THE EFFECTS OF EIGHT WEEKS SPORT ROCK CLIMBING TRAINING ON ANXIETY

DICLE ARAS[1], ALAN W. EWERT[2]
[1]Faculty of Sport Sciences, Ankara University, Ankara, Turkey - [2]School of Public Health, Indiana University Bloomington, IN, USA

ABSTRACT

Regular physical activity can be an efficient method for prevention for anxiety. The purpose of the study is to examine the effects of 8 weeks of sport rock climbing (SRC) training on anxiety in healthy sedentary adults. A total number of nineteen students participated in this study voluntarily composing of a control group (CG, n=10, age 21.90 ± 1.66 years, height 168.50 ± 4.40 cm, weight 61.18 ± 7.08 kg) and an experimental group (EG, n=9, age 21.11 ± 2.31 years, height 167.33 ± 6.44 cm, weight 59.31 ± 8.39 kg). After the EG had been taught basic climbing and rope techniques, body composition and aerobic power measurements were taken for both groups. The EG engaged in climbing training by using a top-rope method for 60 minutes a day with an intensity level of 70 % of HR reserve, three days a week for eight weeks. The CG did not engage in any systematic physical activity program during the study. The Competitive Sport Anxiety Inventory-2 (CSAI-2) was given to participants twice. The EG completed the Inventory 20 minutes before the first and the last climbing trial. The CG completed the Inventories on first and last day of 8 weeks period. The results indicated significant changes in all CSAI-2 results for EG, including cognitive (p_=_0.002) and somatic anxiety (p_=_0.032) reduced, self-confidence (p_=_0.001) increased. This current study is one of the first research efforts examining the psychological effects of eight weeks SRC training. Results demonstrated that eight weeks of SRC training significantly reduces cognitive and somatic anxiety and increases self-confidence. In addition to the psychological effects, eight weeks of SRC training also improved the VO2 max of participants. This study suggests that SRC can be useful as a regular physical activity in controlling and improving anxiety in the study sample.

Key words: Sport rock climbing; cognitive anxiety; somatic anxiety; self-confidence.

DOI:10.19193/0393-6384_2016_1_35

***Received** May 30, 2015; **Accepted** January 02, 2016*

Introduction

Anxiety disorders are the most prevalent type of psychiatric disorder[1, 2] and, in some cases, can affect the quality of life (QoL) much more than chronic medical disorders[3]. Similarly, lack of regular physical activity and improved reduced physical fitness levels are related to cardiovascular disease, hypertension, stroke, osteoporosis, type 2 diabetes, obesity, colon cancer, breast cancer as well as anxiety and depression[4, 5, 6, 7].

Some meta-analyses studies have demonstrated a consistent inverse relationship between exercise and anxiety, with exercise resulting in a small to moderate reduction on levels of anxiety[8, 9, 10]. As a result of these findings Wipfli et al. (2011) recommend that exercise can be used as a method for prevention and treatment for anxiety[11]. According to Wipfli, Rethorst, & Landers (2008), exercise can an effective method for reducing anxiety similar to stress management education, stretching and yoga activities, group therapy, mediation and relaxation, and as effective as cognitive behavioral therapy[10]. They do, however, report that pharmacological treatments can be more beneficial on reducing anxiety than exercise[12].

Furthermore, it has been understood that people who have low physical activity and physical fitness level, often have high levels of anxiety[13, 14, 15, 16, 17, 18]. Moreover, high levels of anxiety can impact an athletes' sport performance[19, 20, 21], and increase the risk of injury[22]. Furthermore, the positive effects of exercise on levels of anxiety have been also observed in sedentary adults with a variety of chronic diseases[23, 24, 25, 26, 27, 28].

Rock climbing is one of the basic movement forms of human nature, and has been defined as a physical activity where arms are used when legs are not capable enough while moving on the rock face[29]. Rock climbing is a sports activity which has both physical and psychological requirements[30, 31] and is comprized of many sub-branches. The most popular sub-branch is sport rock climbing (SRC). SRC is a type where fixed anchors are placed in specifically-determined intervals on the climbing wall[32, 33, 34]. Although SRC can appear to be a dangerous sport, injury statistics actually suggest a much safer activity with lower injury rates, when compared to many common sports such as basketball, soccer, volleyball, handball etc.[34].

In this present study we measure the chronic psychological responses of long term SRC training on anxiety by way of using the Competitive Sport Anxiety Inventory-2 (CSAI-2). The CSAI-2 is one of the most frequently used instruments to determine the anxiety level in the scientific researches. This inventory evaluates cognitive anxiety, somatic anxiety and self-confidence parameters which affect cognitive and motor performance of human[35, 36, 37]. Cognitive anxiety is the mental component of anxiety, and causes negative self-evaluations and doubts. Somatic anxiety includes physiological components and affects the organism directly. While self-confidence is not a method to measure anxiety, it has been defined as a belief to implement a task[38].

