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Research article

RELATIONS OF FITNESS PARAMETERS AND MORPHOLOGICAL CHARACTERISTICS OF SEVEN -YEAR - OLD OBESE CHILDREN

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Abstract. *The aim of this research was to determine the relations of fitness parameters and morphological characteristics of seven-year-old obese children. The sample of participants consisted of 103 obese children (63 girls and 40 boys), first grade students (mean age 7,04 years) of the elementary schools in Nis. The following fitness parameters were measured: HR in load, VO2max, resting HR, bend forward - bend backward - throw test, hand taping, 20m dash with a standing start, Abalakov test and forward bend on the bench test. Morphological characteristics were determined by measuring 13 parameters of longitudinal and transversal dimensions of the skeleton, volume and body weight, as well as subcutaneous fat tissue. For all of the data we calculated the Mean and standard deviation (SD). A canonical correlation analysis was used to determine the relations between the set of variables representing fitness parameters and the set of variables of morphological characteristics. Based on the coefficients of the canonical correlation analysis, it can be concluded that the spaces of morphological characteristics and fitness parameters are interconnected with two pairs of statistically significant canonical factors ($p<.05$ and $p<.01$). The general analysis of the relationships between the first pair of canonical factors suggests that participants with higher circular dimensionalities of the body, accentuated adiposity and body mass tend to have poorer results in motoring tasks requiring body flexibility, explosive leg strength and running speed, and also have poorer results in the parameters of cardiorespiratory fitness. It can be concluded that obesity in younger school age has negative implications on the fitness parameters in children, and therefore on their overall growth and development.*

Key words: *obesity, children, fitness parameters, physical activity, younger school age.*

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INTRODUCTION

The global increase in childhood overweight and obesity has become a worldwide epidemic. The World Health Organization claims that there were 41 million obese children in the world under the age of 5 and over 340 million obese children and adolescents aged between 5 and 19 in 2016. The data indicate that the prevalence of excessive nutrition and obesity has increased from 4% (1975) to over 18% (2016) (WHO, 2016). Gender differences were of no particular significance; in the year the study was conducted there were 18% of girls and 19% of boys who had a body mass categorized as higher than normal.

The most significant health complications related to obesity arise in the cardiovascular system, the articulations and skeleton system and the endocrine system (type 2 diabetes), and obesity is increasingly associated with various types of malignancies recently (WHO, 2016).

Young school age is a sensitive developmental period. In this period of growth and development, a child's body is exposed to various influences, the effects of which are manifested in a later period. If obesity occurs in childhood, it very often continues in adulthood and presents a risk factor for many mass non-communicable diseases (WHO, 2016) and result in significant health and socioeconomic consequences.

Childhood obesity has been associated with obesogenic factors such as intake of energy-dense foods and very low levels of physical activity (Maffeis, Zaffanello, & Schutz, 1997), which favours impaired physical fitness (Tomkinson, Leger, Olds, & Cazorla, 2003). Previous studies of fitness parameters and morphological characteristics highlight a decline and a stagnancy in the levels of motor performance and an increase of BMI values (Graf, Koch, Kretschmann-Kandel, Falkowski, Christ et al. 2004; Kopecký & Pridalová, 2008).

Physical fitness is considered to be a significant factor in children's growth and development. It has considerable effects on healthy growing up and the formation of a healthy personality. The term physical fitness covers an entire range of motor activities, such as cardiovascular abilities, strength, coordination, or flexibility (Caspersen, Powell, & Christenson, 1985). President's Council on Physical Fitness defines health-related physical fitness as those specific components of physical fitness that have a relationship with good health (ACSM, 2007). According to the given source, health-related physical fitness elements are: cardiorespiratory fitness, muscular strength, muscular endurance, flexibility and body composition. There is also a set of abilities that are not exclusively related to human health, but primarily with sports achievement (Sport/Skill-Related Physical Fitness).

