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Differences Between Physical Fitness Profiles of Macedonian Children in Urban and Rural Areas in Strumica, Republic of Macedonia

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Abstract: Anthropological characteristics of the children often have been subject of researching in the kinesiology, but still there is a small number of researches that studied the influence of the residential status among the physical fitness and anthropometrical characteristics, especially in our state. The theoretical and empirical research was conducted on a sample of 2097 participants, drawn from 9 primary schools from the Municipality of Strumica, Republic of Macedonia, from which 5 are situated in rural and 4 in urban environment. The differences in the variables between the participants with various residential statuses are analyzed with multivariate and univariate analysis of variant (MANOVA and ANOVA). The boys from rural environment achieve better results in many test for evaluation of fitness' level, have lower height, weight, percentage of body fat and index of body mass. The girls who go to school in urban environments, from the early school ages, have low systolic pressure and achieve better results in the fitness tests: sit – ups for 30 seconds and sit and reach, whereas the girls who go to school in rural environment achieve better results in the fitness tests: plate tapping, hang grip and shuttle running 4 x 100 meters. On the basis of the achieved results it could be assumed that the environmental factors in different environments contribute for differences in the anthropological characteristics of the participants.

Key words: Children · Rural · Urban · Anthropometry · Physical fitness · Measurements

INTRODUCTION

The concept of physical fitness is as old as humankind. Through out the history of mankind physical fitness has been considered an essential element of every day life. The ancient people were mainly dependent upon their individual strength, vigor and vitality for physical survival. This involved mastery of some basic skill like strength, speed, endurance, agility for running, jumping, climbing and other skills employed in hunting for their livings.

The physical fitness is connected to the health condition during the childhood and adolescence [1-3]. Even among children, fitness is inversely associated with cardiovascular risk factors for chronic disease such as high blood pressure [4, 5], total fatness [5], hyperinsulinemia [4], abdominal adiposity [6], atherogenic lipid profile [7], insulin resistance [8] and clustering of metabolic risk factors [5,9]. Unfortunately, in the last two decades we have witnessed more evident tendency of decreasing of the physical activity among children, that happens not only in our state, but also in the countries nearby [10, 11], as well as in the developed countries [12-14].

Huge number of the environmental factors such as: socio-economic status, cultural influence, life style, health condition and many others factors have influence upon the level of physical activity among children and at the same time there is also an indirect influence upon the anthropological characteristics of the children. Both, children and youngsters differ at the level of physical fitness regarding the socio-economic characteristics, as

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well as the living environment and that's because they depend on the economic and cultural potentials of their family.

The parents and the environment have great influence on the development of the abilities and characteristics at most of the children, whereby they have big responsibility for their proper psyche-physical development, education and development of the total abilities, which influence is especially important for the sport results that are achieved by the children.

The first assumption of this research is that the students from different residential status have different level of the physical fitness. In our state, there are no researches for the physical fitness among the students, regarding different residential status, whereas many foreign authors dealt with this matter during the last few years [15-20].

MATERIALS AND METHODS

The research is conducted on a sample of 2097 participants, which is 97% from the total population of students at the researched age, at the primary schools in the Municipality of Strumica, Republic of Macedonia. In the Municipality there are 9 primary schools from which 5 are in rural environment and 4 are in urban environment. The sample is divided into two subsamples according the gender as it: 1149 participants are male (831 from urban and 318 from rural) and 948 participants are female (692 from urban and 256 from rural). The average age of the participants from both genders is 8.13 years.

In the sample all the students who participated, obtained consent from their parents that they allow them to participate in the project and were psycho-physically healthy and regularly attended classes of physical and health education. The participants were treated pursuant to the Helsinki Declaration.

The measuring was realised in March, April and May, 2012, in standard school conditions during the regular classes of physical and health educaton. The measuring was conducted by professionals from the area of kinesiology and medicine, which were previosly trained for measuring of the determined tests and measurements.

Anthropometric Measurements: Anthropometric measurements were taken according to standard methodology of International Biological Program (IBP) and according to the recommendations of World Health Organisation (WHO) and Weiner-Lurie [21].

Weight was measured in underwear and without shoes with an medical decimal weight scales, to the nearest 0.1 kg and height was measured barefoot in the Frankfort horizontal plane with a telescopic height measuring instrument (Martin's anthropmeter) to the nearest 0.1 cm. Body mass index was calculated as body weight in kilograms divided by the square of height in meters.

