

THE INFLUENCE OF SPORTS RECREATIONAL AEROBIC EXERCISE ON THE ADAPTIVE PROCESSES OF FUNCTIONAL ABILITIES

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*(Original scientific paper)***Danko Pržulj i Borislav Cicović***University of East Sarajevo, Faculty of Physical Education and Sport, Pale, RS,
Bosnia and Herzegovina***Abstract**

The aim of the research was to determine the results of the influence of a program of aerobic exercise on the adaptive processes of functional abilities, and then, through the application of the discriminant analysis, to determine their significance between the initial and final measuring. The main goal was to obtain information regarding the significance of the studied dimensions in the process of the management, modeling, planning and programming and control of training of the participants from East Sarajevo. The sample consisted of 46 participants taken from the population of high school students aged 16 and 17 (± 6 months), with a body height of 156 to 185cm and body mass of 50 to 75kg, who took part in a two weekly classes of regular physical exercise and three classes of aerobic exercise. Three tests were used in the study to evaluate functional abilities: 1. heart rate frequency after load (FPPO), 2. the Margaria test (FMARG) and 3. vital lung capacity (FVKP). The measuring instruments used to evaluate functional abilities were taken from the research of Heimar & Medved (1997). The basic statistical parameters were calculated, as well as the t-test and the multivariate canonical discriminant analysis with partiality and neutralization of differences in the initial state. The data were processed using the SPSS 12.0 and Statistika 5.0 programs. On the basis of the obtained results we can conclude that at the end of the experimental period, we were able to obtain statistically significant differences in functional abilities under the influence of sports recreational aerobic exercise.

Keywords: *high school students, extracurricular physical education classes, tests of functional abilities, canonical discriminant analysis*

INTRODUCTION

Aerobic exercise has as its aim to use physical exercise and specific forms of organization and work methods as a means to provide positive transformations of anthropological dimensions and increase the level of the motor knowledge of the subjects. In the realization of this goal, the physical education teacher plays the most important role, and is supposed to provide the necessary conditions for a rational and purposeful aerobic exercise to take place (Ara I, Vicente-Rodriguez G, Jimenez-Ramirez J, Dorado C, Serrano-Sanchez JA, Calbet JA., 2004; Ward, S.D., Saunders, R., Felton, M.G., Wil-

iams, E., Epping, N.J. i Pate, R.R., 2006).

In the aerobic exercise process, the input from scientific methodology is necessary for the determination of the structure of anthropological dimensions, their relations and developmental characteristics as well as the effective procedures in the application of the work method, organizational forms, adequate intensity and extent of the load, and the selection of motor exercises. This type of approach enables the use of an optimally programmed and homogenized sports recreational process of aerobic exercise, adapted to suit the individual abilities and characteristics of the participants (Heimar

& Medved, 1997; Brown, L., Ferrigno, V. i Santana, C., 2000; Pržulj, 2012).

The aim of the research is to determine the results of the influence of the content of an aerobic exercise program on the adaptive processes of functional abilities, and then to use the discriminant analysis to determine their significance between the initial and final measuring in order to obtain information regarding the significance of the studied dimensions in the management process, modeling, planning, programming and the control of the sports recreational work involving participants who were all high school students aged 16 and 17 in East Sarajevo.

The subject matter of the research was the study of functional abilities in the function of the realization of an aerobic exercise program involving high school students from East Sarajevo. Functional abilities (anaerobic and aerobic capacity) have a direct influence on the extent and character of the manifestation of work abilities during the realization of the program tasks of sports aerobic recreational exercise and are indirectly related to morphological and motor characteristics (Heimar & Medved, 1997; Pržulj, 2007; Milanović, 2007).

METHODS

The sample consisted of 46 participants extracted from the population of high school students from East Sarajevo, aged 16 & 17 (\pm 6 months), with a body height of 156 to 185cm and a body mass of 50 to 75kg, who took part into two weekly regular physical education classes and three classes of sports recreational aerobic exercise.

Three tests of functional abilities were used in the study: 1. heart rate frequency after load (FPPO), 2. the Margaria test (FMARG) and 3. vital lung capacity (FVKP). The measuring instruments for the evaluation of functional abilities were taken from the research carried out by Heimar & Medved (1997).

The basic statistical parameters, the t-test and the multivariate canonical discriminant analysis were all calculated in order to determine the hierarchy of the functional tests which contributed to the difference between the initial and final measuring of the participants. The data were processed using the statistical program SPSS 12.0 and Statistika 5.0.

The characteristics of the structure of sports recreational aerobic exercise during the experimental period

The study of the influence of sports recreational aerobic exercise on the adaptive pro-

cesses of functional abilities was realized over 24 classes and a period of two months as part of additional physical education classes during the 2011/2012 school year in East Sarajevo. Two measurements were carried out on functional abilities: prior to and following the treatment (the so-called initial and final measuring).

As a part of the planning and the programming of the sports recreational aerobic exercise program, the goals and tasks were defined, as well as the timeline for their realization and the necessary technical and material conditions. The work programming was focused on the determination of the content, load and work method for the development of the functional abilities of the participants. A selection of motor exercises was carried out along with the dosing of the load and the distribution of the content in accordance with the aims and tasks of the programmed content of aerobic exercise.