Physical fitness (mainly cardiorespiratory fitness and muscular strength) during childhood and adolescence is a powerful indicator of future health (Ortega, Ruiz, Castillo, & Sjöström, 2008; Ruiz, et al., 2009). In spite of its beneficial health effects, secular trends in physical fitness show a decrease of ~0.4% and ~2.0% per year in the level of aerobic fitness and muscular strength, respectively (Cadenas-Sánchez, Artero, Concha, Leyton, & Kain, 2015).

Cardiorespiratory fitness measures have a negative correlation with BMI in children, so there is an assumption that a decrease in cardiorespiratory fitness in children may occur due to an increase in obesity (Stratton, Canoy, Boddy, Taylor, Hackett, & Buchan, 2007; Mota, Flores, Ribeiro, & Santos, 2006). The studies state that obese children have lower relative VO2max (Berndtsson, Mattsson, Marcus, & Larsson, 2007), and therefore, have lower aerobic fitness than their non-obese peers (Marinov, Kostianev, & Turnovska, 2002).

Despite the fact that cardiorespiratory fitness has been emphasized as the primary factor supporting good health, musculoskeletal fitness is now identified as a decisive component in preserving overall health (Thivel, Ring-Dimitriou, Weghuber, Frelut, & O'Malley, 2016). Smith and collaborators (Smith, Eather, Morgan, Plotnikoff, Faigenbaum, & Lubans, 2014) emphasized the possible physiological and psychological assets attributed to muscular fitness in children and adolescents. Their studies provided direct confirmation for an inverse connection between muscular fitness and adiposity (total and central), cardiovascular disease or metabolic risk factors; and a positive association with bone health and self-esteem. Muscle strength and muscular fitness play an important role in daily life and are essential for performing everyday activities (Thivel et al., 2016).

Furthermore, the analysis implies that obesity does have a negative impact on endurance, speed, agility, lower limb power and balance but does not influence handgrip, upper body strength and flexibility (Ceschia, Giacomini, Santarossa, Rugo, Salvadego, Da Ponte et al., 2016). According to Podstawski & Boryslawski (2012), body height is positively correlated with almost all motor abilities, while it is in a variable correlation with body mass. A statistically significant positive correlation of BMI was determined with the frequency of movement, arm strength and strength of the shoulder band, and in a negative one with the shuttle run test and the flexed-arm hang test. The results from a large number of studies indicate that flexibility is independent from the nutritional status (Tokmakidis, Kasambalis, & Christodoulos, 2006; Leskoš ek, Strel, & Kovač, 2007).

The aim of this paper was to determine the relationship between fitness parameters and morphological characteristics of seven-year-old obese children.

METHODS

The research was conducted on a sample of 103 obese children (63 girls and 40 boys), first grade students (mean age 7,04) of elementary schools "Car Konstantin", "Sveti Sava" and "Ratko Vukicevic" in Nis. After measuring body height and body weight and calculating BMI values according to Cole, Bellizzi, Flegal, & Dietz (2000), students whose body weight indexes indicated obesity were isolated from the larger sample. The following fitness parameters were measured: HR in load, VO2max (ml), resting HR, bend forward - bend backward – throw test, hand taping, 20m dash with a standing start, Abalakov test and forward bend on the bench. Morphological characteristics were determined by measuring 13 parameters of longitudinal and transversal dimensions of the skeleton, volume and body weight, as well as subcutaneous fat tissue (body height, leg length, arm length, shoulder width, pelvic width, hip width, body mass, thorax volume, upper arm volume, thigh volume, upper arm skinfold, back skinfold and abdominal skinfold). Measurements were made according to the method recommended by the International Biological Program, IBM (Weiner & Lourie, 1969).

Measurements and tests were conducted in the schools during the course of physical education on the premises for the physical education classes and in training halls. All the participants were healthy on the day of testing and had a written consent from their parents and school principals.

Relationships between fitness parameters and morphological characteristics were determined by a canonical correlation analysis. The structure of isolated canonical factors in the examined spaces was also determined.

RESULTS

Table 1 shows the results of the descriptive statistics of the morphological characteristics.

