1] and Oğuzhan Eroğlu[2]
[1,2] *Mus Alparslan University, Turkey.*

Abstract

The aim of this research is to investigate the relationship between psychological resilience and social problem-solving levels of postgraduate individuals in sports sciences. While the population of the research consists of postgraduate individuals in sports sciences in universities in Turkey, the sample group of the study includes 206 postgraduate and 136 doctorate students, 342 participants in total. 202 of the participants are male (age average: 27.6 ± 7.6) and 140 of them are female (age average: 26.4 ± 3.1). "Short Psychologic Resilience Scale" developed by Smith et al. (2008) and transcribed into Turkish by Doğan (2015) and "Revised Social Problem Solving Scale" developed by D'Zurilla, Nezu and Maydeu-Olivares (2002) and transcribed into Turkish by Eskin and Aycan (2009) have been used as data collection tool in the research. The descriptive methods, Kruskal Wallis-H Test, Mann Whitney-U Test and Spearman Mean Difference Correlation analysis have been used in the data analysis in the research. It has been stated that the total Physiologic Resilience Scale (PRS) points of the participants have shown statistically significant difference in terms of age, being employed, education level and monthly income level variables, but on the other hand it has not shown any significant difference in terms of marital status and gender variables. It has been also stated that total Revised Social Problem-Solving Scale (RSPSS) points of the participants have shown statistically significant difference in terms of age, gender, education level and monthly income level variables but they have not shown any statistically significant difference in terms of being employed and marital status variables. It has been defined that there are positive and medium relationship between Positive Problem Orientation sub dimension points of PRS and RSPSS; negative and low-level relationship between Negative Problem Orientation and Avoidant Problem-Solving Style sub dimension points; positive and high-level relationship between Rationalist Problem Solving Style sub dimension points in statistically significant level. At the end of the research, it can be said that age, being employed, education level and monthly income level variables of the participants have an effect on their physiologic resilience levels and age, gender, education level and monthly income level variables of the participants have an effect on their social problem solving levels. In addition to that, it can be said that there is statistically significant relationship between psychologic resilience and social problem-solving levels of the participants.

Keywords: Social Problem Solving, Psychologic Resilience , Sports Sciences.

1. Introduction

Today, many university students are targeting an academic career after university education and they have to cope with many problems when trying to reach this target. While some individuals can be up to those hitches successfully, some of them can fail in dealing with these negative circumstances (1). It has been thought that those negative situations occurred have an effect on academic careers of postgraduate individuals. In this context, the individuals pursuing postgraduate education should have a strong will with both psychological resilience and problem-solving skills while overcoming the problems they encounter. The main objective of postgraduate education is to train labor force having features of coping with problems with power of thought which can use criticize and produce information (2). One of the most attention-grabbing concepts about the attitudes and behaviors that individuals can cope with the problems is characterized as "resilience" (3). The concept of psychological resilience is explained as resistance or orientation process when individuals present in stressful and risky situations that they are in (4). Resilience is also explained as making an effort to deal with the problem and holding to and standing firm in difficult conditions with another definition (5).

Also, (6) has identified as "it is a dynamic process that individuals show positive adaptation despite experiencing trauma or an important disaster" (p.7). When the body of literature is examined, it has been seen that the concept of resilience is related with skill of problem solving, coping with stress, hopelessness,

exhaustion, depression, choosing a career, loneliness, self-respect, focus of audit, emotional freedom, cognitive emotion, adaptation to university life, using change of behavioral pattern, general well-being, organizational commitment, level of job satisfaction and organizational climate (3-4-5-7-8-9-10-11-12-13-14-15-16-17-18).

The concept of problem is explained as "a situation required to learn by researching, solve by considering and turn the scales" (19). The emerging problems can be both short-term and long-term problems that await a solution and we develop problem-solving mechanisms in order to solve these problems that we face with (20). However, in order to label emerging result as a solution it should not only lead the individual to reach the target to be achieved but also have a satisfying feature for the individual (21).

In the most general definition, the concept of problem can be qualified as a situation that has prohibitive features that the individual has encountered (22). When the literature is examined, it has been seen that the concept of social problem solving has a relationship with concepts such as social intelligence, cognitive awareness, and academic procrastination. (20-23-24).

Although the problems we encounter are considered as undesirable situations, they are an inevitable part of our daily life (25). Problems can find their place in all areas of our lives and, if not overcome, can lead to negative consequences. It is thought that the benefit of postgraduate individuals having problem-solving skills and psychological resilience is an important feature, especially in today's world, where success and quality in education are increasingly important. Because today, the rapidly spreading knowledge has increased the competition in business and professional life and has made being an expert in the field to a more important level (2). It is thought that the ability of individuals receiving postgraduate education to overcome the problems they encounter while performing their duties and responsibilities is related to psychological resilience and problem-solving skills. In addition to that, although there are researches on problem solving skills and psychological resilience in the literature, with respect of that there is a study on students who receive postgraduate education in the field of sports sciences, there is no study examining the relationship between these two concepts. This aspect of the research is thought to be beneficial to the field of sports sciences. Based on this idea; the aim of this study is to investigate the relationship between problem solving skills and psychological resilience levels of individuals who are receiving postgraduate education in the field of sports sciences.

2. Method

This research is a relational scanning model. Relational screening model is a research model that aims to determine whether there is a change between two or more variables and the degree of change (26).

2.1. Research Group

While the population of the research consists of postgraduate individuals in sports sciences in universities in Turkey, the sample group of the study includes 206 postgraduate and 136 doctorate students, 342 participants in total. Of the participants, 59.1% are men (n=202) and 40.9% are women (n=140).

Table 1. *Frequency and Percentage of Participants' Demographic Values*

Variables	Groups	n	%
Gender	Male	202	59.1
	Female	140	40.9
	Total	342	100.0
Marital Status	Single	203	59.4
	Married	139	40.6
	Total	342	100.0
Age	25 and under	138	40.4
	Between 26 and 31	117	34.2
	32 and Over	87	25.4
	Total	342	100.0
Being Employed	Yes	144	42.1

	No	198	57.9
	Total	342	100.0
Monthly Income Level	2.500 TL below	136	39.8
	2.501 TL-4.000 TL	91	26.6
	4.001 TL over	115	33.6
	Total	342	100.0
Education Level	Postgraduate	206	60.2
	Doctorate	136	39.8
	Total	342	100.0

2.2. Data Collection Tools

Personal Information Form, Revised Social Problem-Solving Scale and Psychologic Resilience Scale have been used as data collection tool in this research.

2.2.1. Personal Information Form

It has been prepared by the researcher in order to identify demographic features of the participants in the research. It is the section that includes questions such as age, gender, personal income level, education level, being employed and marital status.

2.2.2. Short Psychologic Resilience Scale (SPRS)

Short Psychologic Resilience Scale developed by Smith et al. (2008) and transcribed into Turkish by (27) consists of 6 items in total. 3 of these 6 items are reverse coded and it is a scale in 5-likert type ("not suitable at all", "not suitable", "somewhat suitable", "suitable", "completely suitable"). After translating reverse coded items in the scale, obtained high points have pointed high psychologic resilience. Second, fourth and sixth items in the scale are reverse coded and the internal consistency coefficient of the scale has been determined as 0.83 by the researchers. In this study, the internal consistency coefficient of the scale has been determined as 0.81.

2.2.3. Revised Social Problem Solving Scale-Short Form (RSPSS)

This scale, which is used to determine the social problem solving levels of the participants, has been developed by D'Zurilla, Nezu, and Maydeu-Olivares (2002) and adapted to Turkish by (28). The scale, consisting of 25 items in total, is of the 5-point Likert type ("not suitable at all", "slightly suitable", "partially suitable", "very suitable", "completely appropriate"). The scale consists of 13 positive and 12 negative items and the highest score is 100 and the lowest is 0. High scores indicate that social problem-solving skill is at a "good level", while low scores indicate that social problem-solving skill is at a low level. The scale consists of 5 sub dimensions: "Positive problem orientation (4, 5, 13, 15, 22)", "negative problem orientation (1, 3, 7, 8, 11)", "rational problem-solving style (12, 16, 19, 21, 23) "impulsive-careless problem solving style (2, 14, 20, 24, 25)" and "avoidant problem solving style (6, 9, 10, 17, 18)". The internal consistency coefficients of the sub-dimensions of the scale have been determined by the researchers as 0.67, 0.78, 0.75, 0.62 and 0.75. In this study, the internal consistency coefficient of the scale for all statements has been determined as 0.70.

2.3. Data Analysis

In this study, SPSS 22.0 package program has been used to analyze the data and the distribution of the data has been examined. As a result of the test, it has been determined that the data has not showed a normal distribution and the data has been analyzed with non-parametric tests. Descriptive statistical methods, Whitney-U Test for paired comparisons, Kruskal Wallis-H Test to determine the difference between three or more groups and Spearman Mean Differences Correlation analysis to determine the relationship between variables have been used in data analysis. The Whitney-U Test has been used to determine between which groups the statistically significant difference has occurred as a result of the Kruskal Wallis-H Test. The significance level of the findings obtained from the analysis has been accepted as $p < 0.05$. In addition, in order to test the reliability of the scales, the internal consistency coefficients (Cronbac'h Alpha) have been calculated and the obtained findings have been organized in tables.

3.Results

Table 2. *Comparison of Psychological Resilience Scale and Social Problem-Solving Scale Points According to the Gender Variable*

Variables	Gender	n	Mean Average	Mean Total	U	p
Social Problem-Solving Scale Total	Female	140	151.3	21184.0		
	Male	202	185.5	37469.0	11314.0	0.00*
	Total	342				
Positive Problem Orientation	Female	140	175.9	24624.0		
	Male	202	168.5	34029.0	13526.0	0.49
	Total	342				
Negative Problem Orientation	Female	140	173.1	24233.5		
	Male	202	170.4	34419.5	13916.5	0.80
	Total	342				
Rational Problem-Solving Style	Female	140	169.3	23708.0		
	Male	202	173.0	34945.0	13838.0	0.73
	Total	342				
Impulsive-Careless Problem-Solving Style	Female	140	168.3	23557.0		
	Male	202	173.7	35096.0	13687.0	0.61
	Total	342				
Avoidant Problem-Solving Style	Female	140	134.9	18894.0		
	Male	202	196.8	39759.0	9024.0	0.00*
	Total	342				
Psychological Resilience Scale Total	Female	140	181.8	25446.5		
	Male	202	164.4	33206.5	12703.5	0.11
	Total	342				

*p<0.05

When Table 2 is examined; It has been determined that SPSS total points (M.A. = 185.5, U = 11314.0, p = 0.00; p <0.05) and Avoidant Problem Solving Style sub-dimension points (M.A. = 196.8, U = 9024.0 p = 0.00; p <0.05) have shown a statistically significant difference on behalf of male participants. However, it has been determined that Positive Problem Orientation (U = 13526.0, p = 0.49; p> 0.05), Negative Problem Orientation (U = 13916.5, p = 0.80; p> 0.05), Rational Problem Solving Style (U = 13838.0, p = 0.73; p> 0.05), Impulsive-Inattentive Problem Solving Style (U = 13687.0, p = 0.61; p> 0.05) sub-dimension points and PRS total points (U = 12703.5, p = 0.11; p> 0.05) have not shown statistically significant difference according to gender variable.

Table 3. *Comparison of Psychological Resilience Scale and Social Problem-Solving Scale Points with Marital Status Variable*

Variables	Marital Status	n	Mean Average	Mean Total	U	p
Social Problem-Solving Scale Total	Married	139	159.9	22229.5		
	Single	203	179.4	36423.5	12499.5	0.07
	Total	342				
Positive Problem Orientation	Married	139	200.1	27819.5		
	Single	203	151.9	30833.5	10127.5	0.00*
	Total	342				
Negative Problem Orientation	Married	139	129.6	18011.0		
	Single	203	200.2	40642.0	8281.0	0.00*
	Total	342				
Rational Problem-Solving Style	Married	139	192.6	26772.5		
	Single	203	157.1	31880.5	11174.5	0.00*

	Total	342				
Impulsive-Careless Problem-Solving Style	Married	139	143.5	19946.0		
	Single	203	190.7	38707.0	10216.0	0.00*
	Total	342				
Avoidant Problem-Solving Style	Married	139	153.3	21313.0		
	Single	203	183.9	37340.0	11583.0	0.00*
	Total	342				
Psychological Resilience Scale Total	Married	139	163.5	22727.0		
	Single	203	176.9	35926.0	12997.0	0.21
	Total	342				

*p<0.05

When Table 3 is examined; it has been determined that while SPSS's Positive Problem Orientation (M.A. = 200.1, U = 10127.5, p = 0.00; p <0.05) and Rational Problem Solving Style (M.A. = 192.6, U = 11174.5, p = 0.00; p <0.05) sub-dimensions points have shown statistically significant difference on behalf of married participants according to marital status variable, Negative Problem Orientation (M.A. = 200.2, U = 8281.0, p = 0.00; p <0.05), Impulsive-Inattentive Problem Solving Style (M.A. = 190.7, U = 10216.0, p = 0.00; p <0.05) and Avoidant Problem Solving Style (M.A. = 183.9, U = 11583.0, p = 0.00; p <0.05) sub-dimensions points have shown a statistically significant difference on behalf of single participants according to marital status variable. However, it has been also identified that SPSS (U=12499.5, p=0.07; p>0.05) and PRS total points (U=12997.0, p=0.21; p>0.05) of the participants have not shown any statistically significant difference according to marital status variable.

Table 4. *Comparison of the Psychological Resilience Scale and Social Problem-Solving Scale Points with the Variable of Being Employed*

Variables	Being Employed	n	Mean Average	Mean Total	U	p
Social Problem Solving Scale Total	Yes	144	181.0	26069.5		
	No	198	164.6	32583.5	12882.5	0.13
	Total	342				
Positive Problem Orientation	Yes	144	168.9	24314.5		
	No	198	173.4	34338.5	13874.5	0.67
	Total	342				
Negative Problem Orientation	Yes	144	167.8	24169.5		
	No	198	174.2	34483.5	13729.5	0.55
	Total	342				
Rational Problem-Solving Style	Yes	144	161.6	23274.5		
	No	198	178.7	35378.5	12834.5	0.11
	Total	342				
Impulsive-Careless Problem-Solving Style	Yes	144	184.1	26513.0		
	No	198	162.3	32140.0	12439.0	0.04*
	Total	342				
Avoidant Problem-Solving Style	Yes	144	190.2	27393.5		
	No	198	157.9	31259.5	11558.5	0.00*
	Total	342				
Psychological Resilience Scale Total	Yes	144	157.4	22671.0		
	No	198	181.7	35982.0	12231.0	0.02*
	Total	342				

*p<0.05

When Table 4 is examined; it has been determined that SPSS's Impulsive-Inattentive Problem Solving Style (M.A. = 184.1, U = 12439.0, p = 0.04; p <0.05) and Avoidant Problem Solving Style (M.A. = 190.2, U =

11558.5, p = 0.00; p <0.05) sub-dimensions points have shown a statistically significant difference on behalf of the participants who have a job according to being employed variable. In addition to that, it has been determined that PRS total points (M.A.=181.1, U=12231.0, p=0.02; p<0.05) have shown a statistically significant difference on behalf of the participants who have not a job according to being employed variable. However, it has been identified that the total SPSS points (U = 12882.5, p = 0.13; p> 0.05) and Positive Problem Orientation (U = 13874.5, p = 0.67; p> 0.05), Negative Problem Orientation (U = 13729.5, p = 0.55; p> 0.05) and Rational Problem Solving Style (U = 12834.5, p = 0.11; p> 0.05) sub-dimensions of the points have not shown any statistically significant difference according to being employed variable.

Table 5. *Comparison of Psychological Resilience Scale and Social Problem-Solving Scale Points According to the Educational Level Variable*

Variables	Education Level	n	Mean Average	Mean Total	U	p
Social Problem-Solving Scale Total	Postgraduate	206	161.1	33190.5		
	Doctorate	136	187.2	25462.5	11869.5	0.02*
	Total	342				
Positive Problem Orientation	Postgraduate	206	177.3	36518.5		
	Doctorate	136	162.8	22134.5	12818.5	0.18
	Total	342				
Negative Problem Orientation	Postgraduate	206	155.3	31996.5		
	Doctorate	136	196.0	26656.5	10675.5	0.00*
	Total	342				
Rational Problem-Solving Style	Postgraduate	206	180.4	37169.5		
	Doctorate	136	157.9	21483.5	12167.5	0.04*
	Total	342				
Impulsive-Careless Problem-Solving Style	Postgraduate	206	162.6	33501.0		
	Doctorate	136	184.9	25152.0	12180.0	0.04*
	Total	342				
Avoidant Problem-Solving Style	Postgraduate	206	173.7	35774.0		
	Doctorate	136	168.2	22879.0	13563.0	0.62
	Total	342				
Psychological Resilience Scale Total	Postgraduate	206	158.6	32677.0		
	Doctorate	136	191.0	25976.0	11356.0	0.00*
	Total	342				

*p<0.05

When Table 5 is examined; it has been determined that while PRS total points (M.A.= 191.0, U = 11356.0, p = 0.00; p <0.05), SSIS total scores (MA. = 187.2, U = 11869.5, p = 0.02; p <0.05) and Negative Problem Orientation (M.A.= 196.0 U = 10675.5, p = 0.00; p <0.05) and Impulsive-Inattentive Problem-Solving Style (M.A.= 184.9, U = 12180.0, p = 0.04; p <0.05) sub-dimensions points have shown a statistically significant difference on behalf of the participants whose education levels are doctorate according to education level variable, rational problem solving style sub-dimension points (M.A.= 180.4, U = 12167.5, p = 0.04; p <0.05) have shown a statistically significant difference on behalf of the participants whose education levels are postgraduate according to education level variable. However, it has been also identified that Positive Problem Orientation (U = 12818.5, p = 0.18; p> 0.05) and Avoidant Problem-Solving Style (U = 13563.0, p = 0.62; p> 0.05) sub-dimensions of the points have not shown a statistically significant difference according to education level variable.