The development of anaerobic capacity was realized primarily through the use of sprinting at maximum speed and an intensity of 70-90%, in the heart rate frequency zone of 160-170 beats per minute and with full recovery between the repetitions. This type of work was realized using an intense exercise with a change in the rhythm, but with application of an interval work method. In addition, the short run technique was also used, including a run forward, backward, and lateral runs at a distance of 10 - 20 meters; reactive takeoffs in three directions (on both feet, alternating left and right and on one foot), as well as running with a change in direction. For the development of aerobic capacity, both fast and slow recreational runs in nature were used, and long-distance running at a moderate and quick pace at an intensity of 60-70%, within the heart-rate frequency zone of 150-160 beats per minute.

This type of approach to the development of functional abilities was supported by several authors (Heimar & Medved, 1997; Brown et al., 2000; Malacko & Rađa, 2004; Ara et al., 2004).

THE RESULTS

The obtained research results of the influence of sports recreational physical exercise on the adaptive changes of the participants' functional abilities were determined using the t-test for small dependent samples and the canonical discriminant analysis.

An analysis of the differences in the functional abilities of female participants between the initial and final measuring carried out by means of the t-test

Table 1. shows the results of the t-test of functional abilities between the initial and final measuring of the participants. Following an analysis of the obtained results we can conclude that statistically significant difference can be determined in all of the tests of functional abilities.

The differences between the initial and final state of functional abilities of the participants studied by means of the discriminant analysis

Legend: the squares of the discriminant

coefficient (Eugenvalue), the canonical correlation coefficient (Cannonical R), the values of Bartlett's test (Wilks' Lambda), the extent of the Chi-square test (Chi-Sqr), the degree of freedom (df) and the level of significance of the determinant coefficient (P-Level)

Table 2. shows one of the significant discriminant factors (Eugenvalue) with a coefficient of 1.502 which represents a common variance of the differentiation of the arithmetic means of the centroids at the initial and final measuring of the tests of functional abilities. The canonical correlation coefficients (R) indicate that the discriminant analysis between the initial and final measuring of the results of the functional abilities was carried out with .62.

Table 1. The significance of the differences between the means of the tests of functional abilities

Measurements	Mean(i)	Mean(f)	T-value	p
FPPO	160.55	150.65	2.63	.020
FMARG	3.89	2.72	2.74	.018
FVKPL	2600.00	3100.00	2.53	.021

The results of the discriminant extent of Wilks'-Lambda with a coefficient of .300, indicate that on the basis of the level of significance (P-Level), the differences between the initial and final measuring of functional abilities are statistically significant at the .004 level, which is confirmed by the value of the Chi-square tests which is very high (Chi-Sqr = 78.28).

Table 3. shows the structure of the discriminant function of the functional abilities variables involvement in formation of significant discriminant functions. The group centroids shown here represent the arithmetic means of the results from the initial and final measuring. With the aim of checking the effectiveness of

Table 2. The significance of the isolated discriminant function of the tests of functional abilities

Disc Func.	Eugenvalue	Canonical R	Wilks' Lambda	Chi-Sqr .	df	P-Level
1	1.502	.62	.300	78.28	3	.004

the experimental treatment, three tests of functional abilities were used, assumed to be suitable predictors of the studied space. Displayed results indicates that the greatest contribution to the discriminant function was made by the Margaria test (FMARG -.480), and to a somewhat smaller extent the heart rate frequency after load (FPPO .412), and least of all, the vital lung capacity (FVKPL -.308).

Table 3. The factor structure of the isolated function of the functional abilities tests

Variables	Root 1
FMARG	-.480
FPPO	.412
FVKPL	.308

Table 4. The centroids of the tests of functional abilities

Measuring	Root 1
Initial	1.563
Final	-1.563

The results shown in table 4 represent a discriminant function of the centroids on the basis of all the tests of functional abilities, with a value of 1.563 and -1.563. The significance of the displayed centroid values, which was tested through the significance of the discriminant function, indicates that their distance (discrimination) is statistically significant.

DISCUSSION

The model of the tests of functional abilities in this study includes the structure of aerobic exercise which requires of the participants to endure the strain of anaerobic, anaerobic-aerobic and aerobic work. Aerobic exercise, in addition to aerobic endurance, which is primary, viewed from the aspect of motor structure and work dynamics, also greatly requires aerobic work such as velocity, movement, short breaks and the like. What is more significant is the frequency of movement of the loco motor apparatus at greater speeds, due to the assumption that it is precisely when more significant exercise activity occurs along with the direct influence on final energy consumption.

Recent findings indicates that the smaller aerobic capacity abilities of the participants maintains a high tempo during the aerobic exercise, which leads us to the conclusion that in the case of exercise, the dominant ability of the participants is the release of energy with the help of anaerobic mechanisms. It follows that for the ones who exercised it's enough to possess the genetic potential for expression of speed-powerful and coordination skills, but not too long and continuous to support the load of medium and low intensity.