Background

A number of studies have investigated the psychological effects of SRC on anxiety and other outcomes. The earlier studies about SRC and anxiety investigated acute effects of different ascent methods and techniques on anxiety in the literature. Some researchers found that anxiety level was increasing while the lead climbing method which contains risk of falling than top rope climbing method which doesn't contain risks of falling and hitting the ground[39, 40, 27]. Other researchers have found no difference between these methods[41, 42, 43]. Commonly, however, it is observed that the first ascent of a climbing route caused more anxiety level than its second ascent[40, 44]. Nieuwnfuys et al. (2008) reported that the route placed in high induces high level of anxiety than its same placed in low[45]. Even though these studies have not examined the chronic influences of SRC, their findings can be helpful to understand the anxiety and self-confidence scores of climbers. Aras & Akalan (2014) evaluated the anxiety levels of twenty-six intermediate sport rock climbers[39]. They reported the cognitive anxiety level 15.81, somatic anxiety 14.08, and self-confidence 30.62 by using CSAI-2 during top-roping. Draper, Jones, Fryer, Hodgson, & Blackwell (2010) determined the cognitive anxiety 16, somatic anxiety 14, and self-confidence 29 in nine intermediate sport rock climbers[42]. In another research, Draper et al. (2012) found the cognitive anxiety 18.6, somatic anxiety 18.6, and self-confidence 27.1 during top roping in nineteen intermediate sport rock climbers[41]. Dickson et al, (2012) observed the cognitive anxiety 15, somatic anxiety 15, and self-confidence 30 during top-rope climbing in fifteen elite sport rock climbers[46].

No literature was identified that specifically examined the effects of eight weeks SRC on anxiety in the literature. However, the chronic effects of different long term physical activity programs on anxiety have been investigated both in healthy and with chronic illness sedentary adults. For example, where participants with chronic low back pain joined, the effect of a one week yoga program on anxiety was examined. As a result, it was observed that this exercise caused significantly reduces in state and trait anxiety[47].

Wipfli et al. (2011) examined the effect on anxiety levels caused by a seven-week aerobic exercise program[11]. Although no significant differences were found in both the experimental and control group, they reported greater reduce in experimental group. Another study was made by Guszkowska and Sionek (2009) where it was reported that after a twelve-week aerobic exercise program a reducing was seen in trait anxiety level in sedentary women[48]. Carraro and Gobi (2012) examined the effect of a twelve-week exercise program on anxiety in people with intellectual disabilies, and they found significant differences on state and trait anxiety[49]. Khademi and Rahimi (2012) found the cognitive and somatic anxiety

effects caused by two eight-week aerobic exercise programs done by high school students[50]. Lokos et al. (2013) reported that the attending to swimming and complex sport therapy for 18 months improves the QoL through reduction of anxiety in children with spinal column disorders and asthma[51]. Another research was made with non-athlete female college students. The results of this study showed that a ten-week aerobic exercise program effect on state and trait anxiety significantly[52]. Aidar et al. (2012) found significantly differences on state and trait anxiety after 12 weeks of resistance exercise training in adults who had ischemic stroke[53]. Some review articles pointed, the reducing on anxiety symptoms are seen as independent from activity types (walking, running, resistance training, yoga, tai-chi and etc.)[8, 54]. This change can be seen in people with chronic mental or physical illness as well as in healthy adults. The examples given above support this information.

Therefore, the aim of the study is to examine the effects of 8 weeks of sport rock climbing (SRC) training on anxiety, and to understand whether SRC can be suggested as a type of physical activity to control anxiety level in sedentary and relatively healthy adults. We hypothesized that the anxiety level would be decreased, and the self-confidence level would be increased after eight weeks of sport rock climbing training in healthy sedentary adults.

Methods

Participants

A total number of 19 students from Ankara University, Turkey, Faculty of Sport Sciences, participated this study voluntarily composing either a control group (n = 10, age 21.90 ± 1.66 years, height 168.50 ± 4.40 cm, weight 61.18 ± 7.08 kg) or an experimental group (n = 9, age 21.11 ± 2.31 years, height 167.33 ± 6.44 cm, weight 59.31 ± 8.39 kg). The students were not randomly assigned. The experimental group consists of people who had not been doing any regular physical training for at least six months and would not participate in any regular physical training other than climbing exercises for eight weeks. The control group is composed of volunteers who have not been doing any regular physical activity for at least six months and will not participate in any systematic exercise program for eight weeks.

The research was approved by Ankara University Medical Faculty Clinical Researches Ethics Committee and then Informed Consent Forms were filled out by all participants for control and experimental groups.