Table 1 the descriptive statistics of the morphological characteristics and fitness parameters

	I grade ♂		I grade ♀	
	Mean	SD	Mean	SD
Age (yrs)	7.03	0.46	7.05	0.55
BMI (kg/m^2)	23.24	1.93	22.62	1.84
Body height (cm)	131.91	6.08	131.05	5.40
Leg length (cm)	71.90	3.94	71.93	4.48
Arm length (cm)	55.45	3.34	54.78	2.55
Shoulder width (cm)	31.32	1.81	30.91	1.52
Pelvic width (cm)	23.62	1.39	23.78	1.75
Hip width (cm)	25.08	1.37	24.93	1.61
Body mass (kg)	40.68	6.33	39.00	5.30
Thorax volume (cm)	70.36	5.72	69.67	5.47
Upper arm volume (cm)	22.66	1.86	22.15	1.85
Thigh volume (cm)	42.84	3.32	42.70	3.34
Upper arm skinfold (mm)	19.24	6.01	19.98	6.97
Back skinfold (mm)	20.39	6.19	18.88	5.53
Abdominal skinfold (mm)	23.79	6.45	22.79	5.35
HR in load (bpm)	159.23	6.44	160.35	7.17
VO2max (ml)	44.51	1.18	43.29	1.32
HR in peace (bpm)	95.90	13.80	96.60	14.49
Bend forward-bend backward-throw (dm)	32.30	8.77	39.54	14.34
Hand taping (reps in 20s)	22.10	2.95	21.65	3.76
20m dash (s)	5.27	0.59	5.43	0.65
Abalakov test (cm)	15.84	5.69	14.60	4.12
Forward bend on the bench (cm)	35.90	6.44	37.73	7.36

A canonical correlation analysis has established a connection between a set of variables of fitness parameters and variables of morphological characteristics (Table 2).

Table 2 Coefficients of canonical correlation of morphological and fitness parameters of seven-year-old obese children

	R	R^2	Chi-sqr.	df	p
0	0.59	0.35	160.69	120	0.008**
1	0.55	0.30	121.99	98	0.051*
2	0.53	0.28	90.26	78	0.162
3	0.44	0.20	60.58	60	0.455

Key: R – canonical coefficient of correlation; R^2 – canonical coefficient of determination or square of canonical correlation; χ^2 – Bartlett chi square test of canonical correlations' significance; df – number of degrees of freedom p – statistical

Table 2 shows the results of the canonical correlation analysis. By analyzing the obtained results, it can be concluded that the spaces of morphological characteristics and fitness parameters are connected with two pairs of statistically significant canonical factors. The first

pair of canonical factors explains 35% (R^2= .0.35) of common variability, at a significance level of .01. The other couple explains 30% (R^2= .030) the remaining common variability, to the level of significance of .05.

The structure of isolated canonical factors in the examined spaces (fitness parameters and morphological characteristics) are defined in order to explain the structure of the canonical dimensions.

Table 3 Factor structure of the fitness parameters

	Root 1	Root 2
HR in load (bpm)	-0.29	0.26
VO2 max (ml)	0.38	0.32
HR in peace (bpm)	0.10	-0.05
Bend forward - bend backward - throw (dm)	0.44	-0.37
Hand taping (reps in 20s)	0.37	-0.02
20m dash with a standing start (s)	0.20	-0.72
Abalakov test (cm)	-0.56	-0.22
Forward bend on the bench (cm)	-0.35	0.06

Table 3 shows the factor structure of fitness parameters. Analysis of the results shows a significant projection of all fitness parameters, except resting HR. The largest projections for the first isolated canonical factor were determined for the Abalakov test (-0.56), bend forward - bend backward - throw (0.44) and VO2max (ml) (0.38). Significant projections for the second isolated canonical factor were recorded in variables: 20m dash with a standing start (-0,72), bend forward - bend backward - throw (-0.37), VO2max (ml) (0.32), resting HR (0.26) and Abalakov test (-0.22).

