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CHANGES OF ANTHROPOMETRIC CHARACTERISTICS AND MOTOR ABILITIES WITH PUPILS WITHIN FOUR YEARS

1. INTRODUCTION

In relation to the type of the research, longitudinal research are "more valuable" and give "better" results than the transversal (Mužić). They are realized in a longer period of time, more often from several months to several years. In the kineziology (physical culture), for us particularly significant are the anthropometrical characteristics and motor skills as a part of the anthropological status of the entities. That was actually the motive for the realization of this research with longitudinal approach, whose main aim is directed toward determining the quantitative changes of the anthropometrical characteristics and motor abilities of treated subjects (students) male at age 11-14 years. So far in the science practice are known many studies in which were established the changes of the anthropometrical characteristics and motor abilities at respondents in the period of adolescence. The larger number of them are with transversal point of view and were realized by authors: Kurelić, & coll. (1975), Ničin, & Kalajđić (2000), Čeleš, Hadžikadunić, M., & Hadžikadunić, A. (2005) and Georgiev, & Hadžić (2008). As we stated, fewer are the researches with the longitudinal approach, and among the more important which were accessible to us are: Kosinac, & Katić (1999), Strel, and coll. (2003) and Georgiev (2006).

2. METHODS OF WORK

The survey was realized with 70 male students who were measured four times (in the fifth, sixth, seventh and eighth grade). Upon them were applied four antropometrical measures: body height (ATV), body weight (ATT), circumference of the forearm (AOPL) and the upper arm skinfold (ANN), which were measured according to the recommendations of the International Biological Program (Medved, & coll., 1987), as well and eight motor tests: shooting with a long stick (GDS), standing on a bench for balance with eyes open (NDO), moving in a figure eight with ducking (OSN), standing long jump (SDM), hanging in knuckle (VIS), hand tapping (TAPR), forward bend on the bench (DPK) and non-rhythmic tapping (NBU), according to the recommendations of Metikoš, & coll. (1989). The received data were processed with the statistical package SPSS for Windows 15.0. From the basic statistic parameters were calculated: the arithmetic mean (X), standard deviation (SD), coefficient of variability (CV), minimal result (MIN), maximal result (MAX), skewness (SKEW), kurtosis (KURT) and Kolmogorov-Smirnov test (K-S). In the study are shown only the arithmetic mean (X) and standard deviation (SD) for each variable and each age. Univariate and multivariate analysis of variance were applied for the Studentov t-test between the proxy ages, especially for each anthropometrical measurement and for each motor test (between 11-12 years old, between 12-13 years and between 13-14 years).

3. RESULTS AND DISCUSSION

According to the presented results in Table 1, in which are shown only the arithmetic mean and standard deviations for anthropometrical measures and motor tests for each age, in the anthropometrical space was registered continuous (linear) increasing of the values of body height (ATV) and circumference of the forearm (AOPL) at respondents from 11 to 14 years, i.e. from the fifth to eighth grade. At body weight (ATT) was registered continuous increasing from fifth to seventh grade (from 11 to 13 years) and a certain decrease at the age of 14 (eighth grade). Values of the applied anthropometrical measure the upper arm skinfold (ANN) are with larger values in the fifth and sixth grade (11 and 12 years), and with lower values in the seventh and eighth grade (13 and 14 years). The received results for applied anthropometrical measures are in line with the developmental changes that are characteristic for the subjects of this age. Similar results are met in the research at Kurelić and coll. (1975), Strel and coll. (1998) and others.

Table 1. Arithmetic mean and standard deviation for anthropometrical measures and motor tests of the subjects according to the age.

Variables	V-grade		VI-grade		VII-grade		VIII-grade	
	X	SD	X	SD	X	SD	X	SD
ATV	145.56	8.04	150.08	7.46	161.81	7.73	164.73	6.16
ATT	39.16	10.27	41.74	8.67	52.94	6.91	51.32	4.52
AOPL	20.42	2.04	20.51	2.34	21.63	1.50	21.83	1.90
ANN	13.90	7.23	13.46	6.80	9.10	3.98	10.76	4.23
GDS	49.31	10.41	54.10	6.23	57.86	6.74	57.31	6.24
NDO	2.45	1.82	4.90	5.96	5.89	5.77	5.16	4.04
OSN	19.94	2.48	21.68	1.53	20.06	1.88	21.05	2.51
SDM	1.46	0.20	1.47	0.19	1.52	0.23	1.62	0.18
VIS	12.94	8.69	18.17	13.63	21.72	14.70	27.69	15.22
TAPR	24.47	3.83	30.01	3.84	27.99	7.18	30.44	5.85
DPK	40.67	10.67	39.53	8.03	42.11	14.37	45.21	8.47
NU	6.71	3.38	6.76	3.44	8.57	4.07	9.27	3.64