Data collection procedure

At the beginning of the 8 week-period the following measurements were made for both the control and experimental groups.

Body composition

Body weights were measured with Avis 333 plus (Korea) analyzer and Holtain branded stadiotmeter with 1-mm distance was used to measure heights (Holtain, U.K.).

Aerobic power

Test protocol of Bruce treadmill was used for the determination of aerobic power in this study. VO2max measurement was made by a Viasys-Oxycon branded MasterScreen-CPX spirometer (Hoechberg, Germany) and RAM branded 770 M treadmill (CAMIN, Italy). Heat, humidity, air volume and gas calibrations of the device were made before each measurement. Bruce protocol was started with a 10 % incline and 2.72 km/h, the incline was increased by 2 % and the speed was increased by 1.28-1.44 in every three minutes. The test continued this way until the participant could not continue anymore. The mask was cleaned with a special solution before each measurement and spirometer tribune was dried. Test protocol was explained to the participant and the participant was told not to hold any part of the treadmill during the test. After the participants wore their masks the test was started. VO2max values obtained at the last minute of the test were accepted as the real VO2max values of the participants and HRmax values were taken as average HR. In this research the duration of climbing training was determined as one hour, frequency as three days a week and intensity as 70 % as recommended in the literature to improve the health-related physical fitness parameters[55, 56].

Heart rates were determined by using the HRreserve method [Target HR = (percentage of load) x (HRmax - HRrest) + HRrest] during training[55]. HRrest and HRmax values taken from Bruce treadmill test protocol were used in calculation with an intensity level of 70 % and monitored during climbing exercises. Each participant completed the climbing exercise within the ± 5 HRtarget range. Training HRs were continuously monitored with a Polar Team 2 (Polar, Finland) model device and

when the participants got out the requested range, their target HRs were preserved by changing climbing pace.

Procedures

The experimental group was given a one-week climbing training before the first climbing session. Basic climbing techniques as well as safe usage of materials and rope techniques were taught.

Before a one-hour climbing exercise, a standard warm-up and cool-down protocol was applied composing of a 5-minute run and 10-minute stretching. Warm-up running exercise was done at a lower level as recommended[56]. In stretching exercises, each move was planned to take 30 seconds for the neck, arms, body and legs respectively. Following warm-up exercises, the participants put on their safety harness and were connected to the rope system to start climbing. The participants used climbing chalk, chalk bag and rock climbing shoes while climbing. They were allowed to use any handhold they wanted to and step wherever they wanted and told not to stop during the actual climbing. The participants were lowered to the bottom within 10 seconds after each climb was completed and then asked to continue with another climb.

SRC trainings were between 16:00 and 19:00 and done on the 12 m-high climbing wall which was in A. U. Faculty of Sport Sciences Hall. All the climbing exercises were done by using the top-rope technique and a safety guy was assigned for each climbing participant during the exercises.

Training ended with a 5-minute run and 10-minute stretching exercises after climbing. Total climbing distance was recorded every week by calculating ascent numbers and height of the route.

Collection of anxiety inventories

Psychological measures for the study were Competitive State Anxiety Inventory-2 (CSAI-2). Participants were instructed to respond to the inventory. The CSAI-2 was given to participants twice. The experimental group completed them by 20 minutes before the first climbing trial on the first day and the last climbing trial on the last day in a quiet room. The control group completed the inventories on first and last day of eight weeks period also in the same, quiet room. The CSAI developed by Martens et al. and revised to CSAI-2 in 1990. CSAI-2 is a 27-item inventory, and has three subscales. Each subscale includes 9 items, with each item being scored on a Likert scale of 1-4.

By way of using CSAI-2, cognitive anxiety, somatic anxiety and self-confidence can be determined[38].

Statistical analysis

All analyses were performed using the SPSS 20 (SPSS Inc., Chicago, IL, USA). At first, the distribution of data was tested to determine if the test to be used for average comparison is parametric or not. Normality distribution was tested with Shapiro Wilk, as in both groups the number of participants was below 50. Average differences were determined with the parametric Paired Sample t-Test for the data where distribution is normal and with the non-parametric Wilcoxon Test for the data where distribution was not normal. Independent-Sample t-Test or Mann-Whitney U Test was used for pre-control and experimental groups' differences according to distribution of the data. Alpha value was accepted as 0.05 for all of the statistical analyses.

Results

The anxiety results obtained from CSAI-2 is listed in Table 1.