Table 6. *Comparison of Psychological Resilience Scale and Social Problem-Solving Scale Points by Age Variable*

Variables	Age	n	Mean Average	X^2	sd	p	Significant Difference
Social Problem-Solving Scale Total	25 and under (A)	138	196.9	28.45	2	0.00*	A>C B>C
	Between 26 and 31 (B)	117	175.7				
	32 and Over (C)	87	125.5				
	Total	342					
Positive Problem Orientation	25 and under (A)	138	197.6	25.6	2	0.00*	A>B
	Between 26 and 31 (B)	117	135.9				
	32 and Over (C)	87	177.9				
	Total	342					
Negative Problem Orientation	25 and under (A)	138	202.9	70.9	2	0.00*	A>B A>C B>C
	Between 26 and 31 (B)	117	190.6				
	32 and Over (C)	87	96.0				
	Total	342					
Rational Problem-Solving Style	25 and under (A)	138	184.1	8.9	2	0.01*	A>B C>B
	Between 26 and 31 (B)	117	149.8				
	32 and Over (C)	87	180.7				
	Total	342					
Impulsive-Careless Problem-Solving Style	25 and under (A)	138	178.7	34.7	2	0.00*	B>A A>C B>C
	Between 26 and 31 (B)	117	200.7				
	32 and Over (C)	87	120.8				
	Total	342					
Avoidant Problem-Solving Style	25 and under (A)	138	156.5	12.8	2	0.00*	B>A B>C
	Between 26 and 31 (B)	117	197.7				
	32 and Over (C)	87	160.0				
	Total	342					
Psychological Resilience Scale Total	25 and under (A)	138	180.1	10.4	2	0.00*	A>B C>B
	Between 26 and 31 (B)	117	148.3				
	32 and Over (C)	87	189.1				
	Total	342					

*p<0.05

When Table 6 is examined; it has been determined that PRS total points (p = 0.00; p <0.05), SPSS total points (p = 0.00; p <0.05) and all sub-dimensions points have shown a statistically significant difference according to age variable. The results of the Mann Withney-U Test conducted to determine between which groups the statistically significant difference has occurred have been given in the "Significant Difference" column in Table 6.

Table 7. *Comparison of Psychological Resilience Scale and Social Problem-Solving Scale Points According to the Variable of Monthly Income Level*

Variables	Monthly Income Level	n	Mean Average	X^2	sd	p	Significant Difference
Social Problem-Solving Scale Total	2.500 TL below (A)	136	140.5	22.8	2	0.00*	B>A C>A
	2.501 TL-4.000 TL (B)	91	187.9				
	4.001 TL over (C)	115	195.3				
	Total	342					
Positive Problem Orientation	2.500 TL below (A)	136	160.8	41.5	2	0.00*	A>B C>A C>B
	2.501 TL-4.000 TL (B)	91	130.8				
	4.001 TL over (C)	115	216.3				
	Total	342					
Negative Problem Orientation	2.500 TL below (A)	136	169.1	15.9	2	0.00*	B>A B>C
	2.501 TL-4.000 TL (B)	91	203.5				
	4.001 TL over (C)	115	149.0				

	Total	342					
Rational Problem-Solving Style	2.500 TL below (A)	136	180.2	52.4	2	0.00*	A>B C>A C>B
	2.501 TL-4.000 TL (B)	91	111.5				
	4.001 TL over (C)	115	208.7				
	Total	342					
Impulsive-Careless Problem-Solving Style	2.500 TL below (A)	136	149.0	32.2	2	0.00*	B>A B>C
	2.501 TL-4.000 TL (B)	91	220.7				
	4.001 TL over (C)	115	159.2				
	Total	342					
Avoidant Problem-Solving Style	2.500 TL below (A)	136	130.4	41.9	2	0.00*	B>A C>A
	2.501 TL-4.000 TL (B)	91	209.8				
	4.001 TL over (C)	115	189.8				
	Total	342					
Psychological Resilience Scale Total	2.500 TL below (A)	136	206.35	55.866	2	0.00*	A>B A>C C>B
	2.501 TL-4.000 TL (B)	91	108.20				
	4.001 TL over (C)	115	180.38				
	Total	342					

*p<0.05

When Table 7 is examined; it has been determined that PRS total points (p = 0.00; p <0.05), SPSS total points (p = 0.00; p <0.05) and all sub-dimensions points have shown a statistically significant difference according to monthly income level variable. The results of the Mann Withney-U Test conducted to determine between which groups the statistically significant difference has occurred have been given in the "Significant Difference" column in Table 7.

Table 8. *The Relationship Between Psychological Resilience Scale and Social Problem-Solving Scale Points*

Variables	Positive Problem Orientation	Negative Problem Orientation	Rational Problem-Solving Style	Impulsive-Careless Problem-Solving Style	Avoidant Problem-Solving Style	Social Problem-Solving Scale Total Points
Psychological Resilience Scale Total	0.461**	-0.282**	0.636**	-0.039	-0.397**	0.055
n = 342. ** Significant at p<0.01 level.						

[Very Low (0-2), Low (2-4), Medium (4-6), High (6-8), Very High (8-10)]

When Table 8 is examined; it has been determined that between PRS points and SPSS's Positive Problem Orientation (r =0.461, p<0.01) sub dimension points, positive and moderate, Negative Problem Orientation (r =-0.282, p<0.01) and Avoidant Problem Solving Style (r=-0.397, p<0.01) sub-dimension points have been negatively and low-level, and there was a positive and high-level statistically significant relationship between Rational Problem Solving Style sub-dimension points. However, it has been found out that there has been no statistically significant relationship between PRS points and SPSS total points and points of the Impulsive-Careless Problem-Solving Style sub-dimension.

4. Discussion and Conclusion

In this research; it has been determined that SPSS total points and Avoidant Problem Solving sub dimension points have shown a statistically significant difference on behalf of male participants according to age variable (Table 2). However, it has been identified that Positive Problem Orientation, Negative Problem Orientation, Rational Problem Solving Style, and Impulsive-Careless Problem Solving Style sub-dimensions points have not shown a statistically significant difference according to gender variable (Table 2). In the research conducted by (29), it has been stated that SPSS points have not shown a statistically significant difference according to gender variable. In addition, in the research performed by (30) it has been identified

that there is a statistically significant difference on behalf of female participants. This situation can be explained as male individuals can deal with the problem if there is any, but sometimes they can show avoidant behaviors. As a result, not every problem can be solved by constantly addressing it. However, different people may react differently to similar events and this may be due to differences in people's perceptions (31).

In this research; it has been determined that PRS points of the participants do not show a statistically significant difference according to gender variable (Table 2). There are studies in the literature that support this finding of our research (8-12-32-33-34-35-36-37-38-39). However, there are studies in the literature that do not support this finding of our research (40-41-42-43-44-45-46-47). This situation has been thought to be due to the different research groups.

In this research; it has been stated that while SPSS's Positive Problem Orientation and Rational Problem Solving Style sub dimensions points have shown a statistically significant difference on behalf of married participants according to marital status, Negative Problem Orientation, Impulsive-Careless Problem Solving Style and Avoidant Problem Solving Style sub-dimensions points on the other hand have shown a statistically significant difference on behalf of single participants according to marital status variable (Table 3). However, it has been identified that SPSS total points of the participants have not shown a statistically significant difference according to marital status variable (Table 3). In the research conducted by (30), it has been stated that SPSS points of the participants have not shown a statistically significant difference according to marital status variable. This situation can be interpreted as that married participants exhibit more rational and positive attitudes in solving the problems they encounter compared to single ones. In addition, individuals who are married may tend to take steps after thorough analysis of the events, by considering or consulting their families in their decisions.

In this research; it has been determined that PRS points of the participants have not shown a statistically significant difference according to marital status variable (Table 3). In the literature, there are studies that support this finding of our research (36-38-48). This situation can be interpreted as marital status does not affect psychological resilience either positively or negatively.

In this research; it has been determined that SPSS's Impulsive-Careless Problem Solving Style and Avoidant Problem Solving Style sub-dimensions points have shown a statistically significant difference on behalf of the participants who have a job according to being employed variable (Table 4). However, it has been stated that SPSS total points and Positive Problem Orientation, Negative Problem Orientation and Rational Problem Solving Style sub dimensions points have not shown a statistically significant difference according to being employed variable (Table 4). This situation can be interpreted as individuals working in a job display careless and avoidant attitudes in solving the problems they encounter. As a result of the stress and fatigue brought about by the busy business life, it is thought that individuals working in a job take an attitude in this way. It is thought another finding of our research that the result of PRS points of the participants have shown a statistically significant difference on behalf of the "unemployed" participants according to the variable of being employed also supports this finding.

In this research; it has been determined that PRS points have shown a statistically significant difference on behalf of the participants "who have not a job" according to being employed variable (Table 4). Similarly, in the study conducted by (8) it has been found that the PRS points of the participants have shown a statistically significant difference on behalf of those who have not a job. It can be interpreted as individuals who are unable to work in a job have a higher level of psychological resilience than those who are working. This situation is thought to result from the fact that the individuals who do not work in a job do not experience the damage caused by the business life.

In this research; it has been determined that while SPSS total points and Negative Problem Orientation and Impulsive-Careless Problem Solving Style sub dimensions points have shown a statistically significant difference on behalf of "doctorate" students according to education level variable, Rational Problem Solving Style sub dimension points have shown a statistically significant difference on behalf of the participants whose education levels are "postgraduate" according to education level variable (Table 5). It has been determined that Positive Problem Orientatiton and Avoidant Problem Solving Style sub dimensions points have not shown a statistically significant difference according to education level variable (Table 5). This situation can be interpreted as that the participants whose education level is doctorate have a negative and careless attitude in solving the problems they encounter. It can be interpreted that the participants with a

postgraduate education level exhibit rational behaviors in solving the problems they encounter. As a result, individuals *"can easily access the information that provides the belief necessary to overcome the problems they encounter"* (49-p.71).

In this research; it has been determined that PRS points of the participants have shown a statistically significant difference on behalf of the participants whose education levels are "doctorate" according to education level variable (Table 5). However, in the study conducted by (50), it has been determined that the PRS points of the participants have shown a statistically significant difference on behalf of the participants whose education levels are "postgraduate". It is thought that this situation is the result of the knowledge and experience that doctorate students have gained during their postgraduate education.

In this research; it has been determined that SPSS total points and all sub dimensions points have shown a statistically significant difference according to age and monthly income level variables (Table 6-7). Similarly, in the research conducted by (30) it has been determined that SPSS points have shown a statistically significant difference according to age variable. This situation can be interpreted as age and monthly income level have a determining effect on social problem solving. In addition, it can be said that as the monthly income level of the participants decreases, SPSS total points can also be decreased.

In this research; it has been determined that PRS points have shown a statistically significant difference on behalf of the participants who are in "32 and older" age group according to age variable (Table 6). In the literature, there are studies that do not support this finding of our research (35-36-42-50-48). This situation can be interpreted as the experiences of the individuals increase as the age of the individuals increases, as a result, the age variable has an effect on the psychological resilience levels of the individuals.

In this research; PRS points of the participants have shown a statistically significant difference on behalf of the participants whose monthly income levels are "2.500 TL and below" according to monthly income level variable (Table 7). However, in the research conducted by (39) it has been stated that PRS points have not shown a statistically significant difference according to monthly income level variable. It is thought that this situation arises because it will vary according to the needs of individuals with different economic conditions. In addition, it is thought that the motivation of individuals with lower income levels compared to others to have a better economic condition may be another factor affecting this situation.

In this research; it has been determined that there is a statistically significant relationship between PRS points and SPSS's Positive Problem Orientation sub dimension points positively and medium level, between Negative Problem Orientation and Avoidant Problem-Solving Style negatively and low-level and between Rational Problem-Solving Style sub-dimensions positively and high level (Table 8). However, it has been determined that there has been no statistically significant relationship between PRS points and SPSS total points and Impulsive-Careless Problem-Solving Style sub-dimension points (Table 8). This situation can be interpreted as individuals with psychological resilience approach the problems with a positive and rational perspective, rather than a negative and avoidant point of view while trying to overcome the problems they encounter.

As a result; it can be said that the variables of age, employment, education level and monthly income level have an effect on the psychological resilience levels of the participants, and the variables of age, gender, education level and monthly income level have an effect on social problem-solving levels. In addition, it can be said that there is a statistically significant relationship between the psychological resilience levels of the participants and their social problem-solving levels.

Suggestions

It is thought that conducting similar studies with different and larger sample groups will contribute to the literature in the future.

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Theoretical and Conceptual Aspects of Forming the Methodical System of Physical Education of the Students of Agrarian Higher Educational Institutions

Grygoriy Griban[1], Pavlo Tkachenko[2], Stanislav Prysyazhniuk[3], Nataliia Terentieva[4], Oleksandr Pronikov[5], Dmytro Oleniev [6], Ganna Grokhova[7], Bogdan Semeniv[8], Lesia Vysochan [9] and Maryna Hres[10]

[1]Doctor of Pedagogical Sciences, Professor, Professor of the Department of Physical Education and Sport Improvement, Zhytomyr Ivan Franko State University, Zhytomyr, Ukraine.

[2]Ph.D. in Pedagogics, Associate Professor, Head of the Department of Physical Education, Polissia National University University, Zhytomyr, Ukraine.

[3]Doctor of Pedagogical Sciences, Professor, Professor of the Department of Safety of Life and Physical Education, State University of Telecommunications, Educational and Scientific Institute of Humanities and Natural Sciences, Kyiv, Ukraine.

[4]Doctor of Pedagogical Sciences, Professor, Professor of the Department of Pedagogy, Psychology and Methods of Physical Education, T. H. Shevchenko National University "Chernihiv Colehium", Chernihiv, Ukraine.

[5]Doctor of Pedagogical Sciences, Professor, Professor of the Department of Pedagogy, Psychology and Methods of Physical Education, T.H. Shevchenko National University "Chernihiv Colehium", Chernihiv, Ukraine.

[6]Ph.D. in Pedagogy, Associate Professor, Lecture of the Department of Theory, Methodology and Organization of Physical Training and Sports, The National Defence University of Ukraine named after Ivan Cherniakhovskyi, Educational and Scientific Institute of Physical Culture and Sports and Health Technologies, Kyiv, Ukraine.

[7]Ph.D. in Pedagogics, Associate Professor, Head of the Department of Physical Education and Sports, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine.

[8]Ph.D. in Pedagogics, Associate Professor, Head of the Department of Physical Education, Sports and Health, Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies, Lviv, Ukraine.

[9]Ph.D. in Pedagogics, Associate Professor, Associate Professor of the Department of Professional Methods and Technologies of Primary Education, Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, Ukraine.

[10]Lecture of the Department of Physical Education, Zhytomyr Polytechnic State University, Zhytomyr, Ukraine.

