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Bojan Guzina[1], Miroslav Markovic[2]
[1] Faculty of Physical Education and Sport, University of Banja Luka
[2] Doctoral studies Student, Faculty of Physical Education and Sport, University of East Sarajevo

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EFFECT OF EXERCISE ON THE FUNCTIONAL ABILITIES OF SECONDARY SCHOOL STUDENTS

Summary

The aim of the research is to study the effects that exercise models have on the functional abilities of secondary students. The sample consisted of high school students in Krusevac, ages 15 and 16, enrolled in full-time physical education and the training process in additional physical education classes. A total of 112 subjects was divided into two sub-samples: The first sub-sample of 56 subjects comprised the experimental group. Here, students are enrolled in regular physical education classes and training three times a week to realize a model of motor exercises (flexibility) in the process of conditioning in additional physical education classes.The second sub-sample of 56 subjects, included in regular physical education classes only, constitutes the control group of respondents. The sample of variables consisted of: a vital lung capacity, pulse rate after load, Margaria test of anaerobic capacity.We analyzed the results of the T-test of functional ability between initial and final measurement of subjects. After analysis of the obtained results, it is concluded that there is a statistically significant difference in the pulse rate after loading (FPPOP .000) and Margaria test (FMARG .000).

Keywords: *exercise, functional abilities, students, t-test*

INTRODUCTION

Previous research
"Functional capabilities are responsible for the ability to adapt to increasing the demands of work and maintaining stability in the regulation and coordination of functions of organ systems that are very complex and complex." (Malacko, 2002; Przulj, 2006).
"In Zagreb, when a sports ambulance was operated at a systematic examination, a large number of athletes had aortic insufficiency who were engaged in persistent sports. The conclusion and the advice is that systematic training and competition that significantly strains the cardiovascular system is not recommended, but in that case it is recommended to change the type of sport, which puts less strain on the cardiovascular system" (p. 93 Medved 1966).
"The pace of development of certain organ systems, as is well known, is not constant and uniform. It certainly leads to bigger or smaller disharmonies. Thus, after the age of 13, body

weight increases by 1.4 times and height by only 1.2 times, while the heart increases by 1.9 times.It follows that growth in height occurs below the growth or development of the heart, that is, there is a period when the heart lags behind the development of the osteomuscular system. Even the heart does not develop in the same way. It first develops more in terms of cavity dilation and only later in terms of strengthening the muscle itself.It follows that growth in height occurs below the growth or development of the heart, that is, there is a period when the heart lags behind the development of the osteomuscular system. Even the heart does not develop in the same way. It first develops more in terms of cavity dilation and only later in terms of strengthening the muscle itself.At the beginning of puberty, female children lag behind boys, so their consumption of O2 / kg is 20% lower. There is a significant difference even before puberty (4-12 years), and this can be attributed to the difference in "training condition".Namely, women's children choose less dynamic games according to their nature. Hormonal changes in puberty have a greater impact (in a negative way) in girls than in boys whose physiological sizes develop further independently of puberty. In terms of pulmonary ventilation, it is seen that children are more ventilated than adults (relative to O2 received).Probably one of the causes is the large difference in respiratory rate in the effort of the youngest (65-70, and in the adult male 40), so-called "dead space" is more pronounced. Higher respiratory rate is due to the relatively lower vital capacity of young people (relative to body surface).Pulse frequency at maximum load is highest in the youngest (200-220) and decreases with age (190-200). Male and female subjects had similar values at the maximum load, but there were considerable differences if the same load was taken. For example, after work, where the subject consumes 2 liters of O2/minute, the pulse in men is 130 beats/min and in women it is 170 beats/min. (Medved1966)."

„Morphological status of athletes is a significant component that affects the functional ability of the body and conditions the predisposition of the human body for certain sports activities. Swimmers are extremely conditioned by their body morphology in which anthropometrics characteristics are very visible, perhaps more than with any other athlete. The buoyancy of swimmers depends on the anthropometric sizes, such as: height, weight, layout of center of gravity and the thrust and the vital capacity. Swimmers are divided by swimming techniques according to the ratio of muscle mass and quality of the sane, the length of limb and joint mobility. Breaststroke swimming technique, by its coordination is the most complicated technique. (Marković, V. Trivun, M. 2013)."