Results of canonical discriminant analysis in this study show (Table 2.-5.) that the final compared to the initial state, under the influence of sports and recreational program of aerobic exercise there was a statistically significant

change in functional abilities.

In the research published by the some authors (Malacko, 2002; Beunen et al., 1992; Blažević, 1997; Pržulj 2007) it has been confirmed that an increase in the level of the functional abilities is most suitable if the load in the sports recreational aerobic exercise suits the biological and psychological features of the participants. According to these authors, this includes a gradual increase in the load in the training until it reaches the limit of motor-functional abilities, in order to enable the start of the super-compensational processes of each individual, as one of the basic functional reactions of the human body, on which the adaptive processes are based, along with the effects and development of the abilities and features.

The results of scientific research and experience gained from practice Armstrong, N. i McManus, A. (1994); Beets, W.M. i Pitetti, H.K. (2005); Milanović, 2007), have confirmed, based on a sample of young participants who took part in the aerobic exercise, that the gradual increase in progressive load in sports recreational aerobic exercise of the development of functional skills, is especially significant for the development of the basis for the further widespread development of complex motor skills which will enable the further realization and easier transition into the acquisition phase of a stable motor stereotype of the functional abilities excitation.

A similar approach to the development of functional abilities through the progressive increase in load was carried out on participants in this research, as part of extracurricular sports recreational exercises for the development of functional abilities.

The results of the canonical discriminant analysis (table 2.), at the final in comparison to the initial measuring, indicate that under the influence of the implemented sports recreational aerobic exercise, during the final in comparison to the initial measuring, a positive and statistically significant changes were determined for the functional abilities (P-Level= .004). What especially contributed to this was the implementation of aerobic exercise during the experimental period, which increased the participants' ability for a faster and more complete activation of motor units with a high level of load, which enabled the increased activity of the agonistic

muscles and an increase in the strength of the entire body.

The adaptive changes in the functional abilities of the participants occurred during the implementation of selected physical exercise aimed at increasing functional skills through the phosphocreatine energy mechanism, the improvement in the glycolytic energy mechanism and the increase in the effectiveness of nerve structures in specific conditions of the oxygen uptake.

CONCLUSION

During the two-month period of realization of the sports recreational aerobic exercise program, the influence of the implemented motor contents on the development of the functional abilities of the participants, female high school students from East Sarajevo, aged 16 and 17, were monitored. A canonical discriminant analysis was used to determine that during the final, in comparison to the initial measuring, a statistically significant increase occurred in the levels of all the studied variables of the functional abilities.

We can assume that these positive changes occurred as a result of proper methodological shaping of the sports recreational aerobic exercise during the planning and programming process, the dosing, distribution and control of the implemented load, as well as the increase in the intensification of the training in accordance with the authentic needs of the participants. The work done during the process of the realization of sports recreational aerobic exercise with the participants contributed to optimal work regime for individual systems of organs and the body as a whole, which enabled the rational and effective process of their adaptation to the implemented load.

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ВЛИЈАНИЕТО НА СПОРТСКО РЕКРЕАТИВНОТО АЕРОБНО ВЕЖБАЊЕ ВРЗ АДАПТИВНИТЕ ПРОЦЕСИ НА ФУНКЦИОНАЛНИТЕ СПОСОБНОСТИ

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(Оригинален научен труд)

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Апстракт

Целта на истражувањето беше да се утврди влијанието на програмските содржини на аеробното вежбање врз адаптивните процеси на функционалните способности, а потоа со примена на методата дискриминативна анализа да се утврди статистичкото значење на тоа влијание меѓу иницијалното и финалното мерење, за добивање информации за истражуваните димензии во процесот на управувањето, моделирањето, планирањето, програмирањето и контролата на тренажната работа кај испитаниците - учениците од основните училишта со возраст од 16 и 17 години (± 6 месеци) во Источно Сарајево. Примерокот на испитаниците за истражувањето, беше сочинет од 46 испитаници од популацијата на учениците од основните училишта. Нивната телесна височина се движеше од 156 до 185 сантиметри, а телената тежина од 50 до 75 килограми. Учениците беа опфатени со два часа неделно со редовна настава по физичко воспитување и три часа аеробно вежбање. Во истражувањето беа применети три тестови за проценување на функционалните способности: 1. Фреквенција на пулсот по оптоварување (FPRO), 2. Маргија тест (FMARG) и 3. Витален капацитет на белите дробови (FVKP). Овие тестови се земени од истражувањето на Хеимар (Heimar) и Медвед (Медвед) (1997). Применети се основните статистички параметри и t-тест за зависни примероци. За утврдување на хиерархијата на разликите на функционалните тестови меѓу мерењата во иницијалната и финалната состојба, применета е каноничка дискриминативна анализа со парцијализација на разликите во иницијалната состојба. Податоците се обработени врз основа на статистичката програма SPSS 12.0 и Statistika 5.0. Според добиените резултати од истражувањето, утврдено е дека рекреативното телесно вежбање статистички значајно влијаело врз функционалните способности на учениците.

Клучни зборови: *ученици од основните училишта,
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