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RELATIONSHIP OF AEROBIC ABILITIES AND AGILITY WITH MILITARY PHYSICAL TASKS IN THE SERBIAN ARMED FORCES

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SUMMARY

The level of physical ability of professional military personnel (PMP) is checked by applying different tests to assess motor and functional abilities, but there is little research that has confirmed their applicative value. The purpose of this study was to determine the relationship of aerobic ability and agility with the military readiness obstacle course (MSKILL). The study was conducted on 17 male subjects, 27.71 ± 7 years old, of PMP in the Serbian Armed Forces (SAF). In the research were applied tests for the aerobic ability and agility assignment. Statistica 8.0 was used for data processing. The results have shown a statistically significant relationship between aerobic ability and agility with MSKILL (R = 0.840, and 0.884; R^2 = 0.706, and 0.782, $p < 0.05$). Agility T-Test and absolute VO_2max have an excellent correlation with MSKILL (r = 0.86, and -0.83, $p < 0.05$). These tests may be the basis for constructing a set of tests to assess military physical tasks.

Keywords: agility, aerobic capacity, military, soldier readiness, obstacle course

INTRODUCTION

Military personnel on professional and combat tasks often have difficult tasks, such as recurring lifting, carrying heavy goods over long distances, and realizing a rapid execution of combat maneuvers through combat surroundings (Sharp, Patton, & Vogel, 1998). In most countries in the world, the level of physical fitness of military personnel is checked by applying different tests (Deakin et al., 2000; Rayson, Holliman, & Belyavin, 2000; Ministry of Defence, 2011; Army, 2012; Australian Defence Force, 2018). The purpose of these check-ups is to confirm personnel's physical abilities to perform various tasks within an assigned mission of a respective military organization. The manual for military physical readiness, which defines standards for assessing an individual's physical abilities has been put into practice in SAF since 2011 (Ministry of Defence, 2011). Military physical readiness includes a set of tests to estimate the repetitive strength of the muscles of the arm, shoulder and abdomen, aerobic fitness tests, and a specially designed military obtsacle course (Ministry of Defence, 2011).

Different sets of tests for military physical readiness have been constructed in countries around the world (Ministry of Defence, 2011; Army, 2012; Australian Defence Force, 2018). All these tests are easy to apply and serve to assess handling heavy materials, such as maximum lifting, repetitive lifting, carrying, military lifting and carrying and / or digging. These sets of tests assess strength, explosive strength - horizontal jumps (Bilzon, Scarpello, Bilzon, & Allsopp, 2002; Harman et al., 2008), long jumps (Foulis et al., 2017); repetitive strength - push-ups and curls (Rayson, Holliman, & Belyavin, 2000; Ministry of Defence, 2011; Army, 2012; Australian Defence Force, 2018), lifting squats (Foulis et al., 2017); static strength - isometric strength of upper arms (Myers, Gebhardt, Crump, & Fleishman, 1984; Rayson, & Holliman, 1995), hand-grip test (Myers et al, 1984; Rayson et al., 2000), and pulling boxes (Carstairs, Ham, Savage, Best, Beck, & Doyle, 2016). On the other hand, besides lifting and carrying loads, one of the important tasks is rapid and endurance movement through a battlefield. In this regard, sets of tests also include agility tests - "Shuttle Run" (Australian Defence Force, 2018), „Illinois Agility Test", „T-Test", and „Edgren Side Step Test" (Kraemer et al., 1998; Raya et al., 2013); anaerobic ability tests - „Beep Test" (Bilzon et al., 2002); aerobic abilities tests - 2400 m and 3200 m runs (Army, 2012; Foulis et al., 2017; Australian

Defence Force, 2018). There are just a few studies that have confirmed the applicative value of using these tests to assess the level of physical abilities required to predict military ability (Stevenson et al., 1992; Sharp et al., 1993; Pandorf et al., 2003). Deakin et al. (2000) found that tests used to estimate repetitive strength and endurance in SAF and the United States (USA) do not have a high significiant correlation with the prediction of military ability. Research by Foulis et al. (2017) also showed that tests constructed in such a way do not have a high statistical prediction.