"The sample of 18 male subjects divided into sub-samples A and B of the finals of the 2nd International Swimming Rally held in Banja Luka from 16 to 17 April 2011, shows little statistical significance, but still worthy of attention and analysis for swimming competitors, not only at major swimming competitions (World Cups, Olympics, World Championships and other world-class competitions), but for analysis and a more complete picture of swimming (Trivun, M. 2013)."

"Swimming provides unlimited possibilities to improve poor health. Special effects are achieved in patients with a weakened muscle tone, as in the period of convalescence after certain diseases, and in conditions where there is a weakening of the function of the muscle (paresis, paralysis). Depending on the swimming technique leads to greater engagement of certain muscles. Swimming improves and lung function, increased activity intercostal muscles. Also significantly hire and other vital systems, especially cardio-vascular system. . (Trivun, M, Tošić, J., Marković, V. 2013)."

“The total sample of respondents consisted of 22 male students, the second year of enrollment in the school 20011/12 year, the Faculty of Physical Education and Sport, University of East Sarajevo. The sample of variables related to: body height (AVIT), upper arm skin folds (AKNL); abdominal skin folds (AKNT), thigh skin folds (AKNN), lower leg skin folds (AKNP), upper arm volume (AONL), thighs volume (AONK), lower leg volume (AOPK), body weight (AMAS), width of shoulders (AŠIR) width of the hips (AŠIK); knee joint diameter (ADZK), and the criterion variable was related to swimming 50 and 100 m backstroke. In addition to descriptive statistics, regression analysis was applied of the swimming results at 50 and 100 m backstroke technique with the result variables of morphological characteristics of students, as well as the correlation analysis. (Trivun, M. 2016).“

“Functional capacity and rated perceived exertion during two different models of the ascent walking are compared in this work. 28 students of Faculty of physical education (aged 21.4, ±1.27) were examined for that purpose. Streamlined treadmill managed by a diagnostic device Fitmate Med (Cosmed) was used for both walking protocols and maximal oxygen expenditure (VO2max) and maximal heart rate (HRmax) were recorded. After each protocol, the examinees expressed their rated perceived exertion (RPE). After the first measuring, when the examinees chose the walking model, there was a 12-minute training of set ascent walking model; then the second measuring followed, when the examinees practised the set walking model. Submaximal test “Chester treadmill walk test“ was applied on both measuring activities. Acquired data were analysed by kinematic method and statistic procedures. In conclusion, differences between examined walking models do exist, i. e, the set model requires larger energy expenditure amount and causes lower level of rated perceived exertion. (Vukić, Ž., Trivun, M., Jakovljević, V. 2017).“

„For establishment of differences in speed swimming craul technique on 25m, 50m and 100m between swimmers and water polo players we used T-test analise of results for independent samples. Based on T-test analise of results for independent samples we can conclude that there is statisticly big difference between swimmer and water polo players in speed during swimming all three criterion variables (BK 25M), (BK 50M),(BK 100M). (Mirvić, E., Bajrić, S., Bajrić., O., Trivun, M.2018).“

„On the basis of the obtained results it was concluded that the morphological characteristics significantly influenced the performance of situational motoric tasks in water polo, depending on the test from 39% to as much as 71%. The most significant applied variables from the morphological space of water polo players were variables; the volume of the thorax, the height of the body, the width of the hand and the foot with a positive effect, while the weight of the body and the subcutaneous fatty tissue were aggravating factors for the performance of situational motoric tasks for the 12-year-old water polo players. .(Janjić, B., Gardašević, N., Trivun, M. 2018).“

METHOD

Subject of research

The subject of research is the study of the application of exercise in the process of conditioning the athletes to functional abilities in young athletes, high school students in Krusevac, ages 15 and 16, covered by regular physical education and training in additional physical education.
Measuring instruments for functional ability assessment:
Vital Lung Capacity.. FVKPL
Post-load Pulse Frequency... FPPOP
Margaria test of anaerobic capacity................................... FMARG
Functional tests in this study were taken from functional test models (*Heim - Description of Measuring Instruments for Functional Assessment*)

1) Vital Lung Capacity (FVKP)
Instruments: Spirometer with beep
Task: The respondent in a standing posture takes a deep breath and holds it, then puts the oral extension of the spirometer in his mouth and quickly exhales all the air from his lungs. This registers the maximum expiratory flow-volume curve.
Assessment: The result is evaluated on a spirometry scale in cm3.
Note: The test is performed three times, (Medved 1966).