Table 4 Factor structure of morphological characteristics of seven-year-old obese children

	Root 1	Root 2
Body height (cm)	0.30	0.27
Leg length (cm)	0.09	0.11
Arm length (cm)	0.06	0.49
Shoulders span (cm)	0.30	0.33
Pelvis span (cm)	0.15	0.23
Hips span (cm)	0.20	0.24
Body weight (kg)	0.35	0.31
Average circumference of the chest (cm)	0.52	0.38
Upper arm circumference (cm)	0.48	0.42
Thigh circumference (cm)	0.20	0.22
Upper arm skinfold (mm)	0.49	-0.05
Back skinfold (mm)	0.42	0.32
Abdominal skinfold (mm)	0.43	0.08
BMI (kg/m^2)	0.25	0.29
BF	0.56	0.13

Table 4 shows the factor structure of morphological variables. By analyzing the results, it can be noticed that the largest projections on the first isolated canonical factor have BF (0.56), average circumference of the chest (0.52) and thickness of skin fold of the upper arm

(0.49). Significant projections of the positive direction recorded all morphological variables, with the exception of the variable arm length, leg length and pelvis span. The largest projections on the second isolated canonical factor were determined for arm length (0.49), upper arm circumference (0.42) and average circumference of the chest (0.38). Projections of the variables thickness of skin fold on upper arm, thickness of skin fold of the abdomen, BF, and leg length are not statistically significant.

DISCUSSION

Based on the coefficients of the canonical correlation analysis (Table 2), it can be concluded that the spaces of morphological characteristics and fitness parameters are interconnected with two pairs of statistically significant canonical factors.

The general analysis of the relationships between the first pair of canonical factors suggests that participants with higher circular dimensionalities of the body, accentuated adiposity and body mass tend to have poorer results in motor tasks requiring body flexibility, explosive leg strength and running speed, and also have poorer results in the parameters of cardiorespiratory fitness. Recent research indicates that flexibility is independent from nutritional status (normally nourished, overweight and obese) (Tomakidis et al., 2006). However, as all participants in this research are obese, it is concluded that the level of nutrition at a certain level starts to have a negative correlation with flexibility. This can be explained primarily by the circular obesity that reduces the results of the forward bend on the bench test. Poor results of obese participants in speed assessment tests are in compliance with other studies (Đokić & Međedović, 2013). Additionally, the poor results on the tests for assessing explosive leg strength are in accordance with previous studies (Ceschia et al., 2016). The HR values in the load are higher in obese children, which is also in agreement with other works (de Sousa, Hussein, Trowitzsch, Andler, & Reinehr, 2009).

On the other hand, this morphological structure positively influences the frequency of arm movement, the explosive power of the hand and shoulders, and greater maximum oxygen consumption. It is concluded that quantitatively higher values of morphological characteristics, with the pronounced volume of the body, which stimulates more of the subcutaneous fat, make it difficult to carry out motor tasks that require lifting and weight transmission in space (the Abalakov test and the 20m dash with a standing start), which is consistent with a number of other surveys (Biskanaki, et al., 2004; Suchomel, 2005; Ara, Moreno, Leiva, Gutin, & Casajús, 2007; Tokmakidis et al., 2006; Brunet, Chaput, & Tremblay, 2007; Leskošek et al., 2007; Casajús et al., 2007; Siahkouhian et al., 2011).

Increased bulk density and body weight, as well as higher development of adipose tissue, are not troublesome factors for the realization of motor tasks requiring frequency of arm movement (Ara et al., 2007; Leskošek et al., 2007; Runhaar, et al., 2010; Esmaeilzadeh & Ebadollahzadeh, 2012; Podstawski & Boryslawski, 2012; Casajús et al., 2007). In relation to normally nourished, overweight and obese children often achieve better results in the explosive arm and shoulder strength (Riddiford-Harland, Steele, & Baur, 2006; Đorđević, Kostić, Pantelić, Uzunović, Milanović, & Mitrović, 2016; Đorđević, Pantelić, Uzunović, & Mitrović, 2016).