A certain test for military physical ability has been applied in the SAF. MSKILL is designed to simulate crossing the battlefield with diverse obstacles (Ministry of Defence, 2011). Newcomers in the SAF, as well as PMP up to 32 years of age, are expected to justify their physical ability on such a constructed test. Since, due to its complexity, obstacle course is not present in admission for SAF, nor is it included in physical military readiness of PMP older than 32 years of age, it is necessary to further investigate which motor skills and tests relate to MSKILL, construct easy-to-use sets of tests which will be a good predictor in selection, monitoring of the physical ability level and designing of training programs.

Based on the above mentioned, the purpose of this study is to determine the predictive models of the time scored on the military readiness obstacle course by determining aerobic ability and agility of PMP in SAF.

METHODS

Subjects

The study included 17 PMP of SAF, aged 25 to 32. The mean values (SD) of their age, body weight, height and BMI were 27.71 ± 7 years, 85.94 ± 33 kg, 1.82 ± 0.17 cm and 25.86 ± 8.60. kg·m^{-2}. All military personnel were qualified for their occupations in their units, with a minimum job tenure of three years in SAF. Their physical readiness varied from the work required physical exercise to leisure physical activities. All participants were given a consent to perform necessary measurements, after which they were subjected to a medical examination to obtain confirmation that they are physically capable to perform necessary motor tasks during the examination. Military personnel who have been identified with immediate or acute injuries, as well as other illnesses, were excluded from the research. Participants were given instructions to continue to apply their regular every day exercise routine during the duration of the research. Prior to the start of the research, the participants were familiar with the Security and Health Protection at Work prescribed by the Sports Regulation in SAF (Ministry of Defence, 2011). The commandmant of the 126.brVOJIN unit approved the research in this unit.

Procedure

The measurements were made in the period from March to June 2018 at the sports fields of the respective unit. All the measurements were carried out by pre-trained persons, i.e. professors of physical education. On the first day of the survey, participants were introduced with the test procedure in detail, and then they approached to the measurements of anthropometric characteristics. On the second day of the survey, participants approached the measurement of motor skills. The tests for the assessment of agility were carried out first, followed by the tests for the assessment of aerobic ability. On the third day, participants were tested on the military obstacles course (Ministry of Defence, 2011). During the research, participants carried sports equipment for measuring motor skills and camouflage uniforms M-10 with boots used for military training. Each day of testing began with warming-up, instructions, and description of exercises on testing.

Outcome measures

Body height (HIGHT) was measured with an accuracy of 0.1 cm using a standardized anthropometric instrumentarium (GPM, Switzerland). The body mass (MASS) was measured with an accuracy of 0.1 kg on a standardized digital balance (Beurer BF 66). Based on the obtained results of body height and mass, BMI was calculated using a standardized formula kg·m^{-2}

Motor Abilities Tests

(1) Tests for the assessment of aerobic ability.

4. 2400 m run (T2400). On the command “go”, the participants that stood behind the start line had to run 2400 m as fast as they could to the end of the track. Walking was allowed during testing. The time required to complete the test was measured in seconds (Ministry of Defence, 2011).

5. Absolute VO_2max (VO2MAXA). It was calculated for each participant based on the time taken on the 2400 m run test using the following formula: $VO_2maxA = (483 / time) + 3.5$. (Wood, 2008)

6. Relative VO_2max (VO2MAXR). It was calculated based on the VO_2maxA value using the following formula: $VO_2maxR = VO_2maxA \times 1000 / kg$. (Bryant, & Green, 2010)

(2) Tests for Agility Assessment.

4. „10 m Agility Shuttle Test“ (SHUTTLE). On the command "go", the participants’ task was to run as fast as they could to the opposite line, raise

the "relay", return to the start line and lower it to or out of the starting line, then turn without rest, go back to the opposite line in order to take the second "relay" and transfer it over the finish line. The time required to complete the test was measured in seconds. The participants had the right to repeat the section twice. The fastest test time was taken as a final result. Attempts with a throw-in or drop-off of the "relay" were not counted as valid (Wood, 2008).

5. „Agility T-Test“ (T-TEST). On the command "go", the participants started moving forward as quickly as possible to the centre cone, sidestepped to the right 5 m to the right cone, sidestepped to the left 10 m to the far left cone, and then sidesstepped back to the right to the centre cone. The participants then moved backward as quickly as possible to cross the finish line. The time required to complete the test was measured in seconds. The participants had the right to repeat the section twice. The fastest test time was taken as a final result. In cases where participants failed to run the course as instructed, disqualification was determined (Raya et al., 2013).