Abstract

The paper considers the theoretical and conceptual aspects of forming the methodical system of the students' physical education. Modern society requires the theory and practice of higher education institutions to direct the accumulated scientific experience at the basis of the formation of a new structure of competent professionals who can think creatively, navigate in the information space, master worldview paradigms on their own and systematically maintain their health and high mental and physical capacity. As a result, the need for effective preparation of students for independent creative and research activities and the ability to maintain their physical condition has significantly increased. It developed in a need to update the educational process in higher education institutions owing to its focus on the model of the future professional activity of graduates under conditions of introducing effective technologies for organizing the educational process, which will promote the formation of personality with creative thinking and a healthful mind. The aim of the study is to substantiate the theoretical and conceptual aspects of the methodical system of physical education of the students of higher educational agricultural institutions, to introduce it into the educational process, and verify its efficiency. The methodical system of physical education of the students of higher educational agrarian institutions is included in the uniform system of pedagogical education and represents an integral formation which allows providing school and university students with special knowledge, vital motor abilities and skills, harmonious development of the forms and functions of an organism, good health, volitional, spiritual, and aesthetic qualities of the individual. Updating the methodical system of physical education of the students of agricultural educational institutions is essential to ensure the transition from traditional to the innovative educational process, aimed at developing practical skills and values of their own health and the health of others. The study was conducted at the Polissia National University in 2013-2019, and 369 students, including 195 males and 174 females took part in it. The evaluation of the effectiveness of the methodical system was carried out on the basis of the testing results of

the students' level of theoretical knowledge, motivation, and the amount of motor activity. Checking the effectiveness of the developed methodical system showed its greater efficiency in comparison to the traditional program of physical education at higher education institutions. The students (both males and females) of the experimental groups were recorded to have significantly ($p<0.001$) better indicators than the CG students, according to the following criteria: the level of theoretical knowledge about the role and importance of physical education in strengthening health, longevity, improving the working capacity, ensuring the efficiency of the future professional activities; the students' motivation to regular exercises and sports; the amount of physical activity of students while studying at university (physical education classes, independent classes, sports sections, morning exercises, etc.). The practical aspect of the study is determined by a comprehensive solution to the problem of introducing the methodical system of physical education, which ensures the achievement of the projected results in the discipline of Physical Education into the educational process of agricultural higher education institutions.
Keywords: methodical system, physical education, system approach, student.

1. Introduction

The modern system of physical education in Ukraine and other post-Soviet countries does not meet the natural biological needs of students in physical activity, does not provide students with the necessary level of health, physical fitness, working capacity, scientifically sound educational and health technologies that can be used later in life [1, 2, 3]. There is a contradiction between the student's needs for worldview, spiritual, cultural, intellectual enrichment and the need for physical improvement. To resolve the contradictions between the level of social requirements and the efficiency of pedagogical actions in the process of the students' physical education, various scientific studies, which are presented in fundamental works, have been conducted in Ukraine and in the post-Soviet countries [4, 5, 6, 7, 8, 9, 10]. The strategy for the implementation of these studies is obvious, but mechanisms for the further implementation of relevant results are not provided. Instead, there are only some reflections of the need to create a new methodical system of physical education in some studies [11, 12]. However, these studies were performed beyond the model of the methodical system of physical education of the students of higher education institutions (HEI).

The generalization of experience made it possible to identify a number of controversial issues to resolve:

- *at the conceptual level of modern education*, controversies between the objective need of society for competitive civic-minded professionals with the state of special professional and applied physical fitness, focused on the formation of the functional readiness of agricultural universities graduates to work in the agricultural sector; between the new social needs for training the specialists to provide the basics of fitness and health education of rural youth, their involvement in a healthy lifestyle and the underestimation of this process in the modern system of higher agricultural education;

- *at the level of determining the special physical fitness and health state of the future agricultural specialist,* controversial issues between the new requirements for the physical fitness and health state of future agrarians and the current state of their motivational and value-based attitude to a healthy lifestyle and performance of their professional duties; between the amount of theoretical knowledge, practical skills, the level of physical fitness and the constant reduction of the number of hours for the discipline of Physical Education; between the need to use innovative sports and health technologies of training in combination with traditional ones and the lack of teaching methods and equipment supply;

- *at the level of determining the motivational and value-based attitude of future agricultural specialists to their own health and the health of others*, controversies between the need for the purposeful formation of motivational and value-based attitude to health and healthy lifestyle and the lack of appropriate technologies.

The efficiency of the physical education system of agrarian students at the present stage of education development in Ukraine and other countries is determined by the adequate choice of goals and objectives, organizational forms, methods and means of teaching, and their rational combination. The focus on the innovative technologies of physical education leads to significant changes in its content and procedural components, determines the modernization of the traditional system of physical education, the development and modernization of a new methodical system, which serves as the theoretical and methodological foundation of the educational process. The development of a model of the physical education methodical system should be based on systemic and integral, personality-oriented, culturological, and other approaches

taking into account the specifics of the professional activity of future specialists and their readiness for an active life. The complex integrative nature of the concept of the methodical system of physical education of the students of agricultural universities determines the scientific search in terms of the methodological, theoretical, and practical aspects.

The leading idea of the study, the main provisions of the concept are concentrated in the general hypothesis that the methodical system of physical education of the students of agricultural universities as a synthesis of theoretical and methodological provisions, methodical and practical complexes, methods, techniques, and tools can ensure the readiness of future agrarians for the efficient capacity not only in the educational environment but also in the process of future professional activity. The general hypothesis is concretized in a number of partial hypotheses, the content of which is that a significant improvement in health, physical fitness, and working capacity of future agrarians is possible subject to the development of modern theoretical and methodical principles of physical education and the introduction of a new methodological system, the basis of which is the principle of fundamentality and fitness and health orientation into the educational process of agricultural universities. This leads to:

- bringing the content of physical education means of agrarian students in line with modern achievements of physical education, theory and methods of physical education and current needs of personal development;
- the integration of the traditional means of physical education and innovative ones that helps to increase the intensity and efficiency of the physical education process, as well as the intensification of fitness and health activities in extracurricular activities;
- the compliance with the principles of individualization and differentiation of physical activity, strengthening motivation and interest in active exercise, the implementation of personality-oriented approach;
- the diversification of the forms, methods, and means of engaging students in fitness and health activities;
- raising the level of fitness and health education, general and special physical fitness, improving health, acquiring skills of a healthy lifestyle that in general will ensure a high level of physical fitness and general life activities;
- engaging students in independent physical exercises and sports that contributes to the expansion of health potential, acquisition of new skills and motor abilities, physical development, and physical fitness.

Applying theoretical analysis, historical and logical methods of scientific knowledge, it is necessary to investigate the genesis, clarify the theoretical and methodological foundations and prospects for creating a methodical system of physical education of agrarian students. To this end, we conducted an analysis of the organization and management of the physical education system, which revealed the ideological, normative, scientific, methodological, and organizational foundations of the physical education development; determined the methodological, psychological, and pedagogical dimensions and valeological principles of physical education; revealed the role of the system approach in the educational process and formed the original definition of the content of the methodical system of physical education of the students of agricultural universities.

2. Literature Review

The functioning of the methodical system of physical education can be effective only if a systemic approach is used, i.e. a systematic analysis of physical education at schools and higher educational institutions, and systematic synthesis of the methodical system. On the basis of a systemic approach to the concept of teaching methods, in which all components of the educational process form a unity with certain internal connections, V. Zhamardiy et al. [12] defined the methodical system of education as a set of five hierarchically related components: learning goals, the content, methods, tools, and organizational forms of learning that form an integral functional structure focused on achieving learning goals. However, M. Nosko et al. [13] noted that the traditional methodical system is fruitful under conditions of the complete management of the educational process at the educational institution and its strict regulation, and the stability of curricula, full methodical support of subjects, which does not correspond to the current system of physical education in Ukraine nowadays. The educational process of physical education at HEI of Ukraine is characterized by instability, rapid development, and deterioration in some cases, so the concept of the

methodical system of education in the traditional form is inadequate to the situation of physical education and needs to be developed in accordance with the changes in the social, economic, scientific, and cultural spheres.

The creation of theoretical and methodological foundations for the construction of a methodical system of physical education requires the use of systematic and integrated approaches to the educational process. It is necessary 1) to identify the components of the system and find out their content; 2) to justify the need for the functioning of each component of the system; 3) to define system-forming connections; 4) to show the conformity of components within the system and the functional existence of the system.

Referring to the research of M. Nosko et al. [13], it is safe to say that the creation of a methodical system of physical education also requires mandatory consideration of the "teacher-student" and "student-teacher" relationship through modern approaches: systemic, complex, structural, activity, differentiated, individual, subject-subject, creative, competence, and personality-oriented. A technological approach does not allow the trial-and-error method: all the actions of a teacher must purposefully lead a student to a predetermined goal.

The theoretical basis for creating a methodical system of physical education is

1) the concept of the integrity of the educational health-improving process at educational institutions, which combines the actions of all levels (administration, academic council, sports club, student fraternity, and other structures and units of HEI), which contribute to the improvement of the educational and sports base; the preservation of physical education as a compulsory discipline; the introduction of innovative technologies of physical education; the implementation of extracurricular activities of fitness and health orientation (fitness programs of aerobic, power, and gymnastic orientation), the formation and education of the student's personality;

2) the concept of the educational, sports, health and fitness activities intensification among school and university students, which combines educational, extracurricular and independent classes and all sports and health-improving activities to develop motivation and interest of students in the increase of motor activity and a positive attitude to the means of physical education;

3) the concept of flexible pedagogical, psychological, physical education, medical and hygienic, life safety, environmental, organizational, and managerial health technologies.

Considering the set of components of the traditional methodical system of education [14, 15, 16, 17, 18] we can claim that they form a certain subsystem, called *a learning technology*. The key concepts of the methodical system of physical education are the didactic system, the system of physical education, and the methodical system of physical education. On the basis of this structure, it is possible to determine the *target, content, organizational, technological, and evaluation* components of the methodical system of education. The modern model of the methodical system of physical education can correspond to the principles proposed by N. V. Morze [19], adapted to the specifics of its operation, namely:

1. *The subjectivity of the model.* The model of the methodical system of physical education may include different sets of components that may be in a specific relationship with each other, which works only for this model. Thus, the methodical system may differ from other systems and have some unique features.

2. *The locality of the model*. Significant differences in the system of physical education in different educational institutions, the features of the educational process, and the infrastructure of educational institutions require the model of the methodical system to take into account not only differences in the educational process but also the peculiarities of its functioning in a particular educational institution. Thus, the improved model of the methodical system should take into account the local features of the educational process of a particular educational institution that is to predict the adjustments of the model that will be implemented in the educational process of another educational institution.

3. *The dynamics of the model.* The components of the methodical system of physical education are constantly developed; their connections that are conditioned by the development of the social and economic system are often changed. There is some instability in physical education especially in recent years: the number of hours in programs and curricula are changed, physical education is removed from HEI, low or high level of equipment supply that causes rapid changes in the content of the educational process, which affect the purpose, content, methods, means, and forms of education. Therefore, in the methodological system as a model of physical education, it is necessary to provide for the general development of the discipline, to identify components with possible developing content and restructuring structural relationships.

When designing a methodical system of physical education at certain educational institutions it is necessary to take into account that 1) the object of research is the system of physical education of students, and the methodical system is not the same, that is several systems can be distinguished in this object depending on research goals; 2) when separating out the methodical system of physical education, the problem under study is artificially singled out from the environment; 3) when separating a methodical system, it is necessary to clearly establish a) the components of the system, b) the components of its environment, c) significant (system-forming) connections between system components, d) significant connections with the environment; 4) each component (subsystem) can be considered as an independent system. It is necessary to realize and strictly comply with the chosen level of difference between them; 5) the high-quality functioning of the methodical system depends on the quality of its structural components, the nature of their relationships and relations between the system and the environment; 6) the introduction of a new model of the methodical system of physical education into educational institutions should not cause destructive changes in the modern education system, should preserve national achievements and historical traditions of education.

In addition, taking into account the study of other scientists [20, 21], when designing a methodical system of physical education one must take into account its specific features: *integrity* – the dependence of each component of the system on its place and functions in the system; *structure* – the functioning of the methodical system is conditioned not by the characteristics of its individual components but the properties of its structure; *interdependence* of the system and the environment – the system is formed and revealed in the process of interaction with the environment; *hierarchy* – each component of the methodical system can be considered as a system, and the methodical system itself is an element of a broader system (the system of physical education as a set of social and pedagogical subsystems); *the plurality of descriptions* – the complexity of each system and their adequate acquiring require the construction of different models, each of which describes only a certain aspect of the methodical system.

The process of designing and reforming the methodical system of physical education complies with fixed regularities [22].

1. *Regularities connected with the internal structure of the system* imply that the change of one or more of its elements necessitates a change in the whole system. For example, the appearance and widespread use of innovative health technologies of physical education expand the possibilities of organizing the educational process; revise the content, forms, and methods of teaching.

2. *Regularities of the external relations of the system* are determined by the fact that the methodical system of physical education operates in a certain social, economic, and cultural environment, which has a direct impact on its existence. Either all components of the system as a whole or its individual elements can be exposed to such influence. The greatest influence is directed at the main component of the methodical system – the aim of physical education. Therefore, it becomes clear that the methodical system of physical education is *a complex dynamic formation*. In addition, to record a particular component of the system and identify the dynamics of its change in the educational process (physical education system), it is necessary to settle on such a fixed component as *the aim of physical education* as the most specific and clearly defined element.

The methodology of physical education implements a developed modern theory of studying the process of physical education, aimed at the formation of various motor actions as a consistent transition from knowledge and ideas about actions to the ability to perform them, and then to skills [22]. The process of teaching motor actions is based on *didactic principles* – the basic regularities of teaching, which constitute the methodical basis of the pedagogical process, in particular, these are the principles of consciousness and activity, clarity, accessibility, individualization, systematicity, and consistency. The organization of the educational process should begin not with the communication of knowledge (ready scientific information) but with the identification of subjective experience of students, the content of which consists of the following components: environment, formed ideas and concepts; techniques, actions, methods; formed values, emotions, attitudes and styles of activity.

The analysis of literature sources showed that there is no comprehensive research aimed at modernizing the methodical system of physical education of the students of HEI nowadays. In Ukraine and other countries, the problem of updating the methodical system of physical education of the students of agricultural universities has not been developed enough. At the same time, physical education as a

discipline allows solving educational and health-improving problems, which are able to provide a balanced pedagogical impact on a student in accordance with the modern requirements of creative, intellectual, morally stable, and physically perfect personality.

The aim of the study is to substantiate the theoretical and conceptual aspects of the methodological system of physical education of the students of agricultural higher educational institutions, to introduce it into the educational process and verify its efficiency.

3. Method

To achieve the aim of the study, we organized a pedagogical experiment. The main pedagogical experiment was carried out at the Polissia National University in 2013-2019. Sixteen groups of students (369 students, including 195 males and 174 females) of economic, agronomic, ecological, agricultural management, technological faculties, and the faculty of agricultural mechanization. All students were divided into control and experimental groups by the method of even distribution. Thus, the experimental groups included 188 students (105 males, 83 females), the control groups involved 181 students (92 males, 89 females) respectively. According to the schedule, physical education classes in all groups were held once or twice a week in the first half of the day. The purpose of the experiment was to substantiate and introduce the methodical system of physical education of agrarian students into the educational process of the students of experimental groups. The students of the control groups were training according to the curriculum of the Physical Education discipline which is traditional for the higher education institutions of Ukraine of III-IV accreditation levels. The evaluation of the methodological system efficiency was carried out on the basis of the testing results of the students' level of theoretical knowledge, motivation, and the amount of motor activity.

Theoretical knowledge of students was tested by the original questionnaires, which contained 20 questions and were aimed at clarifying the students' understanding of the role and importance of physical education in strengthening their health, increasing longevity, improving performance, and ensuring the effectiveness of the future professional activity. The motivation of students for regular physical exercises and sports was studied according to the method of "Educational activity motives'' by A. Rean, V. Yakunin in the original modification. The amount of the students' physical activity while studying at the university was investigated by an interview method in order to determine the time devoted to physical activity of students during the week activities (physical education classes, independent classes, sports sections, morning exercises, sports events, other types of physical activity).

Research methods:

- *theoretical:* 1) the method of conceptual and comparative analysis, which compared the existing theoretical approaches to solving the current issues of the physical education system at HEI, generalizing philosophical, methodological, psychological, pedagogical, and educational literature, archival materials, innovative experience, and many years of teaching experience;

2) the method of structural and systemic analysis allowed to systematize and generalize information about the studied object and create a model of the methodical system of physical education of the students of agricultural universities and identify patterns and features of its functioning on the basis of quantitative and qualitative analysis of the pedagogical experiment;

3) the method of modeling, on the basis of which the theoretical principles of the educational and health-improving process of physical education were substantiated and introduced in higher agricultural education institutions of Ukraine;

- *empirical:* questionnaires and surveys, pedagogical observations, testing, self-assessment, and module-rating assessment were used to confirm the importance of factors that determine the features and trends of physical education at HEI and to diagnose theoretical knowledge, motivation, and motor activity of agrarian students;

- *pedagogical experiment* (summative and formative) was carried out in order to test the efficiency of the developed methodical system of physical education of the students of agricultural universities;

- *the methods of statistical data processing* were used for the correct processing of the obtained results and displaying them in tabular forms.