According to the results of the analysis on the variance (Table 2) determined were statistically significant differences between the groups according to age in all treated anthropometrical measures and motor tests. In the overall analysed space according to the received values with the multivariate analysis of the variance may be concluded that the changes among the respondents in the treated age levels are statistically significant ($Q = 0.00$). A total and more precise overview of those differences among the respondents in cases of proxy ages (11-12, 12-13 and 13-14 years) was determined by t-tests. According to them, statistically significant differences at the anthropometrical measures were noticed: at the body height (ATV) and body weight (ATT) between all proxy ages; at circumference of the forearm (AOPL) and the upper arm skinfold (ANN) between 12 and 13 years (sixth and seventh grade). According to the values of

the t-test, statistically significant differences at the motor tests were determined: at the shooting with a long stick (GDS) between 11 and 12 years (fifth and sixth grade) and between 12 and 13 years (sixth and seventh grade), at standing on a bench for balance with eyes open (NDO) between 11 and 12 years (fifth and sixth grade), at moving in a figure eight with ducking (OSN) between the three neighboring ages the difference is statistically significant, at standing long jump (SDM) between 11 and 12 years (fifth and sixth grade) and 12 and 13 years (sixth and seventh grade), at hanging in knuckle (VIS) between 11 and 12 years (fifth and sixth grade) and 13-14 years (seventh and eighth grade), at hand tapping (TAPR), between all neighboring ages the difference is significant and at non-rhythmic tapping (NBU) between 11 and 12 years (fifth and sixth grade) and 13-14 years (seventh and eighth grade).

Table 2. *Univariate and multivariate analysis of variance for anthropometrical measures and motor tests of the subjects according to the age*

ANOVA	Variability	Sum of Squares	df	Mean Square	F	Sig.
	Between Groups	17710.68	3	5903.56	108.29	0.00
ATV	Within Groups	15046.52	276	54.52		
	Total	32757.21	279			
	Between Groups	9868.05	3	3289.35	52.89	0.00
ATT	Within Groups	17165.19	276	62.19		
	Total	27033.23	279			
	Between Groups	113.42	3	37.81	9.75	0.00
AOPL	Within Groups	1069.89	276	3.88		
	Total	1183.31	279			
	Between Groups	1087.35	3	362.45	10.97	0.00
ANN	Within Groups	9120.84	276	33.05		
	Total	10208.20	279			
	Between Groups	3230.95	3	1076.98	18.60	0.00
GDS	Within Groups	15985.04	276	57.92		
	Total	19216.00	279			
	Between Groups	468.67	3	156.22	7.06	0.00
NDO	Within Groups	6103.41	276	22.11		
	Total	6572.08	279			
	Between Groups	144.32	3	48.11	10.53	0.00
OSN	Within Groups	1261.25	276	4.57		
	Total	1405.57	279			
	Between Groups	1.16	3	0.39	9.44	0.00
SDM	Within Groups	11.31	276	0.04		
	Total	12.47	279			
	Between Groups	8065.19	3	2688.40	15.17	0.00
VIS	Within Groups	48925.25	276	177.27		
	Total	56990.45	279			

	Between Groups	1558.69	3	519.56	18.05	0.00
TAPR	Within Groups	7942.69	276	28.78		
	Total	9501.37	279			
	Between Groups	1271.35	3	423.78	3.71	0.01
DPK	Within Groups	31513.76	276	114.18		
	Total	32785.11	279			
	Between Groups	351.63	3	117.21	8.84	0.00
NU	Within Groups	3658.14	276	13.25		
	Total	4009.77	279			
Wilks' Lambda= 0.21		Rao's F= 15.42		DF1=36	DF2=784	Q=0.00

Only with the forward bend on the bench (DPK) between not even one proxy age was not determined statistically significant difference. In relations between the other unlisted neighboring ages in certain variables are not determined statistically significant differences between the achievements at treated respondents.

4. CONCLUSIONS

Based on the realised longitudinal research possible are the following conclusions:

1. Anthropometrical characteristics of the students are in accordance with the natural growth and development which is characteristic for the adolescent age.

2. In the motor abilities of treated respondents are determined various changes to which besides the known reasons and some unknown factors had impact (internal and external factors).

As a recommendation from this research may come a realization of new researches with longitudinal character in which will be included and female subjects. Certainly that of common interest would be similar researches to be realized, and with participants from preschool age, from the lower grades, as well and the highschool and the college youth.

5. Literature

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SUMMARY

The research is conducted on 70 male pupils in Skopje in order to examine and determine the changes of anthropometric characteristics and motor abilities. They have been measured for four times each (in the V-th, VI-th, VII-th, and VIII-th degree of the primary school) with four (4) anthropometrics measures and eight (8) motor tests. The obtained data is manipulated by analysis of variance (ANOVA), multivariate analysis of variance (MANOVA), and Student's *t*-test of dependent examples. The obtained results point at some quantitative changes. Some other factors apart, these changes can be said to have been induced by the proper organisation and realisation of the physical education class, which is three times weekly on the curriculum.

Key words: anthropometrics measures, motor tests, longitudinal research, quantitative changes, male pupils from V-th to the VIII-th degree of primary school.

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САРАДЊА ФАКУЛТЕТА ЗА СПОРТ И ФВ И ФК БУДУЋНОСТ

Пријем за шампионе

Факултет за спорт и физичко васпитање Универзитета Црне Горе из Никшића и Фудбалски клуб Будућност из Подгорице потписаће у четвртак Споразум о пословно-стручној и техничкој сарадњи.

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T.B.