The components of the body composition are determined by the method of bioelectrical impedance (measuring of electrical conductivity - Bioelektrical Impedance Analysis – BIA). The measuring was realised by the Body Composition Monitor, model "OMRON - BF511", by which the body weight, the percentage of body fat, percentage of muscular mass and the index of body mass were measured (BMI).

Before the measuring in the Body Composition Monitor the following parameters were being entered: gender, ages and height of the participant.

In order to achieve maximally precise results during the measuring i.e. evaluation of the body composition, preconditions which are recommended by ACSM [22] and Heyward [23] were fulfilled before every measuring.

Statistical Analysis: The data are presented mean (SD) for continuous variables. The differences in the variables between the participants from different residential status are analyzed with the multivariable and univariable analysis of variant (MANOVA and ANOVA).

The normality of the distribution of changed variables is tested with Kolmogorov-Smirnov's method. All the analyses were performed using the Statistical Package for Social Sciences software (SPSS, v. 16.0 for WINDOWS; SPSS Inc., Chicago, IL, USA) and values of $p < 0.05$ were considered statistically significant.

Evaluation of Physical Fitness: Prior to starting the study, the researchers involved in the project undertook training sessions in order to guarantee the standardization, validation and reliability of the measurements [24]. Seven tests, forming part of the EUROFIT battery, validated and standardized by the European Council, were applied in the following order:

- Sit and Reach test. With the subject seated on the floor and using a standardized support, the maximum distance reached with the tip of the fingers by forward flexion of the trunk is measured. Test indicative of amplitude of movement or flexibility.

- Falamingo. Balancing on one leg as long as possible while standing on the preferred foot. This test measures general balance.
- Plate Tapping. Test Rapid tapping of 2 plates alternately with the preferred hand. The subject performed 25 cycles for 2 times and the better result was the score.
- Hand Grip test. With the use of a digital Takei TKK 5101 dynamometer (range, 1-100 kg), the maximum grip strength was measured for both hands.
- Standing broad jump test. The maximum horizontal distance attained, with feet together, was measured. This test evaluates lower limb explosive-strength.
- Bent Arm Hang test. A standardized test was used to measure the maximum time hanging from a fixed bar. This test estimates the upper limb endurance-strength.
- Sit-ups 30 sek. Maximum number of sit ups achieved in 30 seconds. This test measures the endurance of the abdominal muscles
- Shuttle run: 4×10 meters. This test provides an integral evaluation of the speed of movement, agility and coordination. The subject does four shuttle runs as fast as possible between 2 lines 10 meters apart. At each end the subject places or picks up an object (a sponge) beside the line on the floor.

Blood Pressure: Measuring of blood pressure (systolic and diastolic) and heart rate were realised by professionals in the area of medicine, doctor- specialist in sport's medicine. The measurements were performed in special premise with optimal ambiental conditions in relaxed condition of the participant, where the relaxation was performed at least one minute before the measuring. The measuring was realised on the forearm above the wrist of the palm, with a clinically tested electronical digit device for measuring of the blood pressure by the firm „Omron". The measuring was performed on the left hand and before it was taken into consideration for the cuff to be properly set, the hand to be on the same height as the heart and the participant to sit upright, not to move or talk. The blood pressure was measured for three times in the interval of 60 seconds and as a result was considered the average value of the three measuring.

RESULTS

The testing of the normality of the distribution with Kolmogorov-Smirnov's procedure showed that most of the variables among the participants from both genders do not deviate from the normal distribution.

In the Table 1 and 2 are shown the average values, standard deviations and the values of the multivariate and univariate analysis of the covariate of the parameters for evaluation of the blood pressure, anthropometrical measurements, body composition and tests for evaluation of the level of physical fitness after the partition of the ages among the participants from both genders.

From the analysis given in the Table 1 it is obvious that at the multivariate level are determined significant statistical differences in the system variables for evaluation of the blood pressure, anthropometrical measurements, body composition and the level of the physical fitness among boys who go at school in urban and rural environment. The value of the F test for the whole system of analyzed variables is statistically important on the level of evaluation $Q < 0,00$.

From the analyses of the achieved results in the Table 1, it is obvious that at the univariate level there are significant statistical differences in the variables body height ($p < 0,00$), body weight ($p < 0,00$), percentage of body fat ($p < 0,00$), as well as the tests for evaluation of the level of fitness standing long jump ($p < 0,00$), plate tapping ($p < 0,00$), bent arm hang ($p < 0,00$), hang grip ($p < 0,01$) shuttle running 4 x 10 ($p < 0,00$).