4. Results and Discussion

Physical education can give the expected results only when it is carried out according to a certain model with the right choice of methods, tools, and forms of the educational and extracurricular processes organization that accurately meet the goals and objectives of society in this area. The study of these components allowed developing an appropriate methodology that makes it possible to solve problems purposefully and obtain reliable results. The presented methodology is the doctrine of the scientific method of cognition as a system of scientific principles on which the research is based and a set of its cognitive means, methods, and techniques is selected. To develop the research *methodology,* the systematic approaches of social sciences, pedagogy, psychology, the theory and methods of physical education, the principles of systematic approach and functional systems, the theoretical provisions of pedagogical research were used, which allows considering the methodical system of physical education of agrarian students as an opened methodical system which has many interconnected and interdependent components. The elements, connections, and components of the methodical system are influenced by environmental factors, the quality of life, the system of pedagogical influences, which should correspond to the gender, age, functional abilities of students, and their interests and preferences.

In addition, different volumes of educational activities at agricultural universities, different staff and equipment supply, educational process features, the ambiguity of the investigation results of the student's personality, etc. require theoretical and methodological substantiation of physical education and the use of a set of modern methods, mutually verifying and complementing, adequate to the nature of the process of physical education study at different educational institutions.

The characteristic features of the newly created methodological system of physical education include:

- scientifically sound planning of the physical education process;
- the unity and interrelation of theoretical, methodical and practical training of students;
- high but accessible level of difficulties in classes, fast and high-quality acquirement of the technique of performing exercises and mastering of a technique of their improvement;
- maximum activity and independence of students during classes;
- a combination of individual and collective fitness and health activities of students;
- providing the educational process with sufficient quantity and quality of technical and sports equipment;
- extensive use of innovative technologies of physical education.

The methodical system of physical education functions only when the aim, tasks, methods, forms, and means of training and the content of the educational process are defined, and educational activity is managed. The aim and objectives of physical education are developed by a teacher for each class. The content of the educational process is determined by the curriculum and adjusted by a teacher depending on the aim and objectives of classes. The planning of the physical education process at agricultural HEI is a complex set of actions of the administration, academic council, educational and methodical center, the department of physical education, dean's office, sports club, teachers, which influences the number of hours, time and place of training and independent classes. Control, analysis, and adjustment of the educational process are carried out by a teacher, the head of the department, the dean's office, rector's office, and the Ministry of Education and Science of Ukraine.

The conception requires taking into account all the variety of possible connections and relationships of the subject of research to build a scientifically sound theory. There is a close dialectical connection between the theory, methodology, and technology of teaching. Thus, the theory of physical education teaching reveals the patterns of the developmental nature of the educational process, related to the peculiarities of the activities of a teacher and a student, the functioning of the methodical system of physical education, which is based on development goals. On the other hand, one of the main aspects of physical education, as well as any other pedagogical process, is teaching, which didactics considers as a process of interrelated activities of a teacher and a student, aimed at acquiring theoretical knowledge, practical skills, the development of physical, mental, and spiritual qualities of students. In physical education, the modern scientific approach assumes that the methodological basis of the theory of motor actions teaching are the laws and positions of such sciences as didactics (in the field of pedagogy), the theory of activity and knowledge management, the formation of actions and concepts (in the field of psychology), the theory of construction and control of movements, physiology of activity, principles of the system approach.

Thus, the activation of the physical education process is based on practical experience, theoretical, conceptual, and operational components of achieving the objectives, and is carried out taking into account the personal factors of the educational process. The personal position of the subjects (student-teacher) of educational and pedagogical activities is the factor that makes it possible to solve the problems of creating a new methodical system of physical education of agrarian students.

The modern agricultural sector's need for specialists who are ready not only for professional self-development but also for the restoration of rural labor resources requires the creation of flexible, adaptive education systems that provide opportunities for the reorientation of professional activities towards the activities that ensure a high standard of living. Therefore, it is necessary to form a system of knowledge, skills, organizational qualities, to develop the ability to build an individual strategy of physical education, motor activity, motivational and value-based attitude to a healthy lifestyle, recovery system, the ability to use the means of physical education for the rehabilitation of physical and mental condition after diseases, etc in the physical education process of the future agrarian specialists. Therefore, the graduates of an agricultural university must not only master high professional skills but also find their place in the social environment of the rural population, have certain personality traits, and be an example in the production team and the place of residence.

Accordingly, personality-oriented education, in which a student is in the center of the teacher's attention, serves as the strategic direction of methodical system development. In this case, the learning activity is a cognitive activity but not teaching. The traditional paradigm of teaching "*teacher-student*" should be replaced by the paradigm "*student - physical and health-improving environment - teacher*" in physical education. This is how the system of physical education is built in developed countries. Obviously, there should be a number of intermediate links between theory and practice, and one of them is learning technology, which is a projection of learning theory on the activities of teachers and students. That is, learning technology is associated with the optimal construction and implementation of the educational process, taking into account the guaranteed achievement of didactic goals. This statement is key because determining the most rational ways to ensure the achievement of goals is the main idea of the educational process technologization. Thus, the technological approach involves the educational process design which ensures the achievement of didactic goals arising from the initial settings (social order, educational guidelines, purpose, and content of education). Therefore, the technology of learning reveals conditions of the methodical system functioning, defines the ways of its realization (designing) in the educational process according to the set purpose.

The innovative original idea of the conception is to create a methodical system of physical education, which helps to increase the educational health-improving, motivational and value-based attitude of young students to the means of physical education and physical activity by creating a microenvironment at HEI, which develops interests and motives for active physical activity, encourages to have a healthy lifestyle, forms a positive attitude to the physical education process. In addition, the idea of the conception is aimed at improving the efficiency of the educational process by differentiating teaching aids and individualizing styles of work with students in order to create equal comfortable conditions and mobility of stylistic behavior studying the discipline of Physical Education.

The goals and objectives of the methodical system of physical education require the use of a system of *general didactic and original principles and the principles of teaching,* modified for physical education, namely:

- *integration* – the essence of this principle is that it systematically integrates all components of the methodical system, as well as reveals its interaction with the environment. It is manifested at several structural levels: between the general physical and methodical readiness of students; between the aim of training and the mechanism of its implementation; between all blocks of the methodical system. A methodical system can reveal its system properties only if its constituents interact on the basis of the integrating bases system. In the theory and methodology of physical education, the principle of integration was not considered, so it is original and innovative for the methodical system of physical education;

- *cultural conformity*, which is a process of personality formation on the basis of universal, aesthetic, and spiritual values of physical culture and sports, Ukrainian folk traditions, and respect for the historical heritage of other countries and peoples. Culturological approach in the physical education of the students of agricultural universities is one of the determining factors in increasing the social activity of the future

specialist as a highly cultured person, capable of implementing a healthy lifestyle and promoting physical culture and sports in the social infrastructure of the village;

- *support of health and fitness initiatives*, which is manifested in the successful development of motivational and value-based attitude to active physical activity, the individual choice of content and forms of training;

- *variability and alternativeness*, aimed at achieving the goals of the educational process at HEI (developmental, educational, upbringing), for which it is necessary to apply a variety of approaches and methods that are theoretically justified and tested in practice. The variety of forms, methods, teaching aids, the communicative side of education allows teachers to be constantly engaged in creative search in order to form their own pedagogical activities, original didactic system;

- *differentiation* - this principle reveals the mechanism of developing the systems of different levels and ranks, from primary integrity to intra-differentiated structures. The principle of differentiation substantiates the implementation of the methodical system on the basis of development laws and system analysis. It makes it possible to view the efficiency of the methodical system of physical education in the event of complications and differentiation into the subsystems of lower levels, maintaining its integrity;

- *optimality*, which implies the development of such norms and requirements, which in the case of their application in the process of physical culture and sports activities, provide the optimal cost of funds and resources with a high health-improving effect;

- *independent actions* (physical education classes without external coercion, bringing pleasure and joy);

- *self-organization* (the formation of operational and activity component of the educational process, based on the ability to exercise independently);

- *development,* which involves the organization of the educational process in the area of immediate development, in cooperation of a student with a teacher, taking into account the level of physical development, physical fitness, and health, in accordance with the achieved level of current development;

- *responsibility* (self-analysis, self-control, and self-assessment of educational activities, recording of sports results and their analysis and evaluation);

- *individual approach* (taking into account individual psychological characteristics, the level of physical fitness of each student in the educational process);

- *the principle of personal development in the team*, according to which the personal development of a student is determined by the activity-mediated type of relationships developed in study groups, in a specially organized environment, when a group of students becomes the main reference group with the common purpose, united by socially significant goals and personally meaningful content, with intentions for educational or training activities, achieving certain sports results, winning group competitions, joint health-improving activities, etc.

Pedagogical conditions for the effective functioning of the methodological system (educational strategies, innovative technologies, methods, tools, conditions, activities evaluation) supplement the conception with the original vision of prospects and opportunities for its further development, determine its place in the educational system, and its adaptation to real conditions of the system of pedagogical relationships and interactions. The conditions for the formation and development of the methodical system of physical education of the future agrarians should be divided into three groups: *external conditions* that create an active fitness and health-preserving environment that ensures the development of the system; *internal*, which depend on the student's potential (motivation, individual psychological qualities, physical fitness level, health status, etc.); *material and technical* (the availability of sports facilities and equipment), which create comfortable conditions for physical education classes, organizing health and fitness activities of students.

The features of the conception realization in the process of physical education are carried out under certain conditions. The conception implementation in the physical education process is carried out in several directions. *The psychological direction* implies taking into account the students' individual psychological and typological qualities, styles of activity in the process of physical education. The methodologies designed for an average student can not meet modern requirements for the physical development and physical fitness of the future agricultural specialists. Therefore, the intensification of the learning process, its efficiency are directly dependent on the study, development, and implementation of differentiated and individual techniques and forms of work with students. Searching for the ways to individualize the process of physical education, the criteria that reveal the individual characteristics of students come to the fore. These features

can be both of a group nature and purely individual for each student. In this regard, the presentation of the educational material took place in different forms according to the psychological characteristics of students.

Organization of the system of classes. Traditional forms of physical education classes are lectures, practical, individual, and independent classes and consultations. The predominant method of presenting the material in lectures is informative. It is based on the formation of the students' need to master the system of knowledge in the field of physical culture and to achieve the general goal - the technology of physical education. To be *a subject of educational activity* means, firstly, to treat it with value; secondly, to master cultural ways of its realization; thirdly, to be able to set goals independently, to plan their achievements, to evaluate results.

Therefore, we can conclude that to teach students to acquire knowledge, skills, and abilities of motor activity, to improve their physical condition on their own, to maintain health, to be a subject of fitness and health activities and mass sporting events, to follow the principles of a healthy lifestyle, to form a universal ability to actively implement these principles in life is the main goal of the methodical system of physical education. To achieve this goal it is necessary to identify the main factors that contribute to its implementation under conditions of the modern educational process. The process of mastering information has three aspects: *conceptual* (understanding the importance of physical culture, its structure, and functions); *categorical* (mastering the conceptual apparatus and definitions of the main categories), and *gnoseological* (mastering the principles and methods of cognition). In the technology of educational and cognitive activities, various forms of abstract thinking are used: concepts (selection of features), judgments (assertion or denial of the subject's properties), and conclusion.

The main form of physical education classes is practical classes that implement the section of the Physical Training program. Practical classes also provide information material. The newly created methodical system of physical education implies forms of learning that dictate the relationship between a teacher and students in terms of solving educational problems. These relations determine the consideration of frontal, collective, group, individual, and joint forms of studying. The joint form of education is characterized by the relationship between a teacher and students, between students of different courses and faculties within the general subject or training. Individual forms of education are based on quantitative characteristics of students (the level of volitional development, physical fitness, health status, anthropometric data, etc.).

The realization of the general purpose of physical education of the students of agricultural universities should be carried out on the basis of the created methodical system, directed on solving a complex of tasks that should provide sufficient educational level, necessary motivational and value-based attitude to physical culture and a healthy lifestyle, harmonious development of the organism, high physical efficiency, and steady need for physical improvement in the process of further life after graduation. Solving the system of pedagogical tasks involves three implementation stages. The principle of multilevel presentation of educational material in physical education forms fundamental knowledge, skills, and professionally-applied psychophysical qualities and organizational abilities of students.

At the first stage (adaptive, the 1st year of study) the solution of the following fundamental pedagogical tasks is provided:

- adaptation to the educational process (intensive mental activity) at HEI and activation of the students' mental processes speed by means of physical education;
- developing students' stable interest, motives, positive attitude and need for motor (physical) activity;
- an increase in the general level of physical fitness, the development of physical abilities, reserve functional capabilities of the body, health improvement, promotion of comprehensive development;
- formation of knowledge on a healthy lifestyle and involvement in independent physical exercises, active leisure;
- mastering the skills and abilities of life safety in the field of physical culture and sports.

At the second stage (achievement of comprehensive development, the 2nd year of study) the solution of the following pedagogical tasks is provided:

- developing students' socially significant qualities;
- the use of various forms of physical education and mastering health programs;
- mastering innovative technologies of physical education;
- the formation of professionally applied psychophysical qualities.

At the third stage (forming the need for a healthy lifestyle, the 3rd-4th years of study) the solution of the following pedagogical tasks is provided:

- harmonious development of an organism and a significant increase in physical performance;
- developing students' stable need for physical self-improvement, self-cognition, and self-assessment;
- defining a system of physical exercises or a sport to create a system of personal physical improvement;
- the acquisition of skills and abilities to conduct independent training and health-improving activities, dosing of physical activity;
- gaining experience to use physical culture and sports activities to get professional and life skills and qualities;
- mastering the methodology of organizing and conducting mass sporting events and fitness and health activities in the social infrastructure of the village.

At this stage, the principle of professional orientation and designing of the educational material content were carried out to use in future professional activities, taking into account the chosen specialty. On the basis of approaches and the state of the developed concept of the methodical system of physical education of agrarian students, we can state that 1) it should be formed according to a block-hierarchical principle and motivationally purposeful, organizational, content, procedural, activity, and diagnostic components; 2) it must be built on the basis of the integration of innovative, competency, activity, modular, and differentiated approaches that contribute to the formation of students' comprehensive readiness; 3) methods, forms, and means that create a methodical system may be traditional but should correspond to the methodical orientation of the educational process and be supplemented by innovative fitness and health technologies.

In order to identify the effectiveness of the methodical system of physical education of future agrarians, we identified the criteria that indicate the level of health and fitness readiness of young students. The efficiency of the methodical system model is assessed by specific indicators that increase the effectiveness of the physical education process. The conducted pedagogical experiment showed that the level of theoretical knowledge of students who studied according to the new methodical system had a clear dynamics of growth during the study period. In addition, the level of theoretical knowledge of students in the experimental groups was significantly better throughout the period of experimental training. The traditional system of physical education does not contribute to the effective acquisition of theoretical knowledge in the field of physical culture, which in the future negatively affects the attitude of students to physical education. The difference in the experimental and control groups at the end of the experiment was 5.38 points for males and 6.15 points for females (Table 1). The acquired knowledge allowed students of experimental groups to understand the natural and social processes of physical culture better, to be able to use them for professional and personal development, self-improvement, healthy lifestyle, leisure, professional and socio-cultural needs.

Table 1. *The indicators of the theoretical knowledge general assessment after the introduction of the methodical system into the physical education process (in points)*

Gender	Experimental groups	Control groups	Difference	Difference significance	
	X □ m	X □ m	ΔX□□	t	p
Male	20.12 □ 1.43	14.74 □ 1.09	5.38	4.39	□0.001
Female	19.93 □ 1.12	13.78 □ 1.27	6.15	4.86	□0.001

The study of the students' motivation for fitness and health activities was carried out by surveying students that determined four levels of motivation. The first level included students who were characterized by a small number of positive motives. The second level included students who were aware of the importance of physical culture and sports for the life of a modern individual. The third level was characterized by students' sense of duty, cognitive interests, motives, and needs for physical education. The fourth level of motivation was characterized by a deep awareness of the necessity of physical education,

certain goals, and specific practical ways of achieving them. The introduction of the methodical system into the educational process of the students of experimental groups radically changed their attitude to physical culture, contributed to the formation of motivation for fitness and health activities (Table 2). The study of the dynamics of motivation formation in the process of physical education showed a significant increase in the number of students with the fourth level of motivation from 6.7 % to 17.7 % in the experimental groups. The increase in the number of students who reached the third level of motivation from 18.1 % to 23.9 % was also noticeable due to a significant decrease in the number of students with the first level from 20.0 % to 7.3 %, i.e. due to those students who were not interested in physical education. The number of female students with the third and fourth levels of motivation increased from 10.9 % and 3.6 % to 22.1 % and 14.3 % respectively.

Table 2. *The dynamics of the agrarian students' formation of motivation for health and fitness activities*

The level of motivation	Experimental groups				Control groups			
	Initial		Final		Initial		Final	
	Number of people	%	Number of people	%	Number of people	%	Number of people	%
Males								
First	21	20.0	7	7.3	18	19.6	14	16.7
Second	58	55.2	49	51.1	53	57.6	46	54.8
Third	19	18.1	23	23.9	16	17.4	17	20.2
Fourth	7	6.7	17	17.7	5	5.4	7	8.3
Females								
First	23	27.7	11	14.3	25	28.1	19	24.4
Second	48	57.8	38	49.3	54	60.7	47	60.3
Third	9	10.9	17	22.1	8	9.0	10	12.8
Fourth	3	3.6	11	14.3	2	2.2	2	2.5

Note. The number of students does not match in the "initial" and "final" indicators owing to their expelling from the university.