CSAI-2			
Group	**Pre test**	**Post test**	**p_**
Cognitive anxiety			
Control	20.10 ± 4.43	19.50 ± 4.22	0.526
Experimental	21.00 ± 3.43	18.44 ± 3.21	0.002**
	p_ = 0.630		
Somatic anxiety			
Control	19.10 ± 4.41	18.60 ± 4.03	0.299
Experimental	17.56 ± 3.68	16.11 ± 3.55	0.032*
	p_ = 0.422		
Self-confidence			
Control	26.40 ± 3.20	26.00 ± 2.75	0.674
Experimental	27.78 ± 4.89	31.11 ± 3.95	0.001**
	p_ = 0.473		

Table 1: CSAI-2 results and their mean differences obtained from pre and post tests.
**p<0.05, **p<0.01*

According to Table 1, it can be seen that no significant differences were found in any subscales of anxiety inventory for the control group. We also found no significant differences when comparing the pre-control and experimental groups' subscales. However, when comparing pre and post scores, significant changes were observed in all CSAI-2 results for the experimental group. These changes indicated a decrease in the anxiety scores. See Figure 1. While cognitive anxiety (from 21.00 to 18.44, 12.19 %, p_=_0.002**) and somatic anxi-

ety (from 17.56 to 16.11, 8.25 %, p_=_0.032*) decreased in reported levels, level of self-confidence (from 27.78 to 31.11, 10.86 %, p_=_0.001**) increased for the experimental group (Figure 1).

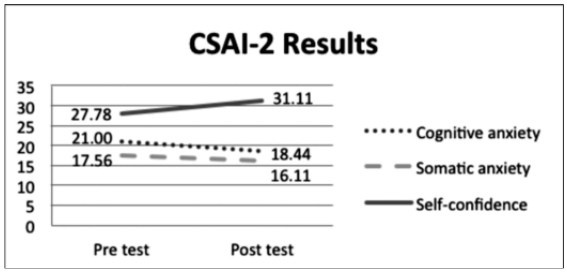

Figure 1: CSAI-2 results for experimental group.

No significant changes were observed for the control group that did not engage in the rock climbing protocol. In addition to the CSAI-2 results depicted in Figure 1, the distance of climbing was approximately 300 m in the first and 900 m in the last week, suggesting an increase in climbing skill, familiarity with the climbing routes, physical fitness or a combination of the three.

The VO2max, HRmax, HRrest values obtained from Bruce treadmill test protocol for both control and experimental groups, and HRtarget range calculated by using the HRreserve method for experimental group are shown in Table 2. In accordance with the Table 2, the data suggest that the experimental group reported a significant increase only on VO2max after eight weeks of SRC training.

Cardiovascular parameters			
Group	**Pre test**	**Post test**	***p_***
VO_2maks (ml.kg^{-1}.m^{-1})			
Control	47.42 ± 6.82	49.53 ± 6.35	0.182
Experimental	50.43 ± 8.44	53.39 ± 8.47	0.005**
HRmax (pulse/min)			
Control	185.37 ± 13.39	181.00 ± 12.25	0.386
Experimental	188.89 ± 7.84	190.36 ± 10.89	0.399
HRrest (pulse/min)			
Control	67.40 ± 4.77	68.40 ± 12.17	0.154
Experimental	64.22 ± 12.57	61.56 ± 11.91	0.755
HRtarget of experimental group (± 5 pulse/min at 70 %)			
146.49 ± 8.04		156.49 ± 8.04	

Table 2: HRrest, HRmax, and VO2max values and their mean differences derived from pre and post test, and the HRtarget values for experimental group.
**p<0.05, **p<0.01*

Discussion

The purpose of the study was to investigate the chronic effects of eight weeks of sport rock climbing training on cognitive and somatic anxiety and self-confidence levels by using the CSAI-2 in healthy sedentary adults, and to comprehend whether SRC can be suggested as a type of physical activity to control anxiety level. We hypothesized that SRC training would be effective on anxiety and self-confidence levels.

As expected, findings showed that there are no significance differences in any of the CSAI-2 subscales in the control group. However, we observed positive significant changes between levels of cognitive and somatic anxiety and self-confidence levels in the experimental group after eight weeks of SRC training. Perhaps not surprisingly, while cognitive and somatic anxiety levels were reduced (p_=_0.002, p_=_0.032), self-confidence (p_=_0.001) was increased.

Besides many positive physiological effects of regular physical activity[57, 58, 59, 60, 61, 62]. the findings from this study suggest that when people engage in rock climbing, they can reduce their cognitive and somatic anxiety levels and increase their levels of self-confidence. Several previous studies have reported that a high level of anxiety and related illnesses can be detrimental toward quality of life both in physical and social terms.[63, 64, 65, 66]. These improvements demonstrate that SRC can be effective in enhancing QoL by reducing of anxiety and increasing of self-confidence. This is an important issue, given the reported cost of depression and anxiety illness' annual cost of $ 180 billion in Europe and a $ 126 billion in the USA[11]. Thus, the potential value of activities such as SRC can be better appreciated, if for no other reason than a health-cost saving method.