The boys from the early school ages who go to school in the rural environments have lower height, lower weight, lower percentage of body, index of body mass and show better results in the tests standing long jump, plate tapping, bent arm hang, hang grip, shuttle running 4 x 10 meters. Statistical significant differences between the boys who go to school in urban and rural environment are not determined in the systolic and diastolic pressure, percentage of body mass and fitness tests for evaluation of the flexibility (sit and reach) and repetitive strength in the abdominal structure.

From the review of the Table 2 it is noticeable that between the girls who go to school in urban and rural environment are determined multivariate statistical differences which are important for the whole system of the analyzed variable ($Q < 0,00$). At univariate level, between girls who go to school in urban and rural environment, there are significant differences in the functional measurements: systolic pressure ($p < 0,00$) and in the fitness tests: plate tapping ($p < 0,00$), sit – ups for 30 sec ($p < 0,00$), hang grip ($p < 0,02$), sit and reach ($p < 0,01$) and shuttle run 4 x 10 meters ($p < 0,00$). The girls from the early school ages who go to school in urban

Table 1: Differences between urban and rural male children

Wilks'Lambda	Rao's R		df 1		df 2	Q
0,87	11,46		15,00		1132,00	0,00
	Urban		Rural			
Variable	Mean	SD	Mean	SD	F	p
Systolic pressure (mmHg)	107,78	7,36	108,44	6,89	1,97	,16
Diastolic pressure (mmHg)	67,70	7,83	67,27	7,91	0,69	,40
Height (cm)	135,21	9,04	134,02	8,52	8,14	,00
Weight (kg)	34,94	9,83	32,11	8,80	25,93	,00
Body fat (%)	23,32	7,96	20,61	6,89	28,72	,00
Muscular mass (%)	31,03	3,06	31,34	3,13	3,60	,06
BMI (kg/m^2)	18,82	3,54	17,62	3,03	30,11	,00
Flamingo (s)	2,11	1,38	2,01	1,07	1,60	,21
Standing long jump (cm)	124,62	22,48	128,99	21,35	10,70	,00
Plate Tapping	19,22	3,79	18,15	3,00	30,03	,00
Sit-ups 30 sek. (n)	14,34	4,36	13,96	4,83	1,84	,17
Bent arm hang (s)	5,14	5,45	7,43	6,34	36,99	,00
Handgrip (kg)	14,82	9,12	16,03	10,01	6,21	,01
Sit and reach (cm)	16,56	5,22	16,22	5,29	1,00	,32
Shuttle run 4x10 m	13,85	1,44	13,24	1,08	59,08	,00

Table 2: Differences between urban and rural female children

Wilks'Lambda	Rao's R		df 1		df 2	Q
0,83	12,39		15,00		931,00	,00
	Urban		Rural			
Variable	Mean	SD	Mean	SD	F	p
Systolic pressure (mmHg)	107,04	7,67	108,71	7,43	9,38	,00
Diastolic pressure (mmHg)	67,11	8,10	67,52	7,98	0,49	,49
Height (cm)	136,40	9,17	136,20	8,56	0,19	,67
Weight (kg)	35,08	9,46	34,60	9,42	0,57	,45
Body fat (%)	22,94	8,49	21,91	8,74	2,68	,10
Muscular mass (%)	30,68	2,51	30,97	2,86	3,37	,07
BMI (kg/m^2)	18,63	3,45	18,70	4,06	0,07	,80
Flamingo (s)	2,05	1,05	2,01	1,19	0,32	,57
Standing long jump (cm)	111,07	19,93	111,28	18,63	0,02	,88
Plate Tapping	20,12	4,40	18,72	3,43	30,26	,00
Sit-ups 30 sek. (n)	12,40	4,33	10,43	5,10	37,30	,00
Bent arm hang (s)	2,89	3,59	3,36	4,07	2,95	,09
Handgrip (kg)	12,03	7,83	13,24	8,57	5,66	,02
Sit and reach (cm)	17,83	5,41	16,80	5,34	6,69	,01
Shuttle run 4x10 m	14,65	1,47	14,23	1,24	21,01	,00

environments have lower systolic pressure and better results in the fitness tests: sit – ups for 30 sec and sit and reach. The girls who go to school in rural environment achieve better results in the fitness tests: plate tapping, hang grip and shuttle running 4 x 10 meters.