The indicators of motivation for health and fitness activities were increased due to the introduction of the methodical system in the educational process that activated the internal motivation of the students of experimental groups. In the male control groups, there was a slight increase in the number of students with the third and fourth levels, and in the female groups, there were almost no significant changes. The obtained data allow us to state that the motivation for physical culture and sports of students can be successfully formed in the physical education process, carried out according to the new methodical system.

The research also confirmed that only purposeful methodical work on the formation of motivational and value-based attitude to the physical education process and the means of physical culture and sports contributes to the activation of the motor activity of young students. Experimental data show that the traditional system of physical education is not able to cause significant changes in the structure of the students' budget of time in favor of physical activity. The comparison of the time spent by the students of control and experimental groups on educational and independent physical exercises, sports training, mass sporting events, fitness and health activities, morning hygienic gymnastics, etc. indicates a huge gap between groups (Table 3). The students of experimental groups miss fewer physical education classes, attend classes in sections and groups of physical training more often, pay more attention to the implementation of morning hygienic gymnastics and sports events held at the university. Accordingly, such differences in the

time spent on physical activity encourage students of experimental groups to successful physical culture and sports activities and a positive result in physical education.

Table 3. *Weekly physical activity of agrarian students as a result of the introduction of the methodical system of physical education (in h, min)*

The types of physical activity	Groups	The year of study								Average data	
		1st		2nd		3rd		4th			
		time	%	time	%	time	%	time	%	time	%
Scheduled classes	exper.	2:51	1.70	2:54	1.73	2:49	1.68	2:46	1.65	2:50	1.69
	contr.	2:45	1.64	2:39	1.58	2:31	1.50	2:14	1.33	2:33	1.52
Independent extracurricular classes	exper.	2:16	1.35	2:43	1.62	3:32	2.11	3:36	2.15	2:57	1.76
	contr.	2:04	1.23	2:18	1.37	2:06	1.25	3:47	2.26	2:44	1.63
Training in sections, groups	exper.	3:21	2.00	4:07	2.45	3:44	2.23	3:41	2.20	3:54	2.33
	contr.	2:34	1.53	2:48	1.67	2:30	1.49	1:52	1.12	2:16	1.35
Morning exercises	exper.	0:54	0.54	1:51	1.11	1:48	1.08	1:43	1.03	1:26	0.86
	contr.	0:43	0.43	0:56	0.56	1:13	0.73	0:52	0.52	0:56	0.56
Sports events	exper.	0:21	0.21	0:29	0.29	0:35	0.35	0:31	0.31	0:29	0.29
	contr.	0:18	0.18	0:15	0.15	0:18	0.18	0:14	0.14	0:17	0.17
Fast walking	exper.	2:26	1.45	2:19	1.38	2:24	1.43	2:37	1.56	2:27	1.46
	contr.	2:38	1.57	2:47	1.66	2:53	1.72	3:09	1.88	2:52	1.71
Other physical activity (dancing, physical work)	exper.	1:15	0.75	1:38	0.98	1:47	1.07	1:56	1.15	1:39	0.99
	contr.	1:27	0.87	1:46	1.06	2:03	1.22	2:18	1.37	1:54	1.33
In total	exper.	13:24	7.98	16:01	9.54	16:39	9.91	16:50	10.02	15:46	9.36
	contr.	12:29	7.43	13:29	8.03	13:34	8.08	14:26	8.60	13:32	8.06

The improvement of the methodical system of physical education should also take into account that any change in one of the components of the system will inevitably affect others. Therefore, when improving the methodical system, it is necessary to follow *the principle of interconnectedness*, which requires a clear establishment and consideration of the consequences of changes in the individual elements for all other components. The principle of interconnectedness is supplemented by the requirement to consider all interconnections in the system, i.e. compliance with *the principle of completeness*. This principle requires paying attention to each component while improving the methodical system of physical education. These principles are projected into specific guidelines aimed at improving physical education at educational institutions.

5. Conclusions

The implementation of theoretical and conceptual aspects of creating a methodical system of physical education for the students of agricultural higher education institutions is the result of theoretical generalization of specific pedagogical and methodical material, which is obtained by defining and developing specific content of the methodical system and its components, namely:

- the concept of the methodical system of physical education of the future agricultural specialists, which contains theoretical and methodical basis, original idea, conceptual and methodical design, the system of principles, pedagogical conditions of the methodical system functioning, as well as features and the ways of realization of the concept, was developed and substantiated;
- the principles of integration between physical and methodical training, variability and alternativeness, differentiation and individualization, optimality and self-organization of students' education on the basis of a pedagogically balanced and relevant combination of the means, methods, and forms of methodical preparation were revealed;
- the content of the physical education process and a system of educational and methodical complexes for agricultural HEI were developed;

- the establishment and development of fitness and health education at agricultural HEI of Ukraine and foreign countries were analyzed;

- the conceptual bases and scientific theoretical conditions of designing, functioning and development of the methodical system of physical education of the students of agrarian universities were improved; the methodical support for the effective realization of the methodical system of physical education was created; the realization stages of solving pedagogical tasks in physical education were revealed;

- the physical education organization of agrarian students, the structure and content of the process of physical education at agricultural HEI, the ways to integrate classical physical education means with innovative ones were further developed, the pedagogical technologies of improving the process of physical education at agricultural universities were introduced.

The check of the efficiency of the developed methodical system showed its greater efficiency in comparison to the traditional program of physical education at HEI. The students (both males and females) of the experimental groups were recorded to have significantly ($p<0.001$) better indicators than the control group students, according to the following criteria: the level of theoretical knowledge of students about the role and importance of physical education in strengthening their health, longevity, improving the efficiency, ensuring the effectiveness of their future professional activities; motivating students for regular exercise and sports; the amount of physical activity of students while studying at the university (scheduled classes, independent classes, sports sections, morning exercises, etc.).

The theoretical significance of the study lies in the conceptual substantiation of the need to improve the methodical system of physical education on the basis of a rational combination of traditional and innovative forms of organization, methods, and tools of the educational process; in expanding scientific ideas about the content and structure of the educational process; in determining the principles of designing the structure and content of the methodical system. The physical culture and health competence of an agrarian are considered an integrative multifactorial state of the specialist, characterized by gnostic, designing, engineering, modeling, technological, communicative, organizational knowledge, skills, and abilities that ensure high standards of living.

The practical aspect of the study is determined by a comprehensive solution to the problem of introducing the methodical system of the students' physical education, which ensures the achievement of the projected results in the discipline of Physical Education, into the educational process of agricultural HEI.

The prospects for further research are aimed at developing physical education curricula, lecture courses, and practical classes for the students of HEI of sports orientation in the course of professional development of teaching staff, writing manuals and textbooks on the problems of training specialists in physical education.

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ACTN3 R577X Polymorphism Does Not Influence Explosive Leg Muscle Power in Elite Turkish Volleyball Players

Esin Ergin[1*], Nurten Dinc[2], Selda Bereket Yücel[3], Fatma Taneli[4] and Burak Durmaz[5]

[1]Assistant Professor, Aydın Adnan Menderes Univesity, Sports Science Faculty, Department of Movement and Training, Aydın Turkey.*

[2]Associate Professor, Manisa Celal Bayar Univesity, Sports Science Faculty, Department of Movement and Training, Manisa Turkey.

[3]Professor, Marmara Univesity, Sports Science Faculty, Department of Movement and Training, İstanbul Turkey.

[4]Professor, Manisa Celal Bayar Univesity, Medicine Faculty, Department of Biochemistry, Manisa Turkey.

[5]Associate Professor, Ege Univesity, Medicine Faculty, Department of Genetics, İzmir Turkey.

Abstract

The aim of the present study was to evaluate the relationship between explosive power and ACTN3 R577X polymorphism among elite women volleyball players. Voluntary participants (20.88±3.20 years, 172.72±9.34 cm, 61.79±10.08 kg, 20.70±2.21 kg/m²) including elite Turkish women volleyball players (n=72) and nonathletic university students (n=99) were included in the study. Venous blood samples were collected before the jump tests. After anthropometric measurements were obtained, subjects performed static vertical jump and counter movement jump to evalute explosive power performances. ACTN3 R577X polymorphism analyses were assessed on the blood samples in order to evaluate the genotypic frequencies of the ACTN3 R577X genotypes differed between groups. There was no statistically significant difference on ACTN3 R577X polymorphism groups' genotype distribution in the study groups. The genotype distribution was similar for both volleyball players and the nonathletic university students (p= 0.77). Moreover, there was no statistically significant difference for vertical and counter jump results on ACTN3 R577X polymorphism RR, RX and XX genotypes for volleyball players and the nonathletic university students. As a conclusion, the findings of the study reveal that ACTN3 R577X polymorphism has a key role in explaining individual phenotypic differences in muscle strength, but not affecting volleyball performance singly at least for elite Turkish women volleyball players. In addition, it is believed that this polymorphism are not strong enough to be predictive or/and utilized seperately as a talent identification factor in volleyball.

Keywords: ACTN3, Volleyball, Explosive power.

Introduction

In recent years, there have been an increasing number of genetic variants associated with athletic phenotypes (1). One of the important genes observed in elite performance is the α-actinin-3 (*ACTN3*) gene, which is especially observed in Type II muscle fibrils with strong explosive contractions such as fast rallies of volleyball (2). In the literature, the most important physiological parameter in the implementation of high volleyball technical skills such as spike, block, etc., has been reported to be the vertical jump height which is mainly depend on muscle fibril type. It is reported that muscle fiber types and resultant expolosive strength's effect on the volleyball performance are 40% and 67%, respectively (3,4).

Polymorphisms such as *ACTN3* R577X are likely to explain at least some of the individual differences in volleyball performance. Theoretically, *ACTN3* R577X polymorphism is critical factor in muscle strength and strength has a key role in explaining individual phenotypic differences in volleyball performance. Four genes for *a*-actinin are found in humans: (1) *ACTN1,* (2) *ACTN2,* (3) *ACTN3*, and (4) *ACTN4*. While *ACTN1* and *ACTN4* are non-muscle proteins (5), *ACTN2* and *ACTN3* are important structural components of Z-disks that help preserve the myofibrillar sequence in skeletal muscles (6,7). These α-actinins constitute the predominant protein structure of the sarcomeric Z-line by providing muscle contractile structure with cross-structure and actin-forming fine filaments (8,9). α -actinin-2 and α-actinin-3 have 80-90% similar properties (9). While α-actinin-2 is found in all skeletal muscle fibrils, α-actinin3, an actin binding protein encoded as *ACTN3*, is restricted to fast-contracting glycolytic type II muscle fibril types, which are responsible for rapid power generation as contained in the volleyball technical elements (2,7,9,10,11,12,13,14,15). *ACTN3* gene, is 16,934-bp long (16) located on the chromosome 11q13.2 (14,15,17) and contains 21 exons and 20 introns (18). The a-actinin-3 (*ACTN3*) gene is responsible for changing of the C nucleotide by T in the position/1.747

of the exon 16, resulting in a mutation in the conversion of the arginine amino acid in a premature stop codon at the 577 residue, R577X, rs1815739, (7, 12,19,20) and single nucleotide polymorphism (14).

ACTN3 gene rs1815739 polymorphism nomenclature is based on the amino acid symbols. The CC genotype is most often called RR; while the truncated TT genotype, which encodes a premature stop codon, is called XX (21). *ACTN3*, a decisive factor for high-rate contractions and high-power production, is divided into three genotypes: (1) RR, (2) RX and (3) XX [17] . The nonsense allele (X) produces no detectable *a*-actinin-3 protein. Although it is well known that this variant, which leads to *a*-actinin-3-protein deficiency, does not cause any muscular functional impairment, there are numerous studies confirming positive association between high power muscle contractions and the presence of the R allele (2,16, 22). X allele homozygotes are deficient in the *a*-actinin-3-protein, which is associated with a lower fast-twitch fiber percentage, but does not result in disease. The XX genotype frequency differs across ethnic groups, with approximately 25% of Asians, 18% of Caucasians, 11% of Ethiopians, 3% of Jamaican and US African Americans, and 1% of Kenyans and Nigerians have the XX genotype (23). Some have indicated that the X allele distribution provides better endurance performance (19, 24, 25,26,27), while others have indicated a positive relationship between the R allele and muscle contraction at higher speed (24,25,26). These findings suggest that *ACTN3* RR genotype is associated with power performance in comparison with XX genotype (28). On the other hand, several studies reported that the muscle strength values reached by participants with the *ACTN3* RR and RX genotypes were higher than the values attained by the XX genotypic participants, which might be postulated to contribute to endurance performance (11,12,29). In addition to these results, some studies in the literature did not find any significant difference between the performance test results of RR, RX and XX genotypic participants (3,13,30,31,32).

Nevertheless, there are no studies investigating the relationship between *ACTN3* allelic distribution and strength performance in Turkish women volleyball players. That is why, the main aim of this study is to determine "the relationship between *ACTN3* R577X polymorphism and explosive power performance among elite Turkish women volleyball players. The secondary purpose of this study is to compare genetic polymorphism in regard to explosive power of volleyball players with the peer nonathletic University students.

Methods

Participants

The present study employed of 72 women elite volleyball players (22.36±4.2 years, 180.10±7.0 cm, 66.91±8.8kg, 18.93±4.4 kg/cm^2) who were competing at the highest stages of Turkish Volleyball Leauges. 14% of the volleyball players were also the members of Turkish National Volleyball team. Ninety-nine healthy nonathletic participants (19.81±1.3 years, 167.35±6.8 cm, 58.07±9.3kg, 20.70±2,5 kg/cm^2) were university students at Aydin Adnan Menderes University of Turkey, department of nursing and faculty of communication. All participants completed a medical history inventory form and signed the informed consent form that explained the objectives and risks of the study. None of the participants had a history of neuromuscular injuries and/or cardiovascular disease.

Antropometric and Muscle Expolosive Strenght Assesments

Body mass and fat free mass (FFM) were measured using Tanita Bioelectrical Impedance analyser (Tanita MC- 780 MA, tanita C.O. Tokyo-Japan). The vertical (VJ) and counter movement jump (CMJ) were assessed by using Newtest Powertimer 300-Series device (Finland), "matt" connected to the device and computer program, to evaluate leg muscle ability to produce explosive power. Both tests were performed three times and the best score was retained. The VJ tests were performed without rebound or previous counter movement. Participants kept both hands on the hips and trunk straight before and during the jumps. Before the jumps, they reached 90˚ of knee flexion angle for approximately 1 s and during the jumps, they could not perform hip or knee flexions. For the CMJ tests, Participants started from a standing position, with trunk straight, legs extended and both hands on hips and performed a vertical jump with a prior fast counter movement allowing 90˚ knee flexion.

Genotype Assessment

Venous blood samples were obtained from all subjects to assess *ACTN3* R577X gene polymorphism by the polymerase chain reaction (PCR). Blood samples with EDTA anticoagulant (2 ml) were obtained from all subjects before doing the jump tests. PCR was performed in order to amplify the sequence containing the mutation. Genomic deoxyribonucleic acid (DNA) was extracted from the venous blood samples manually, using the commercial kit (PureLink genomic DNA, Invitrogen). Concentration and purity of DNA samples were assessed spectrophotometrically at absorbances (A) 260 nm and 280 nm. Ideal pure quality of DNA ratio A260/A280 ratioof 1.8-2.0 was expected for the samples. Final concentration of 1-100ng DNA per PCR reaction was accepted as satisfactory for further analysis.All the necessary components for the PCR reaction (PCR buffer, dNTP, primers, Taq DNA polymerase) and heat prophiles were controlled and standardized individually. The forward primer CTG TTG CCT GTG GTA AGT GGG, and reverse primer TGG TCA CAG TAT GCA GGA GGG were used in PCR amplification. Reaction was performed in total 25 µl volume containing PCR mix of; 2.5 pmol of each primer, 10mmol/L Tris HCL (pH 8.3), 50 mmol/L KCl, 2.0 mmol/L MgCl2 (Bioron, cat. no: 103001), 0.2 mmol/µL of each dNTP, 2 unit Taq DNA polymerase (Bioron, cat. no: 101005) and 4 µL DNA. "The MWG Primus Thermal Cycler-Primus 96 PCR system" analyser was used at the analysis.PCR steps were 3 minutes (min) at 95°C-first denaturation, later 35 cycles; 1 min at 95°C of denaturation,90 seconds at 56 °C for binding and 60 seconds at 72°C for elongation and finally; a fragment of 291bp product was amplified. The primer probes designed for rs1815739snp was used with LightCycler ® FastStart DNA Master HybProbe and the analysis was performed by Roche LightCycler 480II analyser.

