TRANSFORMATION PROCESSES OF YOUNG SCHOOL-AGE STUDENTS ' FUNCTIONAL ABILITIES

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Abstract: *The sample of respondents consisted of elementary school students, aged 9 and 10 (± 6 months) in Niš. The sample of 64 subjects was divided into two groups, the experimental and the control group, with 32 subjects in each group. Subjects of the experimental group were involved in the process of practicing coordination and speed in supplementary physical education classes, while subjects of the control group were only included in regular physical education classes. The results of the discriminant analysis of functional abilities in the final measurement, compared to the initial measurement in the experimental group show us that under the influence of the coordination and speed training program in supplementary teaching of physical education, there was a statistically significant transformation process of the functional abilities of young school-age children. The results of the discriminant analysis of functional abilities in the final compared to the initial measurement in the control group indicate that there were no significant changes in the functional abilities of the respondents under the influence of regular physical education classes.*
Key words: *transformational processes, functional abilities, young school- age, coordination, speed*

INTRODUCTION

Functional abilities of a person are very complex and depend on a large number of factors, first of all on the nervous-vegetative and endocrine systems. It is considered that there is no functional ability of the cardiovascular system common to all life situations, but a series of specific abilities for different activities and situations (Malacko 2002).

Previous research shows that functional abilities are genetically conditioned and the coefficient of innateness is 60%-80%.

In the physiological sense, functional abilities mean aerobic and anaerobic abilities, and due to the high coefficient of innateness, the development of aerobic endurance is greatest at the age of 10 to 13, and anaerobic at the age of 13 to 16.

Aerobic functional abilities represent the ability of organism to deliver and consume the maximum amount of oxygen for long-term muscle work. The development of this ability can be greatly influenced by long-term cyclical activities of low and moderate intensity (Medved, Matković, Mišigoj-Duraković and Pavičić, 1989).

Contrary to aerobic abilities, anaerobic abilities require strain of maximal or submaximal intensity, of short duration, where energy generation occurs without the presence of oxygen. We distinguish between anaerobic alactate processes and anaerobic lactate processes. Anaerobic capabilities depend on the ability of organism to generate energy in conditions of oxygen insufficiency, the ability to compensate for changes in the internal environment, and the degree of tissue adaptation to hypoxia conditions.

Also, functional abilities are directly related to the efficiency of the oxygen transport system (Petrić, 2009) and functional abilities are most favorably influenced by using cyclical activities (Wang & Lobstein, 2006).

METHOD

Population from which a sample of 64 respondents has been taken is consisted of primary school pupils from Niš, of male sex, age 9 and 10 year (± 6 months). The sample of 64 respondents was divided into two groups, an experimental and control group. The first, experimental group consists of 32 respondents who were involved in the process of exercising coordination and speed in additional physical education classes, lasting 8 weeks with 24 hours of training. The second, control group also consists of 32 respondents who were involved only in regular physical education classes.

Following measuring instruments for assessing functional abilities were used in this activity: resting heart rate (number of beats/min) RHR and heart rate after exercise (number of beats/min) HRR.

The tests for assessing functional abilities were taken from the Kinesiology Physiology Practicum (Heimar and Medved, 1997).

The methods used in this paper are descriptive and statistical methods, where basic statistical parameters, significance of the isolated discriminant function, centroid measurements and classification matrix were presented.

RESULTS

The following results were obtained in this research:

Table 1 Basic statistical parameters for assessing the functional abilities of the experimental group at the initial measurement

Varijable	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
FPUMI	32	97.32	82.00	105.00	4.08	0.428	1.174
FPPOP	32	161.78	155.00	166.00	2.71	-0.021	1.618

Legend: Arithmetic mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), skewness (Skewn.), kurtosis (Kurtos.)

The results shown in Table 1 for experimental group respondents in functional abilities test battery point that there are no statistically significant deviations of results from the normal distribution. The results of tests assessing the functional abilities of experimental group respondents point to a positive distribution. This is confirmed by the skewness results not exceeding 1.00, meaning that the test are neither heavy (up to +1.00) nor light (up to -1.00) but are appropriate for the research population and are below one. The results homogeneity (kurtosis) points to good sensitivity (discriminative property) as the values obtained are below 2.75. Obtained results of functional abilities do not deviate from the results of similar research verified on this respondents population, allowing the application of multivariate result processing methods in this research. Results generalization over the sampled population is thus possible.