6. „30 s Endurance Jump“ (RJUMP). The participants were standing on one side of the 30 cm high obstacle. On the command "go", the participants started jumping over the obstacle sidestepped on one side (for example, to the right) and then returned the same way. This was a complete cycle. The participants’ task was to complete as many cycles as possible in one minute. Incorrectly performed cycles were not counted. One complete cycle was counted as 1, and half a cycle as 0.5. The result wass expressed as a repetition rate in one minute (Wood, 2008).

A Military readiness obstacle course

MSKILL is designed to simulate crossing a battlefield with scattered obstacles. It is composed of 18 different obstacles arranged on a 240 m long section. Obstacles: wire mesh, a fence made of undergrowth, palisades, logs, two beams, scaffolding, horizontal ladders, a wire fence, a shaft, combined ladders, three beams, holes, doors and windows, a tunnel, horns, a corridor, sloping palisades, a trench. The initial position of the participants was foreground lying. On the command “go”, the participants had to overcome the obstacles as fast as they could. Walking was allowed during testing. The time required to complete the test was measured in seconds. The participants had the right to repeat the section twice. In cases where participants failed to run the course as instructed, disqualification was determined (Ministry of Defence, 2011).

Statistical analysis

Descriptive data were calculated for anthropometrics and motor abilities. The results are presented by mean ± standard deviation (SD). The Pirson coefficient of correlation was used to determine the relationship between the predictor and the criterion variables (one with each of them). The values of this coefficient range from -1 to +1. The regression analysis was used to determine the impact of agility and aerobic ability on military readiness course. Statistical analyses were conducted in Statistica 8.0. The level of statistical significance was taken for $p < 0.05$.

RESULTS

Table 1 shows basic statistical parameters of the general indicators of the sample. By analyzing them, it was found that the participants’ included in this study was average aged 28 (27.71 ± 7.00), body height 182 cm (1.82 ± 0.17), body weight 86 kg (85.94 ± 33.00), and BMI 26 (25.86 ± 8.60).

Table 1. Basic statistical parameters - general indicators of the sample

Variables	N	Mean	Min	Max	Range	SD
YEAR	17	27.71	25.00	32.00	7.00	2.592
HIGHT	17	1.82	1.76	1.93	0.17	0.050
MASS	17	85.94	68.00	101.00	33.00	9.562
BMI	17	25.86	21.60	30.20	8.60	2.571

By analyzing Table 2 in which basic statistical parameters of agility and aerobic ability of PMP are shown, it can be seen that these tests showed a slightly lower variability. This can be explained by the participants’ lack of motivation to carry out the tasks. By screening the result, a normal symmetry of distribution around the arithmetic mean can be seen in almost all motorics tests. T-TEST is on the limit, while T2400 is more right-oriented which means that the test was relatively easy for this group of subjects. Kurtosis indicates that the results in all variables are in normal distribution. The results of T2400 and REJUMP are mildly compressed, while in SHUTTLE are slightly spread out.

By inspecting basic statistical parameters of MSKILL, it can be noticed that the results have an excellent discrimination. The best time scored on MSKILL is 86 s, while the weakest is 230 s. By screening the results, the distribution of data around the arithmetic mean is symmetric, and the results are in normal distribution.

Table 2. Basic statistical parameters of predictor variables and criterion variables

Variables	N	Mean	Min	Max	Range	SD	Error	Skew	Kurt
VO2MAXR	17	50.12	41.50	64.30	22.80	6.393	1.551	0.472	-0.161
VO2MAXA	17	4.25	4.04	4.37	0.33	0.088	0.021	-0.893	0.503
T2400	17	650.06	558.00	880.00	322.00	83.968	20.365	1.437	2.284
SHUTTLE	17	10.81	9.60	12.13	2.53	0.881	0.214	0.523	-1.356
T-TEST	17	10.60	9.66	12.10	2.44	0.859	0.208	1.030	-0.462
REJUMP	17	51.00	28.00	66.00	38.00	8.448	2.049	-0.977	2.758
MSKILL	17	160.12	86.00	230.00	144.00	36.662	8.892	0.446	0.643

Table 3 shows intercorrelations of the variables for assessing the aerobic capacity and MISKILL with the help of Pirson's correlation coefficient. By its inspection, it can be noticed that VO2MAXA and VO2MAXR are positive, and that all the variables statistically correlate significantly with each other. The highest coefficient of the correlation is between T2400 and VO2MAXA ($r = 0.99$, $p < 0.05$), and the weakest is between T2400 and VO2MAXR ($r = 0.64$, $p < 0.05$).