2) Post-load Pulse Frequency (FPPO)
Instruments: Stopwatch, metronome and 40cm high bench for climbing.
Task: It is accomplished by placing the respondent on one bench with his right foot, on two he climbs and brings his left leg to the right, on three puts his right foot on the ground, and on four he brings his left leg with his right. In order to keep pace, a metronome is used which is set at 90 beats per minute. That way, one climb and one descent are done in exactly two seconds, which equals 23 climbs per minute. The test takes 5 minutes, after which participants sit at tables prepared in advance.
Assessment: It measures the frequency of the pulse palpation and auscultation in the first 10 seconds after the termination of the test. The pulse rate thus obtained is multiplied by 6 to obtain the heart rate per minute.

3) Margaria test of anaerobic capacity
Instruments: Stopwatch with an accuracy of 1/100 sec., Space of at least 15 meters for a run-in of subjects, seven steps 17.5 cm high.
Task: After the previous run-in, the subjects climbed the stairs at the highest speed, alternating with one leg and the other with the highest speed possible.
Assessment: Measure time from the moment of touching the first step to the moment of leaving the reflective foot from the seventh step. After the results obtained, absolute anaerobic capacity is determined as the product of body mass in kg (T) and lifting power (V).

(1) Functional skills exercises

- Sprints with acceleration (gradual increase in speed from slow running through faster running to sprinting in sections of 60-100 meters)
  Sprint Training (A) repetitive maximum speed sprints with complete recovery between reps

Sprint Training (B) Two sprints between which are periods of slow running and walking

- Interval sprints (alternating change of 40 meters sprints and slow running 60 meters)
  Interval Training (A) - Intensive repetitive training periods alternating with relatively shorter breaks
  Interval Training (A) - Extensive interval training with longer periods of work and rest
- Fartlek (alternating long and slow running in nature)
  Continuous fast running (or swimming) of a long section at a fast pace
  Continuous slow running (or swimming) of a long section at a slow pace

(2) Exercise of anaerobic abilities

- Anaerobic capacity
  6 x 10 meters sprint, 3 x 20 meters sprint, 3 x 40 meters sprint, 2 x 60 meters sprint, 2 x 80 meters sprint

RESULTS WITH DISCUSSION

Data processing methods

The central and dispersion parameters of the distribution functions of anthropometric measures, motor and functional tests were calculated.

The arithmetic mean (X) were calculated for each measure and variable of the subjects, as well as the standard deviation (SD) which is a measure of the distance of the respondents' results from the arithmetic mean. To estimate the size of the range (variability), a minimum (MIN) and a maximum (MAX) result was calculated.

Table 1, Program of structure of model of motor exercises in the process of fitness preparation

WORK PROGRAM IN EXPERIMENTAL PERIOD	NUMBER OF HOURS
Initial diagnosis: Anthropological features (morphological characteristics, motor and functional abilities)	Before the implementation of the program
Functional skills exercises	5
Exercises of anaerobic abilities	4
Jumping exercises	5
High Intensity Jumping Exercises	5
Heavy ball throwing exercises	4
Exercises explosive power	7
Coordination exercises	6
Final diagnosis: Anthropological features> functional abilities	After the implementation of the program
Total:	36 hours

Table 2, Basic statistical parameters for evaluating the functional abilities of the experimental group at the initial measurement

Variables	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
FVKPL	56	3880.00	3310.00	4280.00	5.11	-0.520	-0.003
FPPOP	56	161.64	151.00	170.00	8.15	0.309	0.600
FMARG	56	3.81	3.05	4.48	4.32	0.221	-0.455

Legend: arithmetic mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. Dev.), Skewns (Skewn.), Kurtosis (Kurtos.)