Statistical analysis

The statistical analyses were performed with the SPSS 22.0 package program, working under Windows XP. One way analysis of variance test was used to evaluate the probable difference between the independent variables. The chi-square test was used to compare genotype frequencies between groups as well as between nonathletic University students and volleyball players. To calculate the odds ratio (OR) for being an elite volleyball player using both dominant (RR vs RX+XX) and recessive (RR+RX vs XX) models, a logistic regression was performed. The significance level used throughout the study was set at 0.05.

Ethics

The study was approved by the Ethics Committee at the Faculty of Medicine, Manisa Celal Bayar University (Decision No. 20478486-397) and was performed according to the Declaration of Helsinki.

Results

The main aim of this study was to investigate the relationship of *ACNT3* R577X polymorphism with explosive power and physical fitness level. Univariate outliers were defined as scores falling more than ±3SDs from the mean score of their cell and were discontinuous from the scores of their closest neighbours. No univariate outliers were found in the standardised residuals plot. Mean, standard deviation, frequencies and case summaries of each variable were analysed. All the results of 171 participants were used in the statistical analysis of the study.

Both groups's descriptive statistics and vertical jump scores are illustrated in Table 1. To evaluate differences between volleyball players and nonathletic participants's independent t test scores is also presented in Table 1.

Table 1: *Demographic data*

Variables	Groups		P
	Volleyball Players (n=72)	Sedanteries (n=99)	
Height (cm)	180.10±7.07	167.35±6.83	<0.001**
Weight (kg)	66.91±8.85	58.07±9.30	<0.001**
BMI	20.71±1.67	20.70±2.54	0.97
Fat %	18.93±4.48	20.41±5.20	0.04*
Muscle mass	51.67±5.24	43.65±5.17	<0.001**
VJ (cm)	27.94±6.87	18.98±5.56	<0.001**
CMJ (cm)	32.81±7.39	22.28±5.73	<0.001**

**p<0.05; **p<0.01*

Table 1 showed that volleyball players' body height, body weight, body fat percentage and muscle mass values were statistically higher than nonathletic university students as supported in the literature (p<0.05) while there was no statistically significant difference between BMI values of participants (p>0.05). Moreover, VJ and CMJ values of volleyball players were statistically higher than University students as expected (p<0.05).

The distribution of *ACNT3* R577X polymorphism in different genoytpes are shown in Table 2. According to these results, there was no statistically significant difference between *ACNT3* R577X polymorphism distribution for volleyball players and nonathletic university students.

Table 2. *Genotype distribution in control and volleyball groups*

Genotype	Volleyball			Control		X^2 (P-value)	OR (95 CI) dom.	OR (95 CI) recess.
	n	%			%			
RR	23	%31.9		2	%32.3	0.512 (0.774)	0.983 (0.513-1.883)	0.741 (0.307-1.786)
RX	40	%55.6		1	%51.5			
XX		%12.5		6	%16.2			

Cl, confidence interval; dom., dominant(RR vs RX+XX); OR, odds ratio; recess., recessive (RR+RX vs XX); RR major allele, XX minor allele

The association between the *ACTN3* R577X polymorphism and explosive power in both and the volleyball groups is presented in Table 3. It is revealed that *ACNT3* R577X polymorphism is not related with explosive power in either group.

Table 3. Mean± standart deviasion estimates study phenotypes by genotypes of the ACTN3 R577X (rs1815729) polymorphism in the control and the volleyball group

	Control						Volleyball					
				p add	p dom	p recess				p add	p dom	P recess
	RR (n=32)	RX (n=51)	XX (n=16)				RR (n=23)	RX (n=40)	XX (n=9)			
VJ (cm)	18.26±5.48	19.34±6.04	19.28±4.08	0.680	0.379	0.817	27.44±7.51	27.42±6.73	31.53±5.19	0.249	0.677	0.094
CMJ (cm)	21.61±7.05	22.56±5.10	22.75±4.88	0.723	0.424	0.723	33.26±7.71	31.93±7.62	35.53±5.03	0.398	0.720	0.130

Add., Addictive; CMJ, counter movement jump, VJ, vertical jump; dom., dominant (RR vs RX+XX); recess., recessive (RR+RX vs XX)

Discussion

According to the results of this study, XX genotype distribution were, 14,6%, RX 53.2% and RR 32,2% in overall participants. On the other hand, the elite volleyball players' *ACNT3* R577X genotype distribution were 55.6% RX, 31.9% RR and 12.5% XX and the control' groups alignment were 51.5% RX, 32.3% RR and 16.2% XX respectively. In addition, no statistically significant relationship was found between *ACTN3* R577X polymorphism and explosive power performance in Elit Turkish women volleyball players.

The findings of this study revealed that the ratio of XX genotype distribution is 14.6% which is close to the European population, and the worldwide average In the case of Turkey, Ulucan (2016) declared that 234 (21%) of the 518 athletes with RR, 207 (40%) RX and 77 (15%) have XX genotypes. It is assumed that the difference between the findings of Ulucan et al. (2016) and the current study may stem from the use of

multiple athlete cohorts in Ulucan et al. (2016) research (33). Muscle explosive strength and antropometric parameters of elit volleyball players and nonathletic University students of this study, was statistically different than each other as expected and also supported in the literature (34).

In the present study, the ACTN3 R577X polymorphism was chosen as a candidate to influence volleyball players athletic status as it has provided the most consistent results to date, being the only muscle gene polymorphism to be associated with performance across multiple athletic population. On the other hand, surprisingly no statistically significant relationship was found between *ACNT3* R577X polymorphism and vertical and counter movement jump parameters in and between the groups of this study. That is unexpected result since the *ACNT3* gene has been reported (4) to play a key role in muscle explosive strength which has the main determinator of success in most of the volleyball technical skills. On the other hand, nonsignificant results of the present study have been supported by the literature. In Ruiz et al. (2010) no significant associations between *ACTN3* R577X polymorphism and explosive leg muscle strength were found among control group and Spanish volleyball players (3). In addition; Coelho et al. (2016) found no significant assosiation in genotypic or allelic frequencies between different performance ratings in Brazilian Soccer Players (35). Atanasov et al. (2015) also found no significant difference between *ACTN3* polymorphism and Wingate test results for Bulgarian athletes from different branches, including volleyball players (31). Sessa et al. (2011) identified volleyball as a power sport and did not find any association in the distribution of the RR genotype among athletes in which the volleyball players were also included (36) . Studies investigating team sports participants other than volleyball indicated that vertical jump and sprinting have no relationship with *ACTN3* R577X polymorphism by testing power performance through field tests, isokinetic dynomometers and wingate anaerobic tests found no association between *ACTN3* R577X polymorphism and athletic capacity in team sports (7, 13, 30, 32, 37).

Result of current investigation also revealed that ACNT3 R577X polymorphism is not related with explosive power in either group. On the contrary, Ginevičienė et al. (2011) compared 193 Lithuanian elite athlete and 250 sedentary population in terms of grip strength and vertical jump test (11). They reported in detail that *ACTN3* XX and RX genotypes have the potential to achieve better results in power-requiring sports. Lastly, Orisyak et al. (2014) aimed to determine the relation between *ACTN3* distrubution and strength performance. The study included 200 male Polish athletes from different branches, 25 of the participants were volleyball players, and the results of the study revealed that athletes who has RR and RX genotypes strength performance were higher than that of XX genotypes (38).

Aforementioned studies indicated the fact that in addition to technical and tactical skills, muscle strength and explosive power are critical factors for elite volleyball performance (39). Powerfull strikes with high and rapid vertical jumps are the defining characteristics of the game. On the otherhand *ACTN3* R577X polymorphism may not be use as a only indicator of the explosive leg and body moves i.e. vertical jump. In a branch such as volleyball that includes jumping in the structure of the game, trying to evaluate the genetic phenotype by jumping performance may have created limitations. in which multi joints movements with the involvement of the most of the lower extremity muscles is performed in highly skilled technical elements. Also, muscle phenotype is a complicated feature and it is hard to explain it with singular genotype especially in sports like volleyball which requires highly skilled technical elements. In this respect even vertival jump performance ie mainly depended experience is also an important variable in respect with athletes being elite or non-elite (38).

The findings of the above-mentioned studies and the findings of this study may differ due to other respecitves such as gender differences. It was determined that the effect of *ACTN3* R577X polymorphism on athletic performance and muscle phenotype for men and women were different (40). Differences between anatomy, physiology and psychology of men and women also play an important role in athletic performance. Genetic relationships can sometimes be gender specific for athletic performance. Due to the limitations in this study, only the elite Turkish female volleyball players were included in the study group and this resulted in a limited number of participants in the study group. This restriction reduced the number of participants and was the main determinant of the study in terms of homogeneity. Also as the main charefcteristics of genetic studies. It is thought that this difference is due to the fact that the studies has different ethnic origin.

It is thought that these results which are contradictory with the literature may be caused by the mentioned conditions. However, it is also possible to say that ACTN3 R577X polymorphism in Turkish

female volleyball players cannot be considered as a determining factor in talent identification. However, studies with larger groups of participants will lead to more descriptive data on the related topic. Therefore, more studies are needed on this matter.

Conclusion

In conclusion, the *ACTN3* R577X polymorphism and and explosive power performance were not correlated in Turkish elite volleyball players or nonathletic women university students. Muscle phenotypes are complex traits that are not likely to be oversimplify to a single polymorphism. And also, it is difficult to explain one of the complex biomotor abilities, like muscle explosive power by using only *ACTN3* R577X polymorphism. On the other hand, this study provides comparative interpretation that a single gene has now been repeatedly associated with elite athletic performance, these associations are not strong enough to be predictive and the use of genetic testing of these variants in talent selection is premature.

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Authors Contribution

Idea / Concept / Design/ Supervision / Consulting / Comment / Writing Of The Article: Selda Bereket Yücel, Fatma Taneli, Esin Ergin, Data Collection and / or Processing: Esin Ergin, Nurten Dinç, Analysis/ Genotype Assesment: Burak Durmaz, Source Scan: Esin Ergin, Nurten Dinç, Critical Review: Selda Bereket Yücel, Fatma Taneli. All authors read and approved the final version of the manuscript.

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Experimental Verification of the Effectiveness of Organizational and Pedagogical Conditions for the Education of the Future Teacher in the Health-Preserving Environment of the Institution of Higher Education

Olena Momot[1], Valeriy Zhamardiy[2], Hrynova Valentyna[3], Gorlova Lyudmyla[4] and Natalia Sharlay[5]

[1]*Doctor of Pedagogical Sciences, Associate Professor of the Department of Theoretical and Methodological Foundamentals of Teaching Sports Disciplines, Poltava V. G. Korolenko National Pedagogical University, Poltava, Ukraine.*

[2]*Ph.D. in Pedagogics, Lecturer of the Department of Theory and Methods of Teaching Sports, Poltava V. G. Korolenko National Pedagogical University, Poltava, Ukraine.*

[3,4]*Posdgraduate of the Department of Pedagogical Skills and Management named after I. A. Zjazun, Poltava V. G. Korolenko National Pedagogical University, Poltava, Ukraine.*

[5]*Lecturer of the Department of Physiology, Ukrainian Medical Stomatological Academy, Poltava, Ukraine.*

Abstract

The article experimentally tested the effectiveness of organizational and pedagogical conditions for the education of the future teacher in the health-preserving environment of the institution of higher education. The criteria of upbringing of the individual in the conditions of the health-preserving environment were defined. There were motivational and value; cognitive; procedural and activity; practical conditions. The levels of assessment of the criteria of personal upbringing in a healthy environment were clarified as high, medium, sufficient and low. The positive dynamics of indicators of education of the future teacher's personality contributed to creation of a healthy environment for higher education in students from experimental groups. Which confirmed the effectiveness of the experimental innovations proposed in the article.

Keywords: institution of higher education, health-preserving environment, educational process, pedagogical conditions, students.

1. Introduction

At the present stage of development of society, the need for purposeful activities to preserve and strengthen the health of future professionals has increased. It is necessary to increase their professional competence in the field of health preservation. Future teachers of higher education institutions need to form a dynamic stereotype of activity and behavior, which promotes health, determines the care for their own health and the health of children. We can state, that there is a large number of studies in the field of health preservation in educational institutions and training teachers to engage in health preservation activities. The problem of young people's health preservation was studied by following scientists: G. Apanasenko [1], N. Bashavets [2], L. Vashchenko [3], T. Vorontsova [5], V. Gorashchuk [6; 7], L. Goryana [8], T. Denisovets [9], V. Zhamardiy [10; 21; 22; 23; 24], M. Karpenko [12], D. Lysenko [13], V. Orzhekhovska [16], P. Plakhtiy [18], V. Tevkun [19], V. Tkachenko [20] et al.

2. Materials and Methods

The aim of the study is to experimentally test the effectiveness of organizational and pedagogical conditions for the education of the future teacher's personality in a health preservation environment of higher education.

Research and experimental work was carried out on the basis of following institutions: Poltava National Pedagogical University named after V.G. Korolenko, Higher education institution Ukoop union «Poltava University of Economics and Trade», Poltava Institute of Business, International University of Science and Technology named after Buguy, Poltava State Agrarian Academy, Poltava National Technical University named after Yuri Kondratyuk, Cherkasy National University named after Bohdan Khmelnytsky, Kharkiv National University named after V.N. Karazin, Uman State Pedagogical University named after Paul Ticini and in the educational process of secondary education institutions of Poltava region. A total of 450 students and 37 research and teaching staff took part in the pedagogical experiment.

Future teachers were divided into 2 groups: control and experimental. The choice of control and

experimental groups was made from full-time and part-time students. Applicants for higher education (18–20 years) were involved in the experiment. Part-time students were involved in the experiment when they themselves expressed a desire to participate in the study and had the opportunity to attend the proposed activities. At the beginning and at the end of the experimental study, empirical data were collected, which were then processed and compared at the generalizing stage of the experimental work. Among the theoretical research methods, the main ones were: conceptual and comparative analysis (study of pedagogical, philosophical and psychological literature, textbooks on the research topic). Among the empirical research methods, the main ones were diagnostic ones like interviews, questionnaires, sociological observations, surveys, testing. Analysis and processing of research results was carried out using the methods of mathematical statistics: We used comparative, quantitative analysis and statistical calculations by Pearson's criterion to confirm the reliability of the results of experimental work.

3. Results and Discussion

Organizational and pedagogical conditions contribute to the effective education of the future teacher's personality in the health-preserving environment of the higher education institution. Especially conditions which allow to focus on cooperation between the subjects of the educational process, on personal potential development, on active health-preserving attitude of the individual to education and upbringing [11; 14; 15].

The first organizational and pedagogical condition is the creation of a health-preserving environment in higher education. It includes the selection of scientific and pedagogical staff of the appropriate level, able to promote the productive activities of the future teacher, and determination of their health skills. Health-preserving environment in higher education also requires the interaction of the high school and the personality of the future teacher in a healthy environment and provision of conditions for independent, health-preserving activities in order to increase the professional level of the future specialist. It is also necessary to stimulate intellectual and creative search, the ability to see the problems and ways to solve health problems. It is necessary to create a synergy of relations of cooperation and co-creation. It is necessary to modernize health-preserving means, forms, methods of education; creating a stimulating, positive, healthy spiritual and moral-psychological atmosphere. To educate future teachers to take a responsible attitude to their own health and environment. For this desire, discipline and dedication are a must. The implementation of these conditions leads to coordinated and meaningful cooperation of higher education institutions, scientific and pedagogical workers, family and personality of the future teacher in the field of maintaining and promoting health. As a result, it leads to the success of health activities.

The second organizational and pedagogical condition is the formation of health competencies of the future teacher of higher education. It is based on the ability to apply knowledge and skills of pedagogical and psychological methods of influencing the teaching staff, team of pupils and the personality of the future teacher. To fulfill this condition, it is necessary to use health-preserving knowledge, skills and abilities in all spheres of life (observance of the daily routine and nutrition, physical activity, alternation of mental and physical activity). It is necessary to have the ability to self-regulate and the ability to characterize the properties aimed at the harmonious development of personality, its self-realization in professional, creative potentials, on preservation of physical, social, mental and spiritual health, both its own and its surroundings. The implementation of this condition improves the quality of mastery of knowledge, skills, experience, values and attitudes, which can be fully implemented in practice, provides growth of the general level of development of the person.

The third organizational and pedagogical condition is the innovative and healthy climate in the team of research and teaching staff and future teachers of higher education. This implies a positive relationship in the team, rational organization of the health-preserving process taking into account the capabilities of the body of each individual and ensuring normal working, learning and leisure conditions for all participants in the process. Such healthy interpersonal relationships are built on mutual understanding and mutual respect. Fulfillment of this condition increases the motivation of the future teacher to improve health, the desire to preserve the environment, the ability to work in a team, forms the skills of interpersonal interaction.

