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THE EFFECT OF THE TRANING PROCESS ON THE DEVELOPMENT OF FUNCTIONAL ABILITIES OF YOUNG ATHLETES

ABSTRACT

The research study has been conducted with the aim of determining the differences in functional abilities in experimental period on young athletes, under the influence of training process during additional classes of physical education. Sample of the examinees consists of 32 young athletes, primary school pupils from Istočno Sarajevo, aged 14 (± 6 months). Measuring means for the assessment of functional abilities were comprising of tests: vital lung capacity (FVKPL), pulse frequency after cardiac stress **(**FPPOP) and Margaria test (FMARG). Obtained results of canonical discriminative analysis have shown that young athletes are statistically significantly different with statistically significant level of functional abilities (P-Level= .002) in final, as opossed to the initial measuring.

Keywords: *young athletes, functional abilities, central and dispersive parameters, canonical discriminative analysis.*

1. INTRODUCTION

In order to achieve an optimal development of functional abilities of young athletes, in accordance with the sports training principles, in certain periods of the training process it is required to change the extent of exertion taking into account the fitness level of the athletes.

During the particular periods of training (for example, preparatory), exertion for the development of result-efficiency of functional abilities should not be linearly increased, because in order for the organism to adapt on new exertions a certain amount of time (sometimes longer period) is required, therefore, every uncontrolled increase of exertion could have negative impact on the traning.

Optimal plannning of the training process for the development of functional abilities requires variable application of the forms of the training, where is necessary to take care of the physiological and biochemical changes that are happening in the athlete's organism during the particular training sessions.

The subject matter of the research was to investigate if there are statistically significant differences under the influence of the transformational processes model for the development of functional capacities (aerobic and anaerobic), on the final measuring in relation to the initial state.

The aim of the research is to determine the impact of the training process on the development of functional abilities on young athletes during the additional classes of physical education.

2. METHODS

The examinees sample consists of 32 primary school pupils from East Sarajevo, aged 14 (± 6 months), included in the regular and additional classes of physical education. Measuring means for the assessment of functional abilities were comprising of vital lung capacity (FVKPL), pulse frequency after cardiac stress **(**FPPOP) and Margaria test (FMARG). Functional tests were taken from the research of *Heimar and Medved, 1997*. Central dispersive parameters and canonical discriminative analysis were calculated.

2.1 Experimental Procedures

In this paper, the research of the impact of the training process on the development of functional abilities of young athletes has been achieved by the additional classes of physical education.

Establishing of the means of physical exercises for the development of functional abilities was in the function of previous diagnosis of the extent of antropological features of each examinee, in order to form three homogenous groups in the training process, and thus achieve certain individualisation of work based on the abilities and characteristics of the examinees.

Methodological approach to the development of fuctional abilities consisted of simultaneous impact on cardio-vascular and neuro-muscular system. On the one side, it was an energetic stamina, on the other, a neuro-muscular component of stamina. Such methodological approach in the training process is supported by numerous researchers (*Kurelić and co., 1975; Pržulj, 2006; Malacko and Doder, 2008; Đurašković 2009; Cicović, 2010*).

In the experimental period, the following means were applied (modified according to *Pržulj, 2007; Milanović, 2007*):

1. For the development of anaerobic capacity: sprint with acceleration, repetition of sprints with maximal speed with complete recovery between repetitions, more sprints with periods of relaxation intervals by light running of walking.

2. For the development of aerobic capacity: alternate fast and slow running on natural ground, running on long sections with moderate pace, interval training with longer periods of exercise and rest with 60-80% intensity in the heart frequency rate of 150-180 beats per minute.

Applied motoric exercises for the development of functional abilities in the additional classes have increased the athletes' capability of quicker and more complete activation of motoric units by higher level of exertion, which enabled the increased activity of agonistic muscles and an increase in general strength of an entire organism. Furthermore, to the adaptive changes of functional abilities of athletes also contributed the usage of selected physical exercise means for increase of functional abilities of phosphocreatine energy mechanism, perfecting of the glycolytic energy mechanism, and increasing of neural structures efficiency in specific conditions of the oxygen debt.