While there have been several studies that have examined the effects of different long-term physical activity programs on anxiety in the literature.o our knowledge, this present study is one of the first to investigate the anxiety influences from eight weeks of sport rock climbing in healthy sedentary adults. Research findings are in line with the studies made with similar time periods and frequencies[11, 47, 48, 50, 51, 53]. Our results show a 12.19 % decreasing on cognitive anxiety and an 8.25 % on somatic anxiety, and a 10.86 % increasing on self-confidence levels. The change rates after a two different aerobic exercise program were 19.70 and 26.16 % for cognitive and 24.27 and 24.35 % for somatic anxiety[50]. These findings are somewhat in line with or greater than those of Tekur et al. (2012) who reported 20.4 % reduction on state, and 16 % on trait anxiety levels after doing a yoga program[47].

and Aidar et al. (2012), who reported a 4.26 % reduction on state and 7.64 % on trait anxiety after a resistance exercise program. Similar changes also observed after different kinds of aerobic activity types[53]. Wipfli et al. (2011) observed 9.91 % decreasing on state anxiety[11] an 8.44 % reducing was determined on trait anxiety by Guszkowska and Sionek, (2009)[48], Carraro and Gobi (2012) found 36.91 % reducing on state, and 36.39 % on trait anxiety,(49) and Arazi et al. (2012) reported the decreasing 38.87 % on state and 35.49 % on trait anxiety[52].

Unlike many other team sports, rock climbing often necessitates people taking risks and assuming complete responsibility for their successes or failures during a rock climbing event. This situation provides people with opportunities to observe their limits and strengths, both in psychological and physiological terms. Even if there is only a short distance of falling during top-rope climbing, it usually causes a determination to finish the route without falling. Moreover, participants often have a chance to improve their psychological and physiological awareness and perceived limits.

A developed sense of self-efficacy, occurring as a result of the climbing process, can be another reason for the observed reduction in levels of cognitive and somatic anxiety and increases in self-confidence after eight-week sport climbing training in healthy sedentary adults. Self-efficacy has been defined by Bandura (1997) as "belief in one's capabilities to organize and execute the courses of action required to produce given attainments"[67]. Self-efficacy can be improved and this improvement often depends on performance accomplishment, verbal persuasion, vicarious experience and emotional arousal, with the most powerful technique being performance accomplishment[68]. An important indicator of participants' improved performance was the increase in the climbing distance at the end of the eighth week compared to the beginning.

Conclusion

In this current study it is shown that eight weeks of sport rock climbing training reduces cognitive and somatic anxiety and increases levels of self-confidence in addition to some increase in levels of VO2max. While there are numerous other types of activities to select, this study suggests that rock climbing can be both psychologically and physically helpful to both participants and exercise practitioners. When considering the negative effects and cost of anxiety disorders, as is true with other forms of physical activity, rock climbing can be used for the prevention and treatment of high levels of anxiety.

Likewise, this study is important because it represents the first research examining the psychological effects of eight weeks of sport rock climbing. Despite the fact that this activity is substantially different from those used in daily life, the findings from this study suggest that rock climbing activities can be an effective mediator in lessening levels of anxiety and increasing an individual's self-confidence. These improvements probably occur depending on self-knowledge after being experienced both of psychological and physiological limits concurrently, and self-efficacy. Since these positive changes can be seen in only eight weeks of training, sport rock climbing can be considered a relatively efficient method. To develop a better understanding of the dose-response phenomenon within this type of activity, more research is needed using other populations such as to children and elderly, as well as different lengths of time. Likewise, to increase the study sample and to extend the study period would provide more valuable consequences. The researchers could consider these limitations for further studies.

References

1) DuPont RL, Rice DP, Miller LS, Shiraki SS, Rowland CR., Harwood HJ. *Economic cost of anxiety disorders*. Anxiety 1996; 2: *167-172*.
2) Kessler RC, Foster CL, Saunders WB, Stand PE. *Social consequences of psychiatric disorders I: Educational attainment*. Am J Psychiatry 1995: 152(7): *1026-1032*.
3) Spitzer RL, Kroenke K, Linzer M, Hahn SR, Williams JB, DeGruy FV, Brody D, Davies M. *Health-related quality of life in primary care patients with mental disorders. Results from the prime-md 1000 study*. JAMA 1995; 274(19): *1511-1517*.
4) Feskanich D, Willett W, Colditz G. *Walking and leisure-time activity and risk of hip fracture in postmenopausal women*. JAMA 2002; 288(18): *2300-2306*.
5) Haskell WL, Lee IM, Pate RR, Powell KE, Blair SN, Franklin BA, Macera CA, Heath GW, Thompson PD, Bauman A. *Physical activity and public health: updated recommendation from the American College of Sports Medicine and the American Heart Association*. Circulation 2007; 39(8): *1423-1434*.
6) Leitzmann MF, Rimm EB, Willett WC, Spiegelman D, Grodstein F, Stampfer MJ, Colditz GA, Giovannucci E. *Recreational physical activity and the risk of cholecys-*

tectomy in women. N Engl J Med 1999; 341(11): *777-784*.