The results presented in Table 2 in the subjects of the experimental group, in the space of tests of functional abilities, indicate that there are no statistically significant deviations of the results from the normal distribution. The test results were evaluated the functional capabilities of the experimental groups indicate that the distribution is positive.This is confirmed by the results of asymmetry of distribution (Skewn.) not exceeding 1.00, which means that the tests are not difficult (up to +1.00) or light (up to -1.00), but correspond to the research population and are below 1. The homogeneity of the results (kurtosis) indicates that good sensitivity (test discriminability) is present as values below 2.75 are obtained.

Table 3, Basic statistical parameters for evaluating the functional abilities of the experimental group at the final measurement

Variables	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
FVKPL	56	3960.00	3400.00	4290.00	15.44	0.230	1.100
FPPOP	56	154.82	150.00	166.00	12.27	0.254	0.027
FMARG	56	3.27	2.78	4.36	10.05	0.027	-0.204

Legend: arithmetic mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. Dev.), Skewns (Skewn.), Kurtosis (Kurtos.)

The results presented in Table 3 in the experimental group subjects, in the space of functional ability tests, indicate that there are no statistically significant deviations of the results from the normal distribution. The test results were evaluated the functional capabilities of the experimental groups indicate that the distribution is positive. This is confirmed by the results of asymmetry of distribution (Skewn.) not exceeding 1.00, which means that the tests are not difficult (up to +1.00) or light (up to -1.00), but correspond to the research population and are below 1. The homogeneity of the results (kurtosis) indicates that good sensitivity (test discriminability) is present as values below 2.75 are obtained.

Table 4, Basic statistical parameters for the assessment of the functional abilities of the control group at the initial measurement

Variables	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
FVKPL	56	3920.00	3290.00	4190.00	15.38	0.888	-1.502
FPPOP	56	163.75	153.00	171.00	10.90	0.137	-0.805
FMARG	56	3.94	3.20	4.56	10.51	0.255	0.522

Legend: arithmetic mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. Dev.), Skewns (Skewn.), Kurtosis (Kurtos.)

The results presented in Table 4 in the control group subjects, in the space of the functional abilities tests of the subjects, indicate that there are no statistically significant deviations of the results from the normal distribution. The test results were evaluated the functional capabilities of the experimental groups indicate that the distribution is positive. This is confirmed by the results of asymmetry of distribution (Skewn.) not exceeding 1.00, which means that the tests are not difficult (up to +1.00) or light (up to -1.00), but correspond to the research population and are below 1. The homogeneity of the results (kurtosis) indicates that good sensitivity (test discriminability) is present as values below 2.75 are obtained.

Table 5, Basic statistical parameters for the assessment of the functional abilities of the control group at thefinalmeasurement

Variables	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
FVKPL	56	3980.00	3340.00	4260.00	12.34	0.335	1.687
FPPOP	56	161.58	151.00	170.00	11.22	0.500	0.884
FMARG	56	3.85	3.00	4.45	11.55	0.547	-0.365

Legend: arithmetic mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. Dev.), Skewns (Skewn.), Kurtosis (Kurtos.)

The results presented in Table 5 in the control group subjects, in the space of the functional abilities tests of the subjects, indicate that there are no statistically significant deviations of the results from the normal distribution. The test results were evaluated the functional capabilities of the experimental groups indicate that the distribution is positive. This is confirmed by the results of asymmetry of distribution (Skewn.) not exceeding 1.00, which means that the tests are not difficult (up to +1.00) or light (up to -1.00), but correspond to the research population and are below 1. The homogeneity of the results (kurtosis) indicates that good sensitivity (test discriminability) is present as values below 2.75 are obtained.

Table 6, Multivariate analysis of functional ability variance between experimental and control subjects at initial measurement

WILK'S LAMBDA TEST	**.699**
RAO's F-approximation	**1.78**
Q	**.102**

Legend: Bertlett test values (Wilks' Lambda), Rao's F approximation (Rao's F) and significance level (Q)

The analysis of Table 6, which shows the results of testing the significance of differences in the level of arithmetic means of all functional tests during the initial measurement between the samples of experimental and control group, did not find statistically significant difference, since WILK'S LAMBDA is .699, which gives Ra's F-approximation of 1.78, and a level of difference Q = .102. Therefore, no statistically significant differences were found in the applied system of functional abilities of the respondents.