3. RESEARCH RESULTS

Research results of functional abilities are processed based on the statistics programme „Statistica“ 8.0 for Windows, for the calculation of the following parameters: central dispersive parameters and canonical discriminative analysis.

Table 1. Basic statistic parameters for the assessment of functional abilities on the initial measuring

Variables	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
FVKPL	53	2450.00	2300.00	2800.00	6.51	0.380	2.22
FPPOP	53	158.00	150.00	167.00	17.59	0.300	2.24
FMARG	53	4.25	3.40	4.80	13.83	0.415	2.61

*Legend***:** the arithmetic mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), Skewness (Skewn.), Kurtosis (Kurtos.)

Table 2. Basic statistic parameters for assessment of functional abilities on the final measuring

Variables	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
FVKPL	53	2600.00	2390.00	2900.00	1.31	-0.936	2.03
FPPOP	53	150.00	148.00	165.00	1.27	-0.328	2.06
FMARG	53	3.65	3.32	4.60	1.13	-0.777	2.12

*Legend***:** the mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), Skewness (Skewn.), Kurtosis (Kurtos.)

Displayed results in the tables 1 and 2 on the young athletes examinees in the field of functional abilities, indicate that there is no significant deviation of results from normal distribution. It has been confirmed by the asymmetric distribution results

(Skewness) that they exceed 1.00,which means that tests are neither difficult (up to +1.00) nor easy (up to -1.00), but correspond to the research population and are under one. Homogenity of results (Kurtosis) indicates that good sensitivity is present (discrimination of tests), since the obtained values are under the coeficient 2.75.

Table 3. Significance of the isolated discriminative function of functional abilities of experimental group

Disc Func.	Eugenvalue	Cannonical R	Wilks' Lambda	Chi-Sqr.	df	P-Level
1	3.400	.75	.214	127.11	3	**.002**

*Legend***:** discrimination coeficient square (Eugenvalue), canonical correlation coeficient (Cannonical R), Bartlett test value (Wilks' Lambda), value of Chi-square test (Chi-Sqr), degree of freedom (df) and significance of determination coeficient level (P-Level)

A significant discriminative function of high intensity of canonical correlation was obtained (CR=75%), that indicates in what correlation is the data base, on the basis of which the discriminative analysis of the obtained results is performed (Table 3). Results of discrimintative intensity of variables of functional abilities are shown by the Wilks' Lambda test (.214), that indicates that the differences between the initial and final measuring in the area of functional abilities of experimental group are significant (P= .002), since the value of Chi-square test has a high result (Chi-Sqr = 127.11).

Table 4. Factor structure of isolated discriminative function of experimental group

Variables	Root 1
FVKPL	0.510
FPPOP	0.402
FMARG	0.302

In the table 4. was given a structure of discriminative function of variables involvement of functional abilities in forming of significant discriminative functions. Displayed centroids of the groups represent the mean of the initial and final measuring results. Due to checking of the efficiency of experimental model in the karate club, for development of antropological features, three tests of functional abilities have been measured, for which is assumed that they are good predictors of an examined field. Displayed results indicate that the biggest contribution to the discriminative function has a vital lung capacity (FVKPL 0.510).

Table 5. Centroids of measuring of experimental group

Measuring	Root 1
Initial	-3.175
Final	3.175

The results in the table 5 represent the discriminative function of centroids based on all the tests of functional abilities which is -3.175 and 3.175. The significance of the presented centroids of measuring that is tested through the significance of discriminative function, indicates that their distance (discrimination) is significant.