By analyzing the intercorrelation variables for assessing aerobic capacity and MSKILL, it is noted that all the coefficients are statistically significant and that VO2MAXR and VO2MAXA are negative, while T2400 is positive. The highest coefficient of correlation with the criterion variable has VO2MAXA ($r = -0.83$, $p < 0.05$), slightly weaker T2400 ($r = 0.81$, $p < 0.05$) and the weakest VO2MAXR variable ($r = -0.68$, $p < 0.05$).

Table 3. Intercorrelations of variables for the assessment of aerobic ability and MSKILL

Variables	VO2MAXR	VO2MAXA	T2400	MSKILL
VO2MAXR	1.00			
VO2MAXA	0.70	1.00		
T2400	-0.64	-0.99	1.00	
MSKILL	-0.68	-0.83	0.81	1.00

Table 4. Intercorelations of variables for the assessment of agility and MSKILL

Variables	REJUMP	SHUTTLE	T-TEST	MSKILL
REJUMP	1.00			
SHUTTLE	-0.79	1.00		
T-TEST	-0.78	0.90	1.00	
MSKILL	-0.80	0.81	0.86	1.00

Table 4 shows the intercorrelations of the variables for assessing the agility and MSKILL. It can be noted that T-TEST and SHUTTLE are positive and that all variables correlate significantly with each other. The highest coefficient of the correlation is between T-TEST and SHUTTLE ($r = 0.90$, $p < 0.05$), and the weakest is between T-TEST and REJUMP ($r = 0.78$, $p < 0.05$).

By analyzing the intercorrelation of the variables for assessing the agility and MSKILL, it is noted that all the coefficients are statistically significant and that SHUTTLE and T-TEST are positive, while REJUMP is negative. The highest coefficient of correlation with the criterion variable has T-TEST ($r = 0.86$, $p < 0.05$), slightly weaker SHUTTLE ($r = 0.81$, $p < 0.05$) and REJUMP ($r = -0.80$, $p < 0.05$).

By analyzing these intercorrelation variables for assessing aerobic ability and agility and MSKILL, it can be assumed that T-TEST ($r = 0.86$, $p < 0.05$) plays a major role in the predictions of MSKILL, and then VO2MAXA ($r = -0.83$, $p < 0.05$).

In accordance with the objective and tasks of the research, the regression analysis will show the proportion between the aerobic ability and MSKILL, and agility and MSKILL, and to what extent aerobic ability and agility can influence achieving better time on MSKILL.

Variables	r	Part - r	b	Std.Err. - of b	t(13)	p-value
Table 5. Regression analysis of MSKILL using the aerobic ability system						
VO2MAXR	-0.68	-0.204	-1.079	1.437	-0.750	0.466
VO2MAXA	-0.83	-0.153	-325.931	584.709	-0.557	0.587
T2400	0.81	-0.018	-0.038	0.569	-0.066	0.948
R = 0.840	**R^2 = 0.706**	**F(3,13) = 10.391**				**p < 0.00092**
Table 6. Regression analysis of MSKILL using the agility system						
REJUMP	-0.80	-0.379	-1.402	0.950	-1.476	0.164
SHUTTLE	0.81	-0.006	-0.264	13.282	-0.020	0.984
T-TEST	0.86	0.486	26.297	13.106	2.007	0.066
R = 0.884	**R^2 = 0.782**	**F(3,13) = 15.566**				**p < 0.00014**

The relationship between the overall system of aerobic ability and MSKILL was 0.84 (R = 0.840; R^2 = 0.706, $p < 0.05$). These results give a statistically significant explanation of the criterion variable by means of the aerobic ability system ($p < 0.00092$), so that it can be concluded that the aerobic capacity system has a statistically significant effect on military training.

By analyzing the individual regression coefficients, one can conclude that no coefficient is individually statistically significantly related to the criterion variable MSKILL.

The relationship between the overall agility system and MSKILL was 0.89 (R = 0.884; R^2 = 0.782, $p < 0.05$). These results give a statistically significant explanation of the criterion variable using the agility system ($p < 0.00014$), so it can be concluded that the agility system has a statistically significant effect on military training.

By analyzing individual regression coefficients, one can conclude that no coefficient is individually statistically significantly related to the criterion variable MSKILL. T-TEST showed individually the nearest boundary statistically significant in association with the criterion ($p < 0.066$).