7) Wenger NK, Froelicher ES, Smith LK, Ades PA, Berra K, Blumenthal JA, Certo CM, Dattilo AM, Davis D, DeBusk RF. *Cardiac rehabilitation as secondary prevention. Agency for Health Care Policy and Research and National Heart, Lung, and Blood Institute*. Clin Pract Guidel Quick Ref Guide Clin 1995; (17): *1-23*.
8) Asmundson GJG, Fetzner MG, De Boer LB, Powers MB, Otto MW, Smits JAJ. *Let's get physical: a contemporary review of the anxiolytic effects of exercise for anxiety and its disorders*. Depress Anxiety 2013; 30: *362-373*.
9) Petruzzello SJ, Landers DM, Hatfield BD, Kubitz KA, Salazar W. *A meta-analysis on the anxiety reducing effects of acute and chronic exercise*. Sports Med 1991; 11(3): *143-182*.
10) Wipfli BM, Rethorst CD, Landers DM. *The anxiolytic effects of exercise: a meta-analysis of randomized trials and dose-response analysis*. J Sport Exerc Psychol 2008; 30: *392-410*.
11) Wipfli BM, Landers D, Nagoshi C, Ringenbach S. *An examination of serotonin and psychological variables in the relationship between exercise and mental health*. Scand J Med Sci Sports 2011; 21(3): *474-481*.
12) O'Connor PJ, Raglin JS, Martinsen EW. *Physical activity, anxiety and anxiety disorders*. Int J Sport Psychol 2000; 31: *136-155*.
13) Camacho TC, Roberts RE, Lazarus NB, Kaplan GA, Cohen RD. *Physical activity and depression: evidence from the Alameda County Study*. Am J Epidemiol 1996; 13: *220-231*.
14) Goodin BR, McGuire LM, Stapleton LM, Quinn NB, Fabian LA, Haythornthwaite JA, Edwards RR. *Pain catastro- phizing mediates the relationship between self- reported strenuous exercise involvement and pain ratings: Moderating role of anxiety sensitivity*. Psychosom Med 2009; 71: *1018-1025*.
15) McWilliams LA, Asmundson GJG. *Is there a negative association between anxiety sensitivity and arousal-increasing substances and activities?* J Anxiety Disord 2001; 15: *161-170*.
16) Paffenbarger RS, Lee IM, Leung R. P*hysical activity and personal characteristics associated with depression and suicide in american college men*. Acta Psychiatr Scand Suppl 1994; 377: *16-22*.
17) Smits JA, Zvolensky MJ. *Emotional vulnerability as a function of physical activity among individuals with panic disorder.* Depress Anxiety 2006; 23: *102-106*.
18) Pauli A, Bianco A. *What is Fitness Training? Definitions and Implications: a systematic review article*. Iran J Public Health 2015; 44(5): *602-614*.
19) Gould D, Feltz D, Horn T, Weiss M. *Reasons for discontinuing involvement in competitive youth swimming*. J Sport Behav 1982; 5: *155-165*.
20) Smith RE, Smoll FL. *Behavioral research and intervention in youth sports*. Behav Ther 1991; 22: *329-344*.
21) Woodman T, Hardy L. *The relative impact of cognitive anxiety and self- confidence upon sport performance: a meta-analysis*. J Sports Sci 2003; 21: *443-457*.
22) Van Wijk CH. *The Use of Spielberger's State-Trait Personality Inventory (trait anxiety subscale) with Naval Subaquatic Specialists*. Int J Occup Med Environ Health 2014; 27(6): *959-966*.