Table 7, Univariate analysis of variance of the functional ability between experimental and control group of subjects at initial measurement

Tests	Mean (E)	Mean (K)	F-ratio	Q
FVKPL	3880.00	3920.00	1.44	.196
FPPOP	161.64	163.75	1.53	.159
FMARG	3.81	3.94	1.52	.122

Legend: arithmetic mean experimental group (Mean (e)), arithmetic mean control group (Mean (k)), F-test value (F-ratio) and significance level (Q)

In Table 7, a univariate analysis of the variance of functional ability tests is presented by comparing the results of the arithmetic means of the experimental and control groups at the initial measurement. Based on the F-ratio coefficients and their significance (P-Level), it can be concluded that no statistically significant difference in the level of functional abilities was found between the experimental and control groups.

Table 8, Significance of differences of the arithmetic means of the experimental group:

Tests	Mean(i)	Mean(f)	T-value	p
FVKPL	3880.00	3960.00	1.25	**.152**
FPPOP	161.64	154.82	11.23	**.000**
FMARG	**3.81**	**3.27**	**5.12**	**.000**

Legend: arithmetic mean initially (Mean (i)), arithmetic mean final (Mean (f)), T-value (T-value) and significance level (p)

Table 8, contains the results of the T-test of functional abilities between the initial and final measurements of the experimental group. After analysis of the obtained results, it is concluded that there is a statistically significant difference in the pulse rate after loading (FPPOP .000) and in the Margaria test (FMARG .000).

Table 9, Significance of differences of arithmetic means of the control group subjects:

Tests	Mean(i)	Mean(f)	T-value	p
FVKPL	3920.00	3980.00	1.84	**.154**
FPPOP	163.75	161.58	-1.54	**.276**
FMARG	**3.94**	**3.85**	**1.45**	**.250**

Legend: arithmetic mean initially (Mean (i)), arithmetic mean final (Mean (f)), T-value (T-value) and significance level (p)

Table 9, contains the results of the T-test of functional abilities between the initial and final measurements of the control group subjects. After analysis of the obtained results, it is concluded that there is no statistically significant difference in the tests of functional abilities.

Table 10, Significance of isolated discriminant function of functional abilities of experimental group

Disc Func.	Eigenvalue	Cannonical R	Wilks' Lambda	Chi-Sqr.	df	P-Level
1	2.986	.76	.255	85.14	3	**.024**

Legend: Eugenvalue squares, Cannonical R coefficients, Bertlett test values (Wilks' Lambda), Hi square test size (Chi-Sqr), degrees of freedom (df) and significance level of the coefficient of determination (P-Level)

Table 10, One significant discriminant high intensity function (CR = 76%) was obtained, showing in which correlation the data set on the basis of which discriminant analysis of the obtained results was performed (TABLE 10.).Results of the discriminant strength of the functional ability variables are presented with the Wilks' Lambda test (.255). This indicates that the differences between the initial and final measurements of the functional abilities of the experimental group are significant (P = .024), since the size of the Hi square test has a high value (Chi-Sqr = 85.14).

CONCLUSION

The sample of respondents referred to a high school student in Krusevac, aged 15 and 16 years, covered by regular physical education classes and the training process in additional physical education classes.The total sample of 112 students was divided into two sub-samples: The first sub-sample of 56 students was enrolled in regular physical education and training three times a week to realize the model of motor exercises (flexibility) in the process of conditioning in additional physical education classes and made experimental group.The second sub-sample of 56 students, included in regular physical education classes only, constitutes the control group of respondents. The sample of variables consisted of: vital lung capacity, pulse rate after loading andMargaria testof anaerobic abilities. The aim of the research is to study the effects of exercise models on the functional abilities of high school students.

The analysis included the results of the T-test of functional ability between the initial and final measurement of the subjects. After analysis of the obtained results, it is concluded that there is a statistically significant difference in the pulse rate after loading (FPPOP .000) and Margaria test (FMARG .000).

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Correspondence:
Bojan Guzina Faculty of Physical Education and Sports,
University of Banja Luka
e-mail:bojan,guzina@ffvis.unibl.org