The second canonical factor in the morphological space is defined by positively oriented measures of longitudinal and transversal dimensionality, volume and body mass.

The second factor in the fitness parameter area is defined by positively oriented variables HR in load, VO2max and the 20m dash with a standing start, and negatively oriented variables of the Abalakov test and bend forward - bend backward - throw test. This relation provides an explanation for the remaining common variability with 30%. Relations of the second pair of canonical factors indicate that participants with higher dimensions of longitudinal and transversal dimensionality of the skeleton with higher body volume and mass have higher oxygen consumption but achieve worse results in motor tasks requiring running speed and explosive power of the arm and the leg.

The relationships obtained may be interpreted on the basis of some other factors outside the scope of this research (e.g. previous motor experience, neurological, functional and mental development of the respondents, etc.).

CONCLUSIONS

Previous studies of fitness parameters and morphological characteristics of children at various levels of nutrition confirm that the highest number of fitness parameters (cardiorespiratory fitness, muscular strength, muscular endurance) have a negative correlation with morphological characteristics in obese children. The results of the tests for cardiorespiratory fitness evaluation from this study indicate that children with higher circular dimensionalities of the body have poorer parameters of cardiorespiratory fitness. Participants with higher circular dimensionalities of the body and body mass tend to have poorer results in motor tasks requiring explosive leg strength and running speed. Moreover, the results show that the degree of nutrition at a certain level starts to have an adverse correlation with flexibility. Accordingly, it is concluded that obesity at a young school age has negative implications on the fitness parameters in children, and therefore on their overall growth and development.

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REFERENCES

American College of Sports Medicine. *ACSM's health-related physical fitness assessment manual.* 2nd Ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2007.

Ara, I., Moreno, A.L., Leiva, T.M., Gutin, B., & Casajús, A.J. (2007). Adiposity, physical activity, and physical fitness among children from Aragón, Spain. *Obesity*, 15(8), 1918-1924.

Berndtsson, G., Mattsson, E., Marcus, C., Larsson, U.E. (2007). Age and gender differences in VO2max in Swedish obese children and adolescents. *Acta Paediatrica*, 96(4), 567-571.

Biskanaki, F., Panagiotou, K.A., Papadopoulou, S. K., Spiridou, N.G., Gallos, G. K., Gill, J., Zacharis, E. M., Tassoulas, E.,& Fachantidou, A. (2004). The effect of sex and obesity on specific motor skills of Greek children aged 8 years old. *Pakistan Journal of Medical Research*, 43(3), 99-103.

Brunet, M., Chaput, J. P., & Tremblay, A. (2007). The association between low physical fitness and high body mass index or waist circumference is increasing with age in children: the 'Québec en Forme' Project. *International Journal of Obesity*, 31, 637-643.

Cadenas-Sánchez, C., Artero, E.G., Concha, F., Leyton, B., & Kain, J. (2015). Anthropometric characteristics and physical fitness level in relation to body weight status in Chilean preschool children, *Nutrición Hospitalaria*, 32(1), 346-353.

Casajús, A. J., Leiva, T. M., Villaroya, A., Legaz, A., & Moreno, L.A. (2007). Physical performance and school physical education in overweight Spanish children. *Annals of Nutrition & Metabolism*, 51(3), 288-296.

Caspersen, C.J., Powell, K.E., & Christenson, G.M. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Reports*, 100(2), 126–131.

Ceschia, A., Giacomini, S., Santarossa, S., Rugo, M., Salvadego, D., Da Ponte, A., Driussi, C., Mihaleje, M, Poser, S., & Lazzer, S. (2016). Deleterious effects of obesity on physical fitness in pre-pubertal children. *European Journal of Sport Science*, 16(2), 271-278.

De Sousa, G., Hussein, A., Trowitzsch, E, Andler, W., Reinehr, T. (2009). Hemodynamic responses to exercise in obese children and adolescents before and after overweight reduction. *Klinische Pädiatrie*, 221(4), 237-240.