23) Freitas DP, Haida A, Bousquet M, Richard L, Mauriege P, Guiraud T. *Short term impact of a 4-week intensive cardiac rehabilitation program on quality of life and anxiety-depression*. Ann Phys Rehabil Med 2011; 54(3): *132-143*.
24) Herring MP, O'Connor PJ, Dishman RK. *The effect of exercise training on anxiety symptoms among patients: systematic review*. Arch Intern Med 2010; 170: *321-331*.
25) Mehnert A, Veers S, Howaldt D, Braumann KM, Koch U, Schulz KH. *Effects of a physical exercise rehabilitation group program on anxiety, depression, body image, and health related quality of life among breast cancer patients*. Onkologie 2011; 34(5): *248-253*.
26) Strohle A. *Physical activity, exercise, depression and anxiety disorders*. (2009). J Neural Transm 2009; 116: *777-784*.
27) Vancampfort D, Probst M, Scheewe T, Maurissen K, Sweers K, Knapen J, DeHert M. *Lack of Physical Activity during leisure time contributes to an impaired health related quality of life in patients with schizophrenia*. Schizophr Res 2011; 129: *122-127*.
28) Martines F, Sireci F, Cannizzaro E, Costanzo R, Martines E, Mucia M, Plescia F, Salvago P. *Clinical Observations and Risk Factors for Tinnitus in a Sicilian Cohort*. Eur Arch Otorhinolaryngol 2015; 272(10): *2719-2729*.
29) Sturm G, Zintl, F. *Felsklettern, alpin-lehrplan 2, deutscher alpenverein*. München, Germany: BlV Verlagsgesellschaft; 1979.
30) Hodgson CI, Draper N, McMorris T, Jones G, Fryer S, Coleman I. *Perceived anxiety and plasma cortisol concentrations following rock climbing with differing safety rope protocols*. Br J Sports Med 2009;43(7):531-535.
31) Morrison AB, Schoffl VR. *Physiological responses to rock climbing in young climbers*. Br J Sports Med 2007; 41: *852-861*.
32) Kidd TW, Hazelrigs J. *Rock climbing-outdoor adventures*. Champaign, IL: Human Kinetics; 2009.
33) Schoffl V, Morrison A, Schwarz U, Schoffl I, Kupper T. *Evaluation of injury and fatality risk in rock and ice climbing*. Sports Med 2010; 40(8): *657-679*.
34) Shaw WD, Jakus P. *Travel Cost models of the demand for rock climbing*. Agr Resource Econ Rev 1996; 25(2): *133-142*.
35) Lundqvist C, Hassmen P. *Competitive State Anxiety Inventory-2 (CSAI-2): Evaluating the Swedish version by confirmatory factor analyses*. J Sports Sci 2005; 23(7): *727-736*.
36) Andrade Fernandez EM, Lois Rio G, Arce Fernandez C. *Pscychometric Properties of the Spanish Version of the Revised Competitive State Anxiety Inventory-2 with Athletes*. Psicithema 2007; 19(1): *150-155*.
37) Perpina-Galvan J, Richart-Martinez M. *Scales for Evaluating Self-perceived Anxiety Levels in Patients Admitted to Intensive Care Units: a review*. Am J Crit Care 2009; 18(6): *571-580*.
38) Martens R, Vealey R, Burton D. *Competitive anxiety in sport: Development and Validation of the Competitive State Anxiety Inventory-2*. Champaign, IL: Human Kinetics; 1990.
39) Aras D, Akalan C. *The effect of anxiety about falling on selected physiological parameters with different rope protocols in sport rock climbing*. J Sports Med Phys