DISCUSSION

The aim of this research is the development of predictive models of physical abilities necessary for solving tasks in the battlefield when performing military tasks.

This research includes tests for the assessment of aerobic ability and agility in order to determine their connection with the required military task in the SAF. T2400 was used to calculate the absolute and relative VO_2max. The high association between aerobic capacity and the criterion variable was (R^2 = 0.706, $p < 0.05$). All three tests have a very high correlation with the criterion variable, of which VO2MAXA has the highest (r = -0.83, $p < 0.05$), T2400 was slightly weaker (r = 0.81, $p < 0.05$), while VO2MAXR has shown moderate association with the criterion (r = - 0.68, $p < 0.05$). For predicting time on the obstacles, Jetté, Kimick, and Sidney (1989) have come to the conclusion that aerobic capacity is in relation with very long obstacles.

A set of agility-based tests chosen for this research do not require high financial needs and serve to assess different types of movement. SHUTTLE involves frontal movement and is good for estimating the speed of direction change, with multiple rotations turned on for 180 degrees. T-TEST includes frontal and sagittal movements that estimate the speed of the directional change when performing tasks by moving forward, backward and stepwise with four changes of direction. RJUMP involves sagittal movement and is good for estimating speed and the speed of the reaction.

The results of these agility tests show a high correlation with the military task (R^2 = 0.782, $p < 0.05$). All three tests have a very high association with the criterion variable, of which T-TEST has the highest (r = 0.86, $p < 0.05$), then SHUTTLE (r = 0.81, $p < 0.05$) and RJUMP (r = 0.80, $p < 0.05$). These results are in correlation with other studies (Raya et al., 2013) Australian Army has already included the Shuttle Run test in its set of tests for selection of candidates for military service (Australian Defence Force, 2018).

CONCLUSION

This research was concerned to determine the predictive models of the time scored on the military readiness obstacle course in order to implement them in the selection of persons for military service and to monitor physical abilities of those in service. Two sets of variables were selected for assessing aerobic ability and agility to determine their prediction in MSKILL. Both sets of variables showed a good prediction of military tasks (R = 0.840, and 0.884; R^2 = 0.706, and 0.782, $p < 0.05$).

The results showed that T-TEST and VO2MAXA (r = 0.86 and - 0.83, $p < 0.05$) can be highly efficient in identifying the right candidates for

admission to the SAF, who will be able to master military training in order to save time and money needed to be trained with them. Also, by applying this easily applied physical readiness test with PMP, they can effectively monitor their level of physical abilities, while at the same time avoiding the possibility of getting injured.

REFERENCES

Army, U. S. (2012). *Army physical readiness training*. Washington, DC: Headquarters, Department of the Army.

Australian Defence Force (2018). *Fitness in the DAF: How fit must I be to apply?* Нађена: 16.06.2018, https://www.defencejobs.gov.au/joining/can-i-join/health-and-fitness.

Bilzon, J. L., Scarpello, E. G., Bilzon, E., & Allsopp, A. J. (2002). Generic task-related occupational requirements for Royal Naval personnel. *Occupational Medicine*, *52*(8), 503-510.

Bryant, C. X., & Green, D. J. (2010). *ACE's Essentials of Exercise Science for Fitness Professionals*. San Diego, CA: American Council on Exercise.

Carstairs, G. L., Ham, D. J., Savage, R. J., Best, S. A., Beck, B., & Doyle, T. L. (2016). A box lift and place assessment is related to performance of several military manual handling tasks. *Military medicine*, *181*(3), 258-264.

Deakin, J. M., Pelot, R., Smith, J. T., Weber, C. L., Fortier, L. D., Rice, B. L., ... & Kuhnke, T. J. N. (2000). *Development and validation of canadian forces minimum physical fitness standard (MPFS 2000)*. Canada, Kingston: Queen's University.

Directive of Sport (2005). Republic of Slovenia, Ljubljana: Ministry of Defence.

Foulis, S. A., Sharp, M. A., Redmond, J. E., Frykman, P. N., Warr, B. J., Gebhardt, D. L., ... & Zambraski, E. J. (2017). US Army Physical Demands Study: Development of the Occupational Physical Assessment Test for Combat Arms soldiers. *Journal of science and medicine in sport*, *20*, 74-78.