Table 2 Basic statistical parameters for assessing the functional abilities of the experimental group at the final measurement

Varijable	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
FPUMI	32	92.08	81.00	99.00	5.10	-0.317	-0.401
FPPOP	32	152.36	153.00	164.00	4.90	-0.840	2. 089

Legend: Arithmetic mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), skewness (Skewn.), kurtosis (Kurtos.)

The results shown in Table 2 for experimental group respondents in functional abilities test battery point that there are no statistically significant deviations of results from the normal distribution. The results of tests assessing the functional abilities of experimental group respondents point to a positive distribution. This is confirmed by the skewness results not exceeding 1.00, meaning that the test are neither heavy (up to +1.00) nor light (up to -1.00) but are appropriate for the research population and are below one. The results homogeneity (kurtosis) points to good sensitivity (discriminative property) as the values obtained are below 2.75. Obtained results of functional abilities do not deviate from the results of similar research verified on this respondents population, allowing the application of multivariate result processing methods in this research. Results generalization over the sampled population is thus possible.

Table 3 Basic statistical parameters for assessing the functional abilities of the control group at the initial measurement

Varijable	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
FPUMI	32	98.86	86.00	104.00	1.15	0.6164	0.776
FPPOP	32	16014.	151.00	167.00	2.54	0.2866	-0.968

Legend: Arithmetic mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), skewness (Skewn.), kurtosis (Kurtos.)

The results shown in Table 3 for control group respondents in functional abilities test battery point that there are no statistically significant deviations of results from the normal distribution. The results of tests assessing the functional abilities of control group respondents point to a positive distribution. This is confirmed by the skewness results not exceeding 1.00, meaning that the test are neither heavy (up to +1.00) nor light (up to -1.00) but are appropriate for the research population and are below one. The results homogeneity (kurtosis) points to good sensitivity (discriminative property) as the values obtained are below 2.75. Obtained results of functional abilities do not deviate from the results of similar research verified on this respondents population, allowing the application of multivariate result processing methods in this research. Results generalization over the sampled population is thus possible.

Table 4 Basic statistical parameters for assessing the functional abilities of the control group at the final measurement

Varijable	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
FPUMI	32	97.53	84.00	103.00	6.02	0.526	0.386
FPPOP	32	161.48	150.00	166.00	7.04	0.339	-1.181

Legend: Arithmetic mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), skewness (Skewn.), kurtosis (Kurtos.)

The results shown in Table 4 for control group respondents in functional abilities test battery point that there are no statistically significant deviations of results from the normal distribution. The results of tests assessing the functional abilities of control group respondents point to a positive distribution. This is confirmed by the skewness results not exceeding 1.00, meaning that the test are neither heavy (up to +1.00) nor light (up to -1.00) but are appropriate for the research population and are below one. The results homogeneity (kurtosis) points to good sensitivity (discriminative property) as the values obtained are below 2.75. Obtained results of functional abilities do not deviate from the results of similar research verified on this respondents population, allowing the application of multivariate result processing methods in this research. Results generalization over the sampled population is thus possible.

Table 5 Significance of an isolated discriminant function of functional abilities in the experimental group

Disc Func.	Eigenvalue	Cannonical R	Wilks' Lambda	Chi-Sqr.	df	P-Level
1	4.984	.89	.100	157.88	12	.000

Legend: Eigenvalue (Euigenvalue), Canonical representation (Cannonical R), Bartlett's test values Bertletovog testa (Wilks' Lambda), Chi-Square test size (Chi-Sqr), degree of freedom (df) and significance level of the coefficient of determination (P-Level).

A significant discriminant function of high intensity (CR=71%) was obtained, which shows the correlation of the dataset on which the discriminant analysis of the obtained results was performed (Table 5.). The results of the discriminant strength of functional variables were given by the Wilk's Lambda test (.244), which indicates that the differences between the initial and final measurements in

the area of functional abilities in the experimental group are significant (p=.000) because the size of the Chi-squared test has a high value (Chi-Sqr 93.99).