Fitness 2014; 54(1): *1-8*.
40) Hardy L, Hutchinson A. *Effects of performance anxiety on effort and performance in rock climbing: A test of processing efficiency theory*. Anxiety Stress Coping 2007; 20(2): *147-161*.
41) Draper N, Dickson T, Fryer S, Blackwell G, Winter D, Scarrott C, Ellis G. *Plasma cortisol concentrations and perceived anxiety in response to on-sight rock climbing*. Int J Sports Med 2012; 33(01): *13-17*.
42) Draper N, Jones GA, Fryer S, Hodgson CI, Blackwell G. *Physiological and Psychological responses to lead and top rope climbing for intermediate rock climbers*. Eur J Sport Sci 2010; 10(1): *13-20*.
43) Fryer S, Dickson T, Draper N, Blackwell G, Hillier S. *A psychophysiological comparison of on-sight lead and top rope ascents in advanced rock climbers*. Scand J Medicine Sci Sports 2013; 23(5): *645-650*.
44) Draper N, Jones GA, Fryer S, Hodgson C, Blackwell G. *Effect of an on-sight lead on the physiological and psychological responses to rock climbing*. J Sports Sci Med 2008; 7(4): *492-498*.
45) Nieuwenfuys A, Pijpers JR, Oudejans RRD, Bakker FC. *The influence of anxiety on visual attention in climbing*. J Sport Exerc Psychol 2008; 30(2): *171-185*.
46) Dickson T, Fryer S, Blackwell G, Draper N, Stoner L. *Effect of style of ascent on the psychophysiological demands of rock climbing in elite level climbers*. Sports Technology 2012; 5(3-4): *1-9*.
47) Tekur P, Nagarathna R, Chametcha S, Hankey A, Nagendra HR. *A comprehensive yoga programs improves pain, anxiety and depression in chronic low back pain patients more than exercise: an rct*. Complement Ther Med 2012; 20(3): *107-118*.
48) Guszkowska M, Sionek S. *Changes in mood states and selected personality traits in women participating in a 12-week exercise program*. Human Movement 2009; 10(2): *163-169*.
49) Carraro A, Gobbi E. Effects of an exercise programme on anxiety in adults with intellectual disabilities. Res Dev Disabil 2012; 33:*1221-1226*.
50) Khademi AR, Rahimi G. *Effects of 8-week maximal and sub-maximal aerobic exercises on high school students' anxiety*. Adv Environ Biol 2012; 6(8): *2226-2231*.
51) Lokos D, Zsidegh M, Popescu AM, Toth L, Sipos K. *Investigating the impact of swimming and complex sport therapy on anxiety*. Cogn Brain Behav 2013; 17(4): *277-288*.
52) Arazi H, Benar N, Esfanjani RM, Yeganegi, S. *The effect of an aerobic training on perceived stress, anxiety and depression of non-athlete female students*. Acta Kinesiol 2012; 6(2):*7-12*.
53) Aidar FJ, Oliveira RJ, Silva AJ, Matos DG, Filho MLM, Hickner RC, Reis VM. *The influence of resistance exercise training on the levels of anxiety in ischemic stroke*. Stroke Res Treat 2012; 2012: *1-7*.
54) Jayakody K, Gunadasa S, Hosker C. *Exercise for anxiety disorders: systematic review*. Br J Sports Med 2014; 48: *187-196*.
55) Ehrman JK, Dejong A, Sanderson B, Swain D, Swank A, Womack C. *ACSM'S resource manual for guidelines for exercise testing and prescription* (6th ed.). Baltimore MD: Wolters Kluver Lippincott Williams & Wilkins; 2010.
56) Thompson WR, Bushman BA, Desch J, Kravitz L. *ACSM'S resources for the personal trainer* (3rd ed.). Baltimore MD: Wolters Kluver Lippincott Williams & Wilkins; 2010.
57) DeLima C, Boullosa DA, Frollini AB, Donatto FF, Leite RD, Gonelli PRG, Montebello MI, Prestes J, Cesar MC. *Linear and daily undulating resistance training periodizations have differential beneficial effects in young sedentary women*. Int J Sports Med 2012; 33(9): *723-727*.
58) Fourie M, Gildenhuys GM, Shaw I, Shaw BS, Toriola AR, Goon DT. *Effects of a mat pilates programme on body composition in elderly women*. West Indian Med J 2013; 62(6): *524-528*.
59) Nikseresht M, Agha-Alinejad H, Azarbayjani MA, Ebrahim K. *Effects of nonlinear resistance and aerobic interval training on cytokines and insulin resistance in sedentary men who are obese*. J Strength Cond Res 2014; 28(9): *2560-2568*.
60) Sekendiz B, Cug M, Korkusuz F. *Effects of swiss-ball core strength training on strength, endurance, flexibility, and balance in sedentary women*. J Strength Cond Res 2010; 24(11): *3032-3040*.
61) Smith MM, Sommer AJ, Starkoff BE, Devor ST. *Crossfit-based high-intensity power training improves maximal aerobic fitness and body composition*. J Strength Cond Res 2013; 27(11): *3159-3172*.
62) Vogelsang TW, Hanel B, Kristoffersen US, Petersen CL, Mehlsen J, Holmquist N, Kjaer A. *Effect of eight weeks of endurance exercise training on right and left ventricular volume and mass in untrained obese subjects: a longitudinal mri study*. Scand J Med Sci Sports 2008; 18: *354-359*.
63) Jayakody R, Danziger S, Kessler RC. *Early onset psychiatric disorders and male socioeconomic status*. Soc Sci Res 1998; 27(4): *371 387*.
64) Judd LL. *The clinical course of unipolar major depressive disorders*. Arch Gen Psychiatry 1998; 54: *989-991*.
65. Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. *Lifetime prevalence and age-off-onset distributions of DSM-IV disorders in the national comorbidity survey replication*. Arch Gen Psychiatry 2005; 62: *593-602*.
66) Mystakidou K, Tsilika E, Parpa E, Katsouda E, Galanos A, Vlahos L. *Assessment of anxiety and depression in advanced cancer patients and their relationship with quality of life*. Qual Life Res 2005; 14: *1825-1833*.
67) Llewellyn DJ, Sanchez X, Asghar A, Jones G. *Self-efficacy, risk taking and performance in rock climbing*. Pers Individ Dif 2008; 45: *75-81*.
68) Ewert AW. *Outdoor Adventure Pursuits: Foundations, Models, and Theories*. Worthington, Ohio: Gorsuch Scarisbrick Pub; 1989.

Corresponding author
DICLE ARAS, Ph.D.,
Faculty of Sport Sciences, Ankara University
Ankara
(Turkey)