Harman, E. A., Gutekunst, D. J., Frykman, P. N., Sharp, M. A., Nindl, B. C., Alemany, J. A., & Mello, R. P. (2008). Prediction of simulated battlefield physical performance from field-expedient tests. *Military medicine*, *173*(1), 36-41.

Hartley, S. (2018). *The BMI formula.* Нађена 20.08.2018, http://www.whathealth.com/bmi/formula.html.

Jetté, M., Kimick, A., & Sidney, K. (1989). Evaluating the occupational physical fitness of Canadian forces infantry personnel. *Military Medicine*, *154*(6), 318-322.

Knapik, J., Staab, J., Bahrke, M., O'Connor, J., Sharp, M., Frykman, P., ... & Vogel, J. (1990). *Relationship of soldier load carriage to physiological factors, military experience and mood states* (No. USARIEM-T17-90). Natick, MA: Army research institute of environmental medicine.

Kraemer, W. J., Nindl, B. C., Gotshalk, L. A., Harman, F. S., Volek, J. S., Tokeshi, S. A., ... & Fredman, B. S. (1998). Prediction of military relevant occupational tasks in women from physical performance components. *Advances in Occupational Ergonomics and Safety*, 719-722.

Ministry of Defence (2011). *Uputstvo za fizičku obuku u Vojsci Srbije.* Beograd: Generalštab Vojske Serbije, Uprava za obuku i doktrinu.

Mitchell, K. B., Batty, J. M., Coyne, M. E., DeSimone, L. L., & Bensel, C. K. (2016). *Reliability Analysis of Time to Complete the Obstacle Course Portion of the Load Effects Assessment Program (LEAP)* (No. NATICK/TR-17/002). Natick, MA: United States Army Natick Soldier Research Development and Engineering Center

Myers, D. C., Gebhardt, D. L., Crump, C. E., & Fleishman, E. A. (1984). *Validation of the military entrance physical selection strength capacity test*. USARIEM Technical Report, 610, Natick, MA, USA.

Pandorf, C. E., Nindl, B. C., Montain, S. J., Castellani, J. W., Frykman, P. N., Leone, C. D., & Harman, E. A. (2003). Reliability assessment of two militarily relevant occupational physical performance tests. *Canadian journal of applied physiology*, *28*(1), 27-37.

Raya, M. A., Gailey, R. S., Gaunaurd, I. A., Jayne, D. M., Campbell, S. M., Gagne, E., ... & Tucker, C. (2013). Comparison of three agility tests with male servicemembers: Edgren Side Step Test, T-Test, and Illinois Agility Test. *Journal of Rehabilitation Research & Development*, *50*(7), 951-960.

Rayson, M. P., & Holliman, D. E. (1995). *Physical selection standards for the British army. Phase 4: predictors of task performance in trained soldiers.* Farnborough, United Kingdom: Defence Research Agency.

Rayson, M., Holliman, D., & Belyavin, A. (2000). Development of physical selection procedures for the British Army. Phase 2: relationship between physical performance tests and criterion tasks. *Ergonomics*, *43*(1), 73-105.

Sharp, M. A., Harman, E. A., Boutilier, B. E., Bovee, M. W., & Kraemer, W. J. (1993). Progressive resistance training program for improving manual materials handling performance. *Work*, *3*(3), 62-68.

Sharp, M. A., Patton, J. F., & Vogel, J. A. (1998). *A Database of Physically Demanding Tasks Performed by U.S. Army Soldiers. Army Technical Report TR98-12*, Natick, MA: U.S. Army Research Institute of Environmental Medicine, United States Army Medical Research Materiel Command.

Stevenson, J. M., Bryant, J. T., Andrew, G. M., Smith, J. T., French, S. L., Thomson, J. M., & Deakin, J. M. (1992). Development of physical fitness standards for Canadian Armed Forces younger personnel. *Canadian journal of sport sciences*, *17*(3), 214-221.

Wood, R. J. (2008). *2.4 km / 1.5 mile Cooper Run Test.* Нађена 01.03.2018, https://www.topendsports.com/testing/tests/2-4-km-run.htm.

Wood, R. J. (2008). *10 meter Agility Shuttle Test.* Нађена 01.03.2018. https://www.topendsports.com/testing/tests/endurance-jump-30sec.htm.

Wood, R. J. (2008). *30 Second Endurance Jump Test.* Нађена 01.03.2018, https://www.topendsports.com/testing/tests/endurance-jump-30sec.htm.