The fourth organizational and pedagogical condition is the introduction into the educational process of higher education institutions of educational and methodological support and methods of its implementation during the education of the future teacher. This condition is realized through the introduction into the educational process of higher educational institutions of educational and

methodological support, which includes educational and methodological complexes of the following disciplines: «Technologies for creating a health-preserving environment in higher education» and «Sports and pedagogical improvement». The implementation of this condition leads to the formation of a holistic system of theoretical knowledge, practical skills and abilities of future teachers and their use in practice.

During the experiment, the highest level of knowledge was found to understand the following concepts: «health-preserving environment» – 63,5 % of respondents, «comfortable atmosphere of the educational process» – 57,3 %, «health-preserving competencies» – 50 %, «healthy lifestyle» – 50 %. This knowledge is necessary, according to the scientific and pedagogical team, to educate the personality of the future teacher in a healthy environment of higher education. In the answers to the survey, this knowledge has a high degree of repetition – 65,7 %, which indicates the correctness of the theoretical conclusions in the study. Conversations and surveys in general confirm the opinion that in the process of educating the personality of the future teacher in a higher education institution not enough attention is paid to interactive methods of working with students. Future specialists are insufficiently involved in health care activities, research work organized and conducted by research and teaching staff.

Experimental verification of the effectiveness of organizational and pedagogical conditions was carried out using the criteria of education of the individual in a healthy environment, namely: motivational and value; cognitive; procedural and activity; practical criterion. Each of the criteria was evaluated by levels: high, medium, sufficient and low. Our surveys showed that future teachers and research and teaching staff (450 people boys and girls, as well as 37 teachers who helped to systematize the data) consider care for their health as the main motive and value of education of the future teacher in a healthy environment of higher education institution physical activity (Tab. 1).

Table 1. *Determining the motives that guided future teachers*

	Answers of future teachers	**Number of answers, %**
1.	Physical activity	32,1
2.	Health care	19,2
3.	Balance your daily routine	13,4
4.	Improving health	14,5
5.	Emaciation	9,7
6.	Learning about health	8,1
7.	Other answer options	3

Among the motives that would encourage health-preservation activities, 40,7 % of respondents mentioned the desire to improve and enhance their health, and 32,1 % of respondents mentioned their own physical development. The study revealed that the main motive for future teachers to maintain health is good health and determination of how interesting and meaningful their student life is in terms of health.

To question «*What would you like to change in educational process in higher education institution on the specified subject?*» 63 % of respondents answered: «to increase the number of measures to preserve and promote health», 29 % of respondents answered: «to increase the number of sports activities», only 8 % of respondents remained indifferent. Analysis of the results of the poll showed that the main reason is not in objective but in subjective factors. The latter include: insufficient level of organization of health, physical culture and sports events at the level of higher education institutions, faculties, and especially the lack of them in academic groups.

To question «*What means / forms / methods of organizing health care activities will suit you?*» the following answers were received: physical education classes in higher education institutions as compulsory – 52 %, training in sports sections – 32,3 %, conducting educational and methodical classes on health – 12,5 %, remained indifferent – 3,2 %.

Future teachers' understanding of the importance of health care, generates interest in them, the need that turns into a motive for health care. Motivation of the future teacher's personality is conditioned by his interests, ideals, value orientations. The study of motives made it possible to determine their significance and understand the level of motivation at the initial stage of the study according to the motivational-value criterion. This, in our opinion, will ensure the effectiveness of the education of the future teacher in terms of

creating a healthy environment for higher education. Thus, we discovered, that the level of motivation of future professionals was at an average level.

In order to determine the level of knowledge in health-preservation by cognitive criteria at the initial stage of the study, we have generalized test questions of the proposed educational and methodological support. We used following questions: «What do you mean by «health-preservation»? What should a physical education program include?, What are the main components of nutrients that should be included in a person's daily menu?, How long should a person's usual meal take?, What food belongs to the category of «fast food»?, What foods should be used for a snack?, In what areas is there a need for health care?».

Thus, only 16,3 % of future teachers were able to define the essence of the concept and 57,3 % of future professionals understood its significance. Only 18,9 % of respondents gave a partially correct answer to the question: «*What does the exercise program include?*». Only 12,3 % of respondents gave a partially correct answer to the question: «*What are the main components of nutrients should be included in a person's daily menu*?». Only 12,1 % of respondents gave a correct answer to the question: «*How long should a person's normal diet take?*». Only 12,4 % of respondents gave the full meaning of the concept: «*What food belongs to the category of «fast food»?*». Only 14,5 % of respondents gave a correct answer to the question: «*What foods should be used for a snack?*». Assessment of the level of knowledge of future teachers about the essence, the meaning of the concept of «health preservation» allowed us to understand that most students have a low level of cognitive criteria. This level of knowledge can be quite understandable, because the category of respondents are individuals who want to gain knowledge related to the future specialty.

The survey showed that respondents propose to introduce new areas in the educational process, such as: health preservation knowledge – 76,7 %, health preservation forms, means, technologies – 57,9 %, educational and methodological support of health-preserving character – 31,2 %, development of health-preserving methods of education of the person and collective – 15,7 %, development of diagnostics of the level of education – 11,7 %.

The study confirms the rationality of the second organizational and pedagogical condition, namely: formation of health-preserving competencies of the personality of the future teacher of higher education institution, which involves the application of knowledge and skills in pedagogical and psychological methods of influencing the teaching staff, the team of students and the personality of the future teacher. It also provides the ability to use health knowledge, skills and abilities in all areas of life (observance of a mode of day and a food, performance of motor activity, alternation of mental and physical activity), ability to self-regulation, the ability to characterize the properties aimed at the harmonious development of personality. This requires self-realization in professional, creative potentials, preservation of physical, social, mental and spiritual health (one's own and one's environment).

To objectively assess the statements that affect the determination of the level of education of the indicators of procedural criteria at the initial stage of the study, we took into account the views of future teachers. Information was collected through surveys. We received the following answers to the questions: to question «*Do you think a person's mood depends on the style of behavior?*», response «Yes» was 49 %, «No» – 18 %, «Indifferently» – 14 %; to question «*Do you follow the rules of nutrition?*», response «Yes» was 40 %, «No» – 13 %, «Indifferently» – 10 %; to question «*Are you familiar with the term «food ignorance?*», response «Yes» was 37 %, «No» – 32 %, «Indifferently» – 5 %; to question «*Do you think «overeating» is a style of eating?*», response «Yes» was 29 %, «No» – 41 %, «Indifferently» – 11 %; to question «*Are you happy with your life?*», response «Yes» was 29 %, «No» – 39 %, «Indifferently» – 8 %; to question «*Do you follow the rules of a healthy lifestyle?*», response «Yes» was 30 %, «No» – 21 %, «Indifferently» – 11 %.

Assessment of the level of mastery by future teachers of technologies, methods and means of health preservation has made it possible to understand that most students have an average level according to procedural and action criteria.

The survey provided the grounds for the need to implement the third organizational and pedagogical condition: formation of innovation and health climate, both in the team of research and teaching staff and future teachers. Which in turn contributes to positive relationships, the rational organization of the health preservation process, taking into account the capabilities of the body of each individual. It allows to provide normal conditions of work, training and rest of all participants of process and to create healthy interpersonal relationships, built on mutual understanding and mutual respect. This is considered by us as the third organizational and pedagogical condition.

The fourth organizational and pedagogical condition is the introduction into the educational process of higher education institution of educational and methodological support and methods of its implementation during the education of the future teacher. This, according to 31,2 % of the participants of the experiment, is reflected in the need of introduction of educational and methodological support of a health-preserving nature into the educational space and development of health-preserving methods of education of individuals and staff (15,7 %).

The analysis of the generalized results after the end of the experiment showed that there were significant changes in the quantitative distribution of students by levels. According to the results of the formative experiment obtained in the process of studying the level of education of the future teacher's personality, in the conditions of creation of the health-preserving environment of the institution of higher education according to the motivational and value criterion we had following distribution: in the experimental group significantly decreased the number of students who have a low and sufficient level, and the number of students who have a medium and high level increased. In the control group 24 % of students and 56,1 % of the experimental group showed a high level, 42,7 % and 33,3 % of students, respectively, showed sufficient level. The average level was observed in 24,9 % of students from the control group and 10,6 % from the experimental group, while 8,4 % of students in the control group have a low level (Fig. 1).

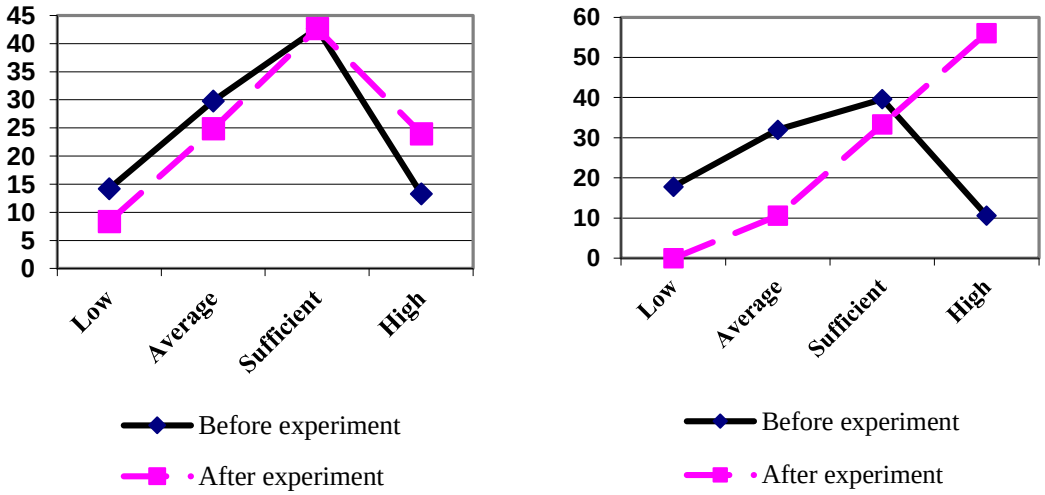

Fig. 1. *Dynamics of personality upbringing of future teachers by motivational and value criteria: a) control groups; b) experimental groups*

The results of education by cognitive criteria showed that in the control group 6,7 % of students had a high level, in experimental group 26,2 % had a high level, 22,7 % of students had sufficient level in control group and 57,4 % of students had sufficient level in the experimental group. Medium and low levels are observed in this number of students: in the control group medium – 36 %, low – 34,6 %; in the experimental group medium – 15,1 %, low – 1,3 % (Fig. 2).

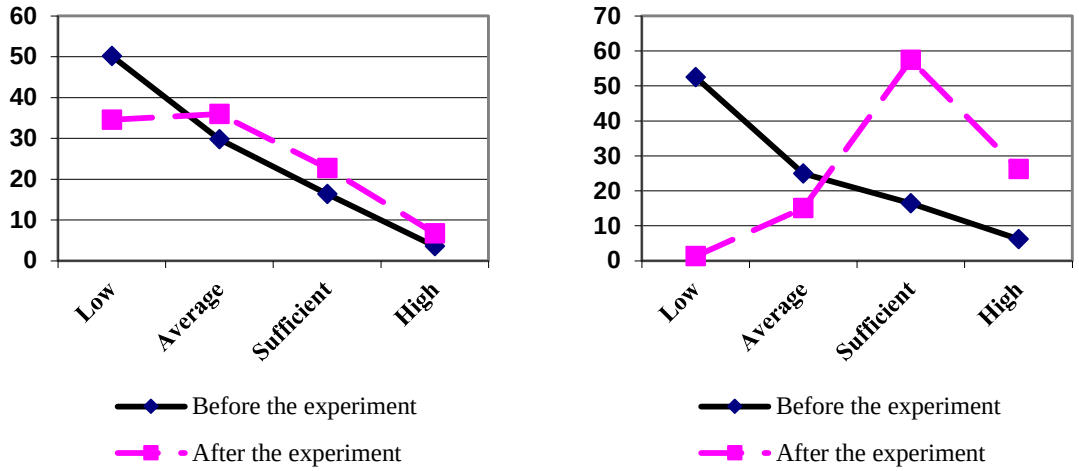

Fig. 2. *Dynamics of education of personalities of future teachers by cognitive criterion: a) control group; b) experimental group*

Analysis of the dynamics of the levels of education of students according to the procedural and activity criterion of control groups shows a slight positive increase in a high and sufficient level and reducing the number of middle- and low-level students. In the course of the research in the experimental group the percentage of students with high (24,5 %) and sufficient level (57,4 %) significantly increased, and the percentage with average and low level decreased significantly and is 15,1 % and 3,1 %, respectively (Fig. 3).

The indicators of the practical criterion after the experiment were as follows: 10,2 % students from control and 20,9 % from experimental group had a high level, 29,3 % of students from control group and 53,8 % from experimental had a sufficient level, 33,8 % of students from control group and 19,1 % from experimental had an average level, 26,7 % of students from control group and 6,2 % from experimental had a low level.

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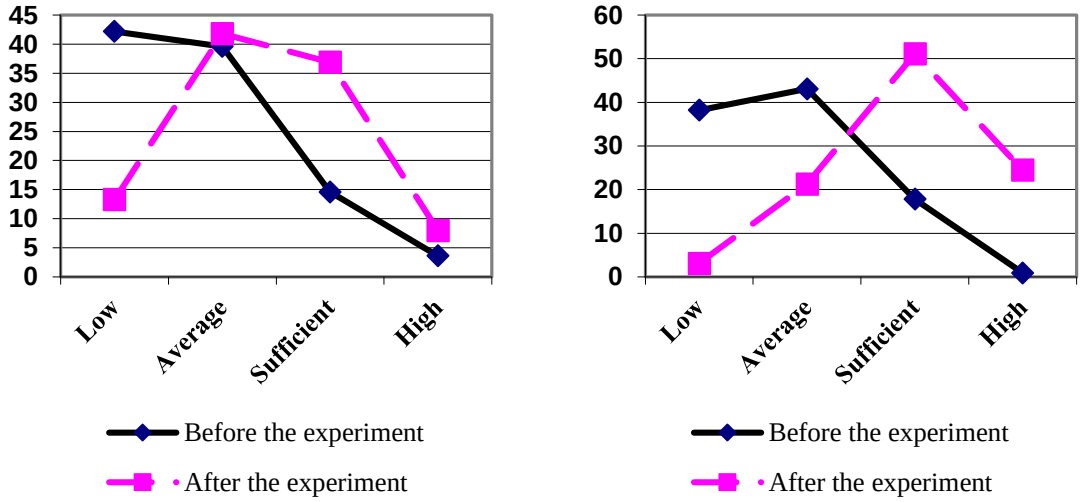

Fig. 3. *Dynamics of education of future teachers according to the procedural and activity criterion: a) control group; b) experimental group*

Summarizing the data, we can state that the high level of education of the future teacher's personality increased in the control group by 4,7 % and in the experimental group by 25,6 %. The sufficient level of education of the future teacher's personality increased in the control group by 10,9 % and in the experimental group by 23,5 %. The average level of education of the future teacher's personality decreased in the control group by 2,3 % and in the experimental group by 18,7 %. The low level of education of the future teacher's personality decreased in the control group by 13,2 % and in the experimental group by 30 4 % (Fig. 4).

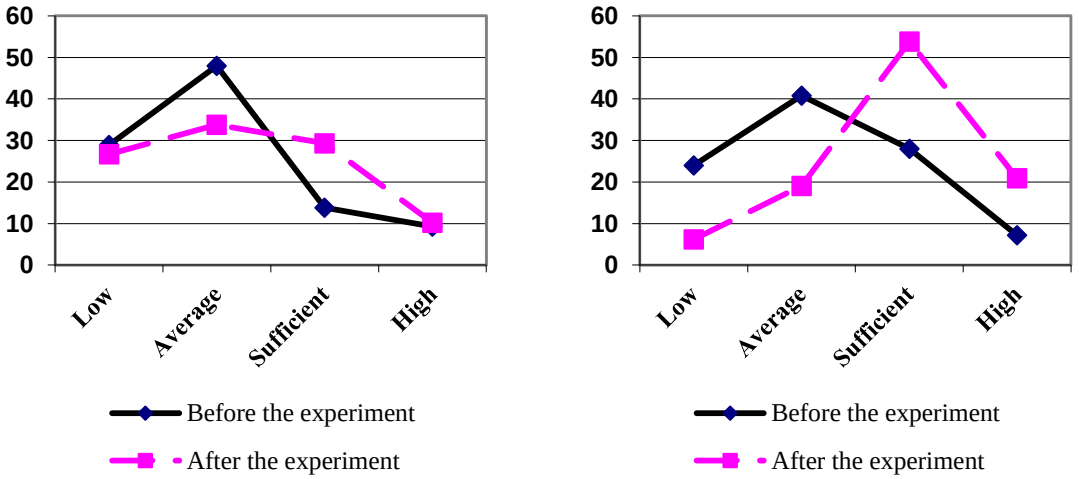

Fig. 4. *Dynamics of education of personalities of future teachers according to practical criterion: a) control group; b) experimental group*

After the experiment, a high level, according to practical criterion, was obtained by 12,2 % of students in the control and 31,9 % of the experimental groups. A sufficient level was obtained by 32,9 % of students in the control and 48,9 % of the experimental group. An average level was obtained by 34,1 % of students in the control and 16,5 % of the experimental group. A low level was obtained by 20,8 % of students in the control and 2,7 % of the experimental group.