DISCUSSION

Physical fitness is fundamental to public health. This has an influence on the risks of morbidity and mortality and therefore can reduce these risks. Disease prevention and health promotion should be implemented as early as possible both in childhood and adolescence. Previous studies have focused on specific health behavior [25-27].

The results from our research point that the students from different residential status are significantly different in the anthropometrical measurements, body composition and the level of physical fitness. The female students who go to school in rural environment have lower height and weight, lower percentage of body fat, index of body mass and achieve better results in the fitness tests for

evaluation of the explosive strength in the lower limbs, frequency of movement, strength and endurance of the hands and shoulder area, strength of grip palm, agility and velocity.

The female students who go to school in rural environment achieve better results in the fitness tests for evaluation of the frequency of the movement, agility and velocity and the strength of palm, whereas the girls from urban environment have lower systolic pressure, stronger abdominal musculature and flexibility.

The results from the previous researches that were conducted in Europe point that the children who live in urban environments are higher regarding their peers from the rural environments, while in many countries these differences stay in the mature age. The changes in the public health, nutrition and the life conditions which are connected to the urbanization are determined as reasons for the above mention [28].

The researches of Sandhu [29], in which there is comparison of the level of physical fitness in urban and rural environments at the district of Amritsar, point that the girls from the rural areas are superior at the physical fitness regarding the girls from urban area.

Mehtap and Nihal, have conducted research in which they compared the level of the physical fitness in rural in relation to the urban children in Turkey and they found that the children who live in urban environment are higher, thicker and physically more inactive in relation to the children who live in rural environment [30].

Tinazci and Emiroðlu explored the differences in the level of physical fitness among students from primary schools in urban and rural environment, between the ages of 9 and 11 years [20]. The results from the research showed that the students from rural environments have better results in the tests for evaluation of the flexibility, endurance and strength. Badriæ and Petračiæ explored the level of physical fitness among students, both from urban and rural environment in Croatia. The analysis of the results of the students from different residential status in Croatia, show that the students in rural environments achieve better results in the tests for flexibility, whereas in the other tests there are no significant statistical differences [17].

Eiben and the collaborators explored the influence of socio-economic status upon the phenomena of the biological acceleration among children in Hungary at the age of 3-18 years. The explorers came to a finding that the number of the members of family and the living place has influence onto the anthropometrical measurements. The children, who belong to families with larger number of members, were shorter, thinner and have lower percentage of body fat – in average values. Unlike them, the children from the urban parts of Budapest were higher, thicker, have larger thorax and shinbone and larger percentage of body fat [31].

The research, which was conducted in Berlin [32] on a sample of students at third and fourth grade from different social environment and different social inheritence, point that the level of physical fitness is somehow conditioned by the social factors. The different social environment is stipulated as a reason for the differences in the level of fitness, but still it should be considered that the differences might be consequence of the differences in the offered content.

The larger presence of the sedentary way of life, especially among children who live in urban environment, decreases the total physical activity and at the same time it decreases the level of physical fitness and accomplishments. The results from our research point that the boys who are educated in rural environment achieve better results in the tests for evaluation of the physical fitness. The assumption that the children from rural environment have more spontaneous physical activities in open area and they use the external terrains more often, unlike the children who live in urban areas which is probably the reason because the first ones achieve better results, especially at the abilities in which the energetic componenet is dominant.

Certainly, despite the stipulated factors for the differences in the level of physical fitness among children, the teacher of physical education, the organization at the school and the education by the parents have great influence and are very important for the physical activity, their personal example and home education.

CONCLUSION

The analysis of the results at the anthropological indicators among children who are educated in urban and rural environment point that the boys who go to school in rural area from the early ages have lower height, weight and percentage of body fat, index of body mass and achieve better results in the tests: standing long jump, plate tapping, bent arm hang, hang grip and shuttle run 4 x 10 meters. The girls who are educated in urban environments from the early ages have lower systolic pressure and achieve better results in the fitness tests: sit – ups 30 sec and sit and reach, whereas the girls who go to school in rural environment achieve better results in the fitness tests: plate tapping, hang grip and shuttle run 4 x 10 meters. The reason for that is probably due to the fact that the children who are educated in rural

environment have better conditions for games in open area, thereby they have larger spontaneous physical activity. The residential status has greater influence on the level of fitness among boys, unlike girls.

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