Table 6 Factor structure of the isolated discriminant function in the experimental group

Variables	Root 1
FPUMI	0.745
FPPOP	0.624

Table 6. shows the structure of the discriminant function regarding the participation of functional ability variables in the formation of significant discriminant functions. The shown group centroids represent the arithmetic means of the initial and final measurement results. To check the efficiency of the training process for the implementation of the coordination training process and speed exercises in additional physical education, 2 functional tests were measured, which are assumed to be good predictors of the explored space. The presented results indicate that the greatest contribution to the discriminant function is made by the envelope test resting heart rate (FPUMI 0.745).

Table 7 Centroid measurements of the experimental group

Measurement	Root 1
Initial	-3.001
Final	3.001

The results in Table 7. represent the discriminant function of centroids based on all functional tests, which are -3.001 and 3.001. The importance of the presented centroid measurements, which was tested through the significance of the discriminant function, indicates that their distance (discrimination) is significant.

Table 8 Classification matrix of the experimental group

Measurement	Initial	Final	Total
Initial	30	2	32
Final	3	29	32
Initial	93.75%	6.25%	100%
Final	9.38%	90.62%	100%

The separation of groups shown in Table 8. as a percentage indicates that the performed separation (discrimination) of measurement results is explained with 92.18% accuracy (mean value of the group's own percentages) from the canonical correlation coefficient which amounts to CR=71%.

Table 9 Significance of an isolated discriminant function of functional abilities in the control group

Disc Func.	Eigenvalue	Cannonical R	Wilks' Lambda	Chi-Sqr.	df	P-Level
1	0.166	.20	.814	9.53	2	.463

Legend: Eigenvalue (Euigenvalue), Canonical representation (Cannonical R), Bartlett's test values Bertletovog testa (Wilks' Lambda), Chi-Square test size (Chi-Sqr), degree of freedom (df) and significance level of the coefficient of determination (P-Level).

A significant discriminant function of high intensity (CR=20%) was obtained, which shows the correlation of the dataset on which the discriminant analysis of the obtained results was performed (Table 9.). The results of the discriminant strength of functional variables were given by the Wilk's Lambda test (.814), which indicates that the differences between the initial and final measurements in

the area of functional abilities in the experimental group are significant (p=.463) because the size of the Chi-squared test has a high value (Chi-Sqr 9.53).

Table 10 Factor structure of the isolated discriminant function in the control group

Variables	Root 1
FPPOP	0.211
FPUMI	0.185

Table 10. shows the structure of the discriminant function regarding the participation of functional ability variables in the formation of significant discriminant functions. The shown group centroids represent the arithmetic means of the initial and final measurement results. To check the efficiency of the training process for the implementation of the coordination training process and speed exercises in additional physical education, 2 functional tests were measured, which are assumed to be good predictors of the explored space. The presented results indicate that low contribution of functional ability tests to discriminative function.

Table 11 Centroid measurements of the control group

Measurement	Root 1
Initial	0.399
Final	-0.399

The results in Table 11 represent the discriminant function of centroids based on all functional tests, which are 0.399 and -0.399. The importance of the presented centroid measurements, which was tested through the significance of the discriminant function, indicates that their distance (discrimination) is not significant.

Table 12 Classification matrix of the control group

MEASUREMENT	INITIAL	FINAL	TOTAL
INITIAL	16	16	32
FINAL	14	18	32
INITIAL	50%	50%	100%
FINAL	43.75%	56.25%	100%

The separation of groups shown in Table 12. as a percentage indicates that the performed separation (discrimination) of measurement results is explained with 53.12% accuracy (mean value of the group's own percentages) from the canonical correlation coefficient which amounts to CR=20%.

DISCUSSION

We are witnesses of the modern way of life and its influence on man. Lack of movement and exercise leaves its mark on both children and adults.

Functional abilities, as well as other abilities and characteristics of children are declining.

The aim of this research is to determine the impact of the coordination and speed training program on the transformation processes of the functional abilities of young school-age children.

Also, this research aims to determine the effects of regular physical education classes, because the results of numerous studies show and indicate a low level of functional abilities and a mild effect of regular, as well as supplementary physical education classes on their development (Bala, 1981; Krsmanović, 1985; Đurašković, 2002).