4. Conclusions

The effect of changes is due to the use of experimental organizational and pedagogical conditions, for example: creating a health-preserving environment in higher education; formation of health-preserving competencies of the future teacher of higher education institution; innovation and health-preserving climate in the team of research and teaching staff and future teachers of higher education; introduction into the educational process of higher education institution of educational and methodological support and methods of its implementation during the education of the future teacher. The results of the study show the positive dynamics of indicators of education of the future teacher's personality in terms of creating a health-preserving environment in institution of higher education for students from experimental group, which confirms the effectiveness of the proposed experimental innovations. Prospects for further research we see in the expansion of the practical orientation of health care activities of future teachers in higher education institutions.

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The Effect of 8-Week Exercise Program on Flexibility and Horizontal Jump of 12-14 Age Children with Atypical Autism

Faruk Güven[1] and Samet Aktaş[2]
[1]*School of Physical Education and Sports, University of Kilis 7 Aralık, Kilis, Turkey.*
[2]*School of Physical Education and Sports, University of Batman, Batman, Turkey.*

Abstract

The main purpose of this study is to examine the effect of the 8-week exercise program on flexibility and horizontal jump of children with atypical autism with repeated measurements. Ten male individuals ,diagnosed 12-14 years atypical autism in an specific autism center, whose average age 13.10 ± 0.87 (years), body weight averages 39.90 ± 3.38 (kg), height length averages 143.00 ± 9.33 (cm), were included in the study for 8 weeks. Within the exercise program, motor skill exercises were applied 3 days a week and flexibility (sit and reach test) and long jump test by standing were practised on Saturday, which is the free day of the week. Each measurement was initially taken 5 times in total, at the 2nd, 4th, 6th and 8th weeks. The statistical evaluation of the study was done with SPSS 22.0 computer program. All data are given as mean and standard deviation. In the analysis of the differences between repeated measurements, Single Factor Analysis of Variance was applied in Repeated Measurements. Statistical significance level was accepted as 0.05. Considering the findings, it was found that there was a statistically significant difference between the measurements according to the results of single-factor variance analysis in repeated measurements of flexibility levels [F (4, 36) = 52.63; p = 0.00]. It was determined that there was a statistically significant difference between the measurements according to the results of single factor variance analysis in repeated measurements of long jump levels by standing [F (4, 36) = 90.86; p = 0.00]. As a result, it has been shown that the training program provides a significant improvement in motor skills in individuals with atypical autism. This development, seen in both flexibility and horizontal leap levels, also suggests that it will have a positive effect on individuals' physical development. Therefore, it is recommended to plan appropriate training programs for the development of gross motor and fine motor skills in individuals diagnosed with atypical autism.

Keywords: Autism spectrum, Exercise, Flexibility, Horizontal Jump.

2. Introduction

Autism, although the causes of autism are not known, is a neurological and biological disease that is generally diagnosed in early childhood and continues for life. A medical problem can occur in only 10% of people with autism. Autism spectrum disorder can occur for different reasons. The course and style of autism, where multiple factors occur depending on the interaction of each other, may also differ from person to person [8]. It is known that specific learning difficulties and social dysfunction negatively affect social life and do not respond positively to treatment [13].

Autism and widespread developmental disorders appear to be quite complex and variable in clinical presentation and findings. Symptoms and features change with the developmental maturity and differ depending on the degree associated cognitive disorders [9]. The majority of individuals with autism have severe impairment in speech and language development, which reflects damage to a particular brain structure or neurological system or dysfunction [26]. Diagnostic features of autism have difficulty in social interaction, delay in communication skills, limiting patterns in certain development and behavior or movements. In addition to these reasons, the development or decline of motor behaviors is found in individuals with autism [1].

It is necessary to include programs that support basic skills for children with autism to recognize their own bodies. It causes children to develop their mobility in terms of getting to recognize their bodies and the world they live in. it also covers other areas of change in children apart from motor development, physiological and biological developments [12]. Autism also affects children's ability to play and win. Autism affects children's motor skills, performance, participation behaviors and behaviors according to age levels.In overcoming these difficulties, a physical education teacher plays an important role for children to

participate in the lesson. in physical education lessons and sports activities [3,7].

Exercise is known not only to reduce the negative effects of inactivity, but also to help manage ASD symptoms. Despite the evidence supporting the importance of exercise for autism, young people with ASD are known to do less physical activity than their peers. Considering that 80% of children with autism do not exercise enough, it is seen that this causes to increase the risk of heart disease, diabetes, obesity and some other chronic health conditions [6]. Motor skill deficiencies are present in school-age children who hve autism spectrum disorders and continue. It is assumed that children with better motor skills will have better social communication skills. It is observed that children who have weak motor skills will have more social communication skills (Staples & Reid, 2010). Joint flexibility, balance, coordination walking, postural stability, and movement speed are among the factors that force those with autism. These difficulties can be reduced with increasing physical activity levels [20]. Motor improvements reveal differences in the flexibility skills of children with autism. Undoubtedly, it is observed that these differences contribute to the improvement of many daily situations such as social interactions, transition to less preferred activities, managing differences and changes and flexible thinking [15]. It has been reported that it will positively contribute to remove the problems related to heart health, weight loss, stress and low muscle density of children with autism who perform exercises that increase flexibility [22]. It has been observed that strength training improves the child's core muscles as well as increase the level of balance and coordination [17].

The main purpose of this study is to examine the effect of the 8-week exercise program on flexibility and horizontal jump of children with atypical autism with repeated measurements.

2. Method

2.1. Participants

10 individuals in a specific autism center who were diagnosed with atypical autism at the age of 12-14 and who did not have a sports branch were included in the study. Ten males with a mean age of 13.10 ± 0.87 (year), body weight averages 39.90 ± 3.38 (kg), and an average height of 143.00 ± 9.33 (cm) were included in the study for 8 weeks. Before the study, consent form was obtained from the parents and information was given about the study. In order to avoid any health problems during the study, the individuals were undergone medical examinations and health personnel were kept throughout the study.

2.2. The working protocol

The study protocol was ptacticed 3 days a week (Monday, Wednesday, Friday) for 8 weeks between 10:00 and 12:00 in the morning. Weekly measurements were also taken between 15: 00-17: 00 on Saturday.

The flexibility exercise program was practiced for a total of 60 minutes as warm-up section, main section and cooling section. 3 days a week, 5 minutes of walking in the gym and 15 minutes of stretching exercises were done. Using different basic gymnastic exercises, The exercises were practiced for 30 minutes in a series of 3 repetitions under the observence of assistant trainer.It was finished by doing cooling for 10 minutes.

Long jump exercise program by standing was practiced on the 15 cm highchair with the left and right foot ascend and descend: Each application was practiced for 30 seconds as 1-minute rest, 3 repetitions. Arm swinging exercise standing up: was practiced by ascending to the fingertips and jumping into colored rings from 30-50 cm and 1 m height. The rest break was performed for 1 min in the form of forward jumping exercises (3 x 12) on the rings at the same distance. The rest was practiced as 1 minute.

2.3. Flexibility Measurement (sit and reach test)

For the flexibility measurements of the individuals participating in the research, Sit and reach test bench, length 35 cm, width 45 cm, height 32 cm, was used. Three measurements were taken for each subject and the best result was recorded in cm [21].

2.4. Horizontal Jump

At the end of the long jump made from the standing position of the participants in the survey without getting speed and power at which the double legs are connected to each other, The distance between the line at the jump point and the point the athlete last stepped was measured in cm. Participants in the research were given two repetitions and two rights and The best grade done has been taken into account [23].

2.5. Data Analysis

The evaluation of the data of the study was carried out using SPSS 22.0 (SPSS INC., USA) computer program. The average of the data is taken and evaluated by creating a standard deviation. The normality analysis of the data was found to show normal distribution with the Shapiro Wilk test. In the analysis of the differences between repeated measurements, the measurements were repeatedly determined by factorial variance analysis. Bonferroni test, one of the post hoc tests, was performed to detect differences in temporal measurements. Statistical significance level was accepted as 0.05.

3. Results

Table 1. *Descriptive information of the individuals participating in the research*

	N	Mean±Std. Deviation	Minimum	Maximum
Age (years)	10	13.10±0.87	12.00	14.00
Body Weight (kg)	10	39.90±3.38	35.00	45.00
Height (cm)	10	143.00±9.33	128.00	156.00

The average age of the individuals with autism who participated in the study was found to be 13.10 ± 0.87 (year), their average body weight was 39.90 ± 3.38 (kg), and their height average was 143.00 ± 9.33 (cm).

Table 2*. Temporal values of flexibility measurements of individuals participating in the research.*

	N	Mean±Std. Deviation	Minimum	Maximum
Before	10	15.00±3.46^{e}	10.00	20.00
2th Week	10	17.80±3.52^{d}	13.00	25.00
4th Week	10	21.30±3.43^{c}	17.00	29.00
6th Week	10	26.70±4.66^{b}	20.00	38.00
8th Week	10	30.80±4.93^{a}	25.00	41,00
abcde: The difference between the averages in the same column is significant (p <0.05).				

Table 2 shows the information of the average and standard deviation of the flexibility levels of the individuals participating in the study in temporal change. The highest average of these values was seen at the end of the 8th week, the lowest level is the values taken before starting the training program. It was found that there was a statistically significant difference between the measurements according to the results of single factor variance analysis in repeated measurements of temporally applied flexibility levels [$F_{(4, 36)}$ = 52.63; p = 0.00].

Table 3. *Average and standard deviation information of horizontal jump measurements of individuals participating in the research.*

	N	Mean±Std. Deviation	Minimum	Maximum
Before	10	39.80±10.99^{e}	25.00	56.00
2th Week	10	50.80±10.59^{d}	36.00	69.00
4th Week	10	62.40±12.37^{c}	45.00	81.00
6th Week	10	73.00±13.26^{b}	50.00	92.00
8th Week	10	89.80±15,03^{a}	60,00	115,00
abcde: The difference between the averages in the same column is significant (p <0.05).				

Table 3 shows the information of the mean and standard deviation of the horizontal jump levels of the individuals participating in the research in the temporal change. The highest average of these values was

seen at the end of the 8th week, the lowest level is the values taken before starting the training program.It was determined that there was a significant difference when the data compared according to the results of one-factor variance analysis in the repeated measurements of the long jump levels practiced temporarily [$F_{(4, 36)} = 90.86$; $p = 0.00$].

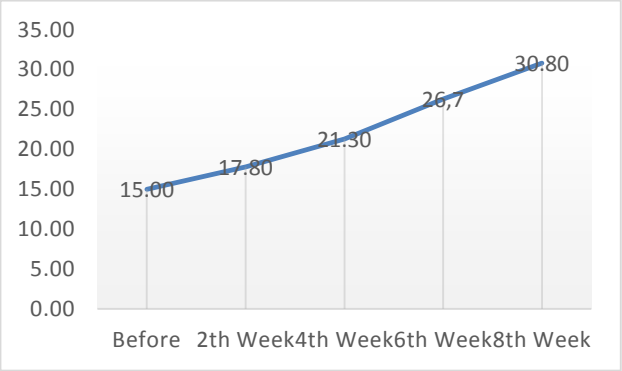

Figure 1. *The mean of flexibility in repeated measurements of the individuals participating in the research.*

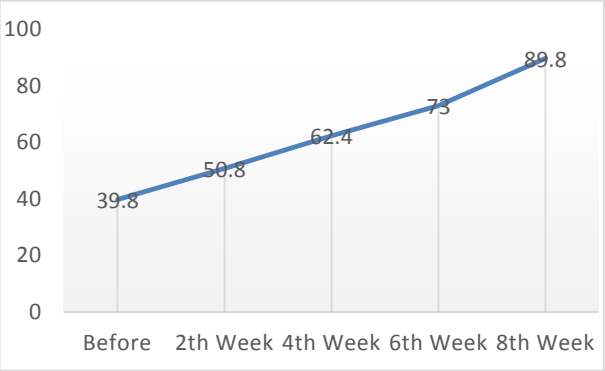

Figure 2. *The mean of horizontal jump in repeated measurements of the individuals participating in the research.*

4. Discussion and Conclusion

The main purpose of this study is to examine the effect of the 8-week exercise program on flexibility and horizontal jump of children with atypical autism with repeated measurements and to show how the exercise program affects the development of motor skills.

The information of the average and standard deviation of the flexibility levels of the individuals participating in the research in temporal change are given. The highest average in these values was seen at the end of the 8th week, while the lowest level is the values taken before starting the training program. According to the results of repeated single-factor analysis of variance in the measurements of flexibility levels practiced temporally, statistical significance was determined between the measurements.

In a study in which the effects of the 24-week special training program practiced by children with autism on physical fitness parameters were investigated, a significant difference was found in balance, flexibility, long jump and vertical jump parameters in 8-10 age group children. In the same study, while there was a significant difference in 25- m speed run, balance, flexibility and vertical jump parameters in 11-13 age group children, A significant difference was found between 25 m speed run, balance, flexibility, vertical jump, right hand grip strength, 30 seconds shuttle and 30 seconds push-up parameters in 14-16 age group children [25].

The average and standard deviation information of the horizontal jump levels of the individuals participating in the research in temporal change are given. The highest average of these values was seen at the end of the 8th week while the lowest level is the values taken before starting the training program. It was observed that there were statistically significant differences in the results of one-factor variance analysis, which was repeatedly measured for the levels of long-jump by standing prcticed temporally .In the research done by Yılmaz et al in 2006, It has been determined that flexibility studies performed for children with autism problems for 8 weeks ,2 hours a day and 3 days a week, increase their flexibility performance values [28].

In the study conducted by Atan et al. [2] in children with autism problems aged 10-11, At the end of basketball training performed 2 hours a week and 1 hour a day for 12 weeks, a increase was found at a positive level in vertical jump, flexibility, reaction time, 20 m running time, hand grip strength and balance skill and test performances of children with autism problem when the effects of basketball training on motor skill levels are examined. In a study in which the effect of physical training on long jump by standing in children with autism and down syndrome was investigated, It has been reported that physical training positively increases jumping distance in children with autism and down syndrome [14].

In the study conducted by Yılmaz and his friends [29], As a result of research in which hydrotherapy is carried out for the group aged 9 with autism problem for 10 weeks,3 days a week,60 min, positive

changes were observed in long jump by standing physical fitness values. In another study in which exercise program is done for 9 children aged 5-9 with autism problems for 26 weeks, 2 days a week, 60 minutes a day, It was stated that there was a significant improvement in the muscle strength of the participants (long jump by standing).

In the research of Fragala et al. [10], 45 minutes of SPARK exercise training for 8 weeks were given to 20 children with autism problems with an average age of 9.7 ± 2.35 3 times a week and the improved data were obtained from the control group of children with long jump degrees by standing. In another study, a significant improvement was observed between the pretest and posttest results in the terms of vertical jump variable.

In the research, as a result of post-test measurements and three-month training program were performed for 9 girls and 17 boys with mental disabilities, It has been observed that power and strength exercises increase the 60 skill developments of long jump by standing of children with disability problems.In the survey of Yanardag [27], an exercise program was given to 8 boys aged 5-7 with autism for 12 weeks, 3 days a week and 40 minutes a day.In black group, No significant significance was found in the data of long jump test by standing before and after the study. Some differences were found in the pool group [5].

In a study to determine whether clinical exercise rehabilitation has beneficial effects in children and adolescents with autism, It has been determined that a high intensity exercise program has positive effects on physical fitness in children with autism [16]. In a study examining the effect of the aquatic program practiced to children with autism and children with no autism in the same peer group for 14 weeks on physical fitness and aquatic skills, It was determined that there was a positive improvement in motor skills and physical fitness levels of children in both groups included in the program [19].

It has been observed that there were positive changes in the values measusred of the long jump variable by standing after programmed training. In the study, the changes obtained in terms of the long jump variable by standing are supported by the literature studies [18]There are some problems in the neuromuscular system,which plays an important role in the practice of motor skills inchildren with autism, and it is seen that minimizing these problems and increasing the effectiveness of the neuromuscular structure will be improved with being supported by physical activities[6]. When children with autism problems who do exercise and those with no autism problems who do not exercise were examined, it was determined that skill levels of those who do exercises were better [11].

As a result, it has been shown that the training program provides improvement at a significant level in motor skills of individuals with atypical autism. This development, which is also seen at horizontal jump levels of the individuals shows that it will have a positive effect on the physical development of them. Therefore, it is recommended to plan appropriate training programs for the development of gross motor and fine motor skills in individuals diagnosed with atypical autism.

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