Đokić, Z., & Međedović, B. (2013). Povezanost prekomerne uhranjenosti i gojaznosti sa motoričkim sposobnostima dece od 9-12 godina (The correlation of excessive nutrition and obesity with the motor skills of children aged 9-12). *Fizička Kultura,* 67(2), 91-102. In Serbian

Đorđević, M., Kostić, R.,Pantelić, S., Uzunović, S., Milanović, Z., & Mitrović, B. (2016). Morpho-motoric status and level of nutrition in nine-year-old girls. *Facta Universitatis, Series: Physical Education and Sport,* 14(1), 1-11.

Đorđević, M., Pantelić, S., Uzunović, S., & Mitrović, B. (2016). The correlation between morphological characteristics and motor abilities in eight-year-old girls. In S. Pantelić (Ed.), XIXI Scientific Conference „FIS Communications 2016" in Physical Education, Sport and Recreation and 4rd International Scientific Conference (pp. 283-290). Niš: University of Niš, Faculty of Sport and Physical Education

Esmaeilzadeh, S., & Ebadollahzadeh, K. (2012). Physical fitness, physical activity and sedentary activities of 7 to 11 years old boys with different body mass indexes. *Asian Journal of Sports Medicine*, 3(2), 105-112.

Graf, C., Koch, B., Kretschmann-Kandel, E., Falkowski, G., Christ, H., Coburger, S., & Predel, H.G. (2004). Correlation between BMI, leisure habits and motor abilities in childhood. *International Journal of Obesity*, 28(1), 22-26.

Kopecký, M., Přidalová, M. (2008). The secular trend in the somatic development and motor performance of 7-15-year-old girls. *Journal of science and Medicine in Sport*, 12(3), 78-85.

Leskošek, B., Strel. J., & Kovač, M. (2007). Differences in physical fitness between normal-weight, overweight and obese children and adolescents. *Kinesiologia Slovenica*, 13(1), 21-30.

Maffeis, C., Zaffanello, M., & Schutz, Y. (1997). Relationship between physical inactivity and adiposity in prepubertal boys. *The Journal of Pediatrics*, 131, 288–292.

Marinov, B., Kostianev, S., Turnovska, T. (2002). Ventilatory efficiency and rate of perceived exertion in obese and non-obese children performing standardized exercise. *Clinical Physiology and Functional Imaging*, 22, 254-260.

Mota, J., Flores, L., Ribeiro, J.C., & Santos, M.P. (2006). Relationship of single measures of cardiorespiratory fitness and obesity in young schoolchildren. *American Journal of Human Biology*, 18(3), 335-341.

Ortega, F.B., Ruiz, J.R., Castillo, M.J., & Sjöström, M. (2008). Physical fitness in childhood and adolescence: a powerful marker of health. *International Journal of Obesity*, 32, 1-11.

Podstawski, R., & Boryslawski, K. (2012). Relationships between selected anthropometric features and motor abilities of children aged 7 - 9. *Clinical Kinesiology*, 66(4), 82-90.

Riddiford-Harland, D.L., Steele, J.R., & Baur, L.A. (2006). Upper and lower limb functionality: Are these compromised in obese children? *International Journal of Pediatric Obesity*, 1, 42-49.

Ruiz, J.R., Castro-Piñero, J., Artero, E.G., Ortega, F.B., Sjöström, M., Suni, J., & Castillo, M.J. (2009). Predictive validity of health-related fitness in youth: a systematic review. *British Journal of Sports Medicine,* 43, 909-923.

Runhaar, J., Collard, D. C. M., Singh, A.S., Kemper, H.C.G., van Mechelen, W., & Chinapaw, M. (2010). Motor fitness in Dutch youth: Differences over a 26-year period (1980-2006). *Journal of Science and Medicine in Sport*, 13(2), 323-328.

Siahkouhian, M., Mahmoodi, H., & Salehi, M. (2011). Relationship between fundamental movement skills and body mass index in 7-to-8-year-old children. *World Applied Sciences Journal*, 15(9), 1354-1360.