Table 6. Clasification matrix of the experimental group

MEASURING	Initial	Final	Total
Initial	52	1	53
Final	2	51	53
Initial	**98.11%**	1.89%	100%
Final	3.78%	**96.22%**	100%

Clasification of groups that is displayed in the table 6 via percentiles, indicates that the performed separation (discrimination) of the measuring results is clarified with 97.16% accuracy (the mean percentage of the very groups) of the coeficient of canonical correlation that is CR = 75%.

Obtained results of discriminative analysis in final as opposed to initial measuring indicate that, under the influence of the training process, the significant changes of functional abilities of young athletes occurred.

4. DISCUSSION

The results of canonical discriminative analysis in this research (Tables 3.-6.) are showing that on the final, as oppose to the initial state, under the influence of the training process there occurred statistically significant changes of functional abilities of the examinees on the multivariate level (P-Level=.002).

In the published papers of some researchers (*Heimar, 1980; Heimar, 1989; Rakovac and Heimar,2003; Malacko, 2009; Cicović, 2012.*) it has been confirmed that an increase of the functional abilities level is the most appropriate if the exertion in the training process matches biological and psychic features of an athletes' organism. According to them, it is a gradual increase of the training process exertion close to the limit of motoric-functional capabilities, so as to enable supercompensation processes with each of the subjects, as one of basic functional reactions of the organism, on which the adaptational processes of the organism, effects and development of abilities and features are based upon.

Results from scientific research and practical experiences (*Stojanović and co., 1980; Bala, 1981; Gajić and co., 1986; Stoiljković, 2003*) have confirmed that, on the sample of young athletes, primary school pupils, gradual increase of progressive exertion in the training process for the development of functional abilities is particularly significant to make basis on which complex motoric abilities will be comprehensively developed.

Similar approach for the development of motor and functional abilities with gradual increasing of progressive exertion was achieved with the examinees in this research in the additional classes of physical education.

Adaptive changes of the examinees' functional abilities occurred by applying the selected means of physical exercises of increasing of functional abilities of phosphocreatine energy mechanism, perfecting of the glycolytic energy mechanism, and increasing of neural structures efficiency in specific conditions of the oxygen debt. The development of anaerobic capacity is realized predominantly through motoric exercises with 60-70% intensity, in the heart frequency rate of 160-170 beats per minute and complete recovery between repetitions. Such work is realized by applying of intensive exercising with the change of rhytm, but also with applying of the methods of interval work.

5. CONCLUSION

The researsch of the effects of training process model on the development of functional abilities at athletes during the additional classes of physical education was conducted on the sample of 32 pupils of primary scholls, aged 14, from East Sarajevo. Differences in functional abilities between the initial and final measuring in the experimental period were calculated by applying of the discriminative analysis based on the results of the three functional tests.

It can be assumed that positive changes of functional abilities happened as results of proper methodical designing of regular physical education curriculum of the process of planning and programming, dispensing, distributing and control of the applied exertions, as well as increase of intensity of the training process in accordance with the authentic requirements of the examinees. With such work, it was, in the process of realization of the regular physical education curriculum with the examinees, contributed to the optimal mode of work of particular organic systems and organisms as whole, which enabled rational and efficient process of their adaptation to the applied exertions.

Obtained results of discriminative analysis in final as opposed to initial measuring on athletes indicate that, under the influence of the training process for the development of functional abilities, the significant changes in the functional abilities have occurred.

6. REFERENCES

1. Arunović, D., Berković, L., Bokan, B., Madić, B., Matić, M., Radovanović, Đ. i Višnjić, D. (1992). *Fizičko vaspitanje, Teorijsko-metodičke osnove stručnog rada.* Niš: »Sirius«.
2. Bala, G. (1981). *Struktura i razvoj morfoloških i motoričkih dimenzija dece SAP Vojvodine.* Novi Sad: Fakultet fizičke kulture.
3. Bompa, T.O. & G. Gregory H. (2009). *Periodization: Theory and methodology of training* (Periodizacija: Teorija i metodologija treninga). Champaign, IL: Human Kinetics.
4. Bompa, T.O. (2008). *Periodization: Threoy and methodology of training* (Periodizacija: Teorija i metodologija treninga). Champaign, IL: Human Kinetics.