The basic statistical parameters for assessing functional abilities of the experimental and control groups, both at the initial and at the final measurement, indicate that there are no statistically significant

deviations of results from normal distribution. The results of the tests that assess the participants' functional abilities indicate that the distribution is positive. This is confirmed by the results of the distribution asymmetry (skewness) which does not exceed 1.00, which means that the tests are not difficult (up to +1.00) or easy (up to -1.00), but correspond to the surveyed participants and the value is below one. The homogeneity (kurtosis) indicates that there is a good sensitivity of the tests, because the obtained values are below 2.75. The results obtained regarding the motor skills do not deviate from the results of similar studies conducted in our country on this population of examinees, thus it is possible to apply the multivariate analysis methods in this research as well. Generalization of the results on the population from which the sample of these respondents was derived is thus possible.

The results shown in Table 5. indicate that the differences between the initial and final measurements in the functional abilities space of the experimental group are significant (p=.000 and Chi-Sqr=93.99).

Table 6. shows the structure of the discriminant function regarding the participation of functional ability variables in the formation of significant discriminant functions. The shown group centroids represent the arithmetic means of the initial and final measurement results. To check the efficiency of the training process for the implementation of the coordination training process and speed exercises in additional physical education, 2 functional tests were measured, which are assumed to be good predictors of the explored space. The presented results indicate that the greatest contribution to the discriminant function is made by the envelope test resting heart rate (FPUMI 0.745).

The results in Table 7. represent the discriminant function of centroids based on all motor tests, which are -3.001 and 3.001. The importance of the presented centroid measurements, which was tested through the significance of the discriminant function, indicates that their distance (discrimination) is significant.

The separation of groups shown in Table 8. as a percentage indicates that the performed separation (discrimination) of measurement results is explained with 92.18% accuracy (mean value of the group's own percentages) from the canonical correlation coefficient which amounts to CR=71%.

CONCLUSION

Based on the results shown in tables 5, 6, 7 and 8, we can conclude that the results of discriminatory analysis of functional abilities in the final, compared to the initial measurement in the experimental group, indicate that there were significant changes in the functional abilities of the respondents under the influence of the exercise program of coordination and speed in supplementary teaching of physical education.

Tables 9, 10, 11, and 12 show the results of the subjects of the control group, on the basis of which we can conclude that the results of the discriminant analysis in the final, compared to the initial measurement in the control group, indicate that there were no significant changes in functional abilities of respondents under the influence of regular physical education classes.

The results of this research indicate that there are no positive effects of regular physical education classes on the transformation processes of functional abilities of young school-age children, while there are positive effects on the transformation processes of functional abilities of young school-age children from additional physical education classes in the subjects of the experimental group at the end of the experimental period.

The results of this research can be used for some future research on this or a similar topic, which would preferably be of a longitudinal type, with the inclusion of a larger number of variables and which would determine, in a more precise way, not only the positive impact of the coordination and speed training program, but also the positive impact of supplementary physical education classes.

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TRANSFORMACIONI PROCESI FUNKCIONALNIH SPOSOBNOSTI UČENIKA MLAĐEG ŠKOLSKOG UZRASTA

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Sažetak: *Uzorak ispitanika činili su učenici osnovnih škola, uzrasta 9 i 10 godina (± 6 meseci) u Nišu. Uzorak od 64 ispitanika podeljen je u dve grupe, eksperimentalnu i kontrolnu grupu, po 32 ispitanika u svakoj grupi. Ispitanici eksperimentalne grupe bili su uključeni u proces vežbanja koordinacije i brzine u dodatnoj nastavi fizičkog vaspitanja dok su ispitanici kontrolne grupe bili uključeni samo u redovnu nastavu fizičkog vaspitanja. Rezultati diskriminativne analize funkcionalnih sposobnosti u finalnom u odnosu na inicijalno merenje kod eksperimentalne grupe ukazuju nam da je pod uticajem programa vežbanja koordinacije i brzine u dodatnoj nastavi fizičkog vapitanja došlo do statistički značajnih transformacionih procesa funkcionalnih sposobnosti dece mlađeg školskog uzrasta. Rezultati diskriminativne analize funkcionalnih sposobnosti u finalnom u odnosu na inicijalno merenje kod kontrolne grupe ukazuju nam da nije došlo do značajnih promena funkcionalnih sposobnosti ispitanika pod uticajem redovne nastave fizičkog vaspitanja.*

Ključne reči: *transformacioni procesi, funkcionalne sposobnosti, mlađi školski uzrast, koordinacija, brzina*