Smith, J.J., Eather, N., Morgan, P.J., Plotnikoff, R.C., Faigenbaum, A.D., & Lubans, D.R. (2014). The health benefits of muscular fitness for children and adolescents: a systematic review and meta-analysis. *Sports Medicine*, 44, 1209–1223.

Stratton, G., Canoy, D., Boddy, L.M., Taylor, S.R., Hackett, A.F., & Buchan, I.E. (2007). Cardiorespiratory fitness and body mass index of 9–11-year-old English children: a serial cross-sectional study from 1998 to 2004. *International Journal of Obesity*, 31, 1172–1178.

Suchomel, A. (2005). Somathic parameters of children with low and high levels of motor performance. *Kinesiology*, 37(2), 195-203.

Thivel D., Ring-Dimitriou, S., Weghuber, D., Frelut, M.L., & O'Malley, G. (2016). Muscle Strength and Fitness in Pediatric Obesity: a Systematic Review from the European Childhood Obesity Group. *Obesity Facts*, 9, 52–63.

Tokmakidis, S.P., Kasambalis, A., & Christodoulos, A.D. (2006). Fitness levels of Greek primary schoolchildren in relationship to overweight and obesity. *European Journal of Pediatrics*, 165(12), 867-874.

Tomkinson, G.R., Leger, L.A., Olds, T.S., & Cazorla, G. (2003). Secular trends in the performance of children and adolescents (1980–2000): an analysis of 55 studies of the 20m shuttle run test in 11 countries. *Sports Medicine*, 33, 285–300.

Weiner, J.S., & Lourie, J.A. (1969). *Human Biology*. Oxford and Edinburgh: Published for the International Biological Programme by Blackwell Scientific Publications.

ODNOS IZMEĐU PARAMETARA FIZIČKE SPREMNOSTI I MORFOLOŠKIH KARAKTERISTIKA GOJAZNIH SEDMOGODIŠNJAKA

Cilj ovog istraživanja bio je da se utvrde odnosi između parametara fizičke spremnosti i morfoloških karakteristika gojaznih sedmogodišnjaka. Uzorak ispitanika činilo je 103 gojazne dece (63 devojčica i 40 dečaka), učenika prvog razreda (prosečne starosti 7,04 godina) osnovnih škola u Nišu. Izmereni su sledeći parametri fizičke spremnosti: puls u opterećenju, VO2max (mL), puls u mirovanju, pregib napred - pregib unazad - izbačaj, taping rukom, 20m sprint iz mesta, Abalakov test i pretklon na klupici. Morfološke karakteristike određene su merenjem 13 parametara: uzdužnih i poprečnih dimenzija skeleta, mase i težine tela, potkožnog masnog tkiva. Za sve podatke izračunali smo srednje vrednosti i standardne devijacije (SD). Analiza kanoničke korelacije korišćena je za određivanje odnosa skupa varijabli koje predstavljaju parametre fizičke spremnosti i skupa varijabli morfoloških karakteristika. Na osnovu koeficijenata kanoničke korelacije, može se zaključiti da su prostori morfoloških karakteristika i parametara fizičke spremnosti međusobno povezani sa dva para statistički značajnih kanoničkih faktora (p<.05 i p<.01). Opšta analiza odnosa između prvog para kanoničkih faktora ukazuje da učesnici koji imaju veću dimenzionalnost tela, odnosno su izrazito gojaznoi i imaju povišene vrednosti telesne mase, obično postižu slabije rezultate kod motoričkih zadataka koji zahtevaju fleksibilnost tela, eksplozivnu snagu nogu i brzinu trčanja, a takođe postižu slabije rezultate za parametre kardiorespiratornog fitnesa. Može se zaključiti da gojaznost kod dece mlađeg školskog uzrasta ima negativan uticaj na parametre fizičke spremnosti kod dece, pa samim tim i na njihov opšti rast i razvoj.

Ključne reči: *gojaznost, deca, parametri fizičke spremnosti, fizička aktivnost, mlađi školski uzrast*