5. Cicović. B.(2010). Efekti kondicionog treninga na razvoj anaerobno-laktatne izdržljivosti i funkcionalnih sposobnosti kod džudista. *Sport i zdravlje*, 5 (1), 14-17.
6. Duraković, M. (2008). *Kinatropologija, Biološki aspekti tjelesnog vježbanja*. Zagreb: Kineziološki fakultet Sveučilišta.
7. Đurašković R. (2009). *Sportska medicina*. Niš: Fakultet sporta i fizičkog vaspitanja.
8. Đurašković, R. (2002). *Biologija razvoja čoveka sa medicinom sporta*. Niš: SVEN.
9. Gajić M. i sar. (1986). *Osnovi motorike čovjeka*. Novi Sad: Fakultet fizičke kulture.
10. Heimar, S. (1980): Faktorska struktura testova za procenu anaerobnog kapaciteta, *Kineziologija, Vol. 22, br. 2.*
11. Heimar, S. (1989): *Taksonomska analiza funkcionalnih karakteristika mladih sportista,* Zagreb: *Kineziologija, Vol. 22, br. 2*.
12. Kurelić N., Momirović, K., Stojanović, M., Radojević, Ž. i Viskić-Štalec, N. (1975). *Struktura i razvoj morfoloških i motoričkih dimenzija omladine*, Beograd: Institut za naučna istraživanja. Fakultet za fizičku kulturu.
13. Malacko, J. (2009). *Utjecaj genotipa i fenotipa u treningu brzine, agilnosti i eksplozivnosti. 8. godišnja međunarodna konferencija* "Kondicijska priprema sportaša 2010." Zagreb. Kineziološki fakultet Sveučilišta u Zagrebu.
14. Malacko, J., & Doder, D. (2008) *Tehnologija sportskog treninga i oporavka* /In Serbian/. (Technology of sport training and the recovery). Novi Sad: Provincial department for sport.
15. Milanović, D. (2007): *Teorija treninga*, Priručnik za studente sveučilišnog studija. Zagreb: Kineziološki fakultet Sveučilišta u Zagrebu.
16. Pržulj, D. & Cicović, B. (2012). The influence of sports recreational aerobic exercise on the adaptive processes of functional abilities. (Uticaj sportsko rekreativnog aerobnog vežbanja na adaptivne procese funkcionalnih sposobnosti). *Research in Kinesiology*, 40 (2), 177-183.
17. Pržulj, D. (2006) *Osnovi antropomotorike*, Udžbenik. Pale: Fakultet fizičke kulture.
18. Pržulj, D. (2007): *Kondiciona priprema sportista*, Udžbenik. Pale: Fakultet fizičke kulture.
19. Pržulj, D. (2008). Efekti bazične pripreme za razvoj motoričkih i funkcionalnih sposobnosti sportista. *Sport i zdravlje*, 3 (1), 5-9.
20. Pržulj, D. (2012) *Dijagnostika antropoloških obeležja i treniranosti sportista.* Pale: Fakultet fizičkog vaspitanja i sporta.
21. Rakovac, M. i Heimar, S. (2003). Utjecaj kondicione pripreme aerobnog tipa na transportni sistem za kiseonik i neke energetsko-metaboličke karakteristike organizma sportista, Međunarodni naučno-stručni skup, *Kondiciona priprema sportista, Zbornik radova*. Zagreb: Fakultet za fizičku kulturu Sveučilišta u Zagrebu.
22. Stojanović, M., Ilić N., Momirović K. i Hošek A (1980). Relacije vitalnog kapaciteta pluća i antropometrijskih dimenzija u mladih odraslih muškaraca, *Kineziologija*, 3, 124-128.
23. Stojiljković, S (2003). *Osnovi opšte antropomotorike*. Niš: Studentski kulturni centar.

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