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Original scientific paper

PHYSICAL ACTIVITY, MOTOR SKILLS AND DIET IN OLDER SCHOOL-AGE CHILDREN BY GENDER

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Abstract: The aim of the study was to explore the physical status, motor skills, nutritional habits and physical activity of elementary school students in relation to their gender. The sample of respondents consisted of 75 5th to 8th grade students. According to the gender structure, the sample consisted of 46 boys and 29 girls whose average age was 13.2±1.2. For the assessment of their physical development, body height and weight were measured, based on which the students' body mass index (BMI) was calculated. To assess motor skills, a a battery of tests was implemented to monitor the physical abilities of the elementary school students during physical education classes. For the purpose of assessment of the level of physical activity the Physical Activity Questionnaire for Adolescents - PAQ-A was implemented, while the KIDMED Questionnaire was used to assess the students' diet. The overall prevalence of obesity among the students is 32% and in relation to the gender, it is higher in girls. Boys achieved better results in all motor skills, except flexibility. In relation to the observed segments of physical activity, boys are more active after school and at weekends. It was found that 41.3% of students have an optimal diet, 41.3% of them should

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improve their diet, while 17.3% have an unhealthy diet. No differences were perceived between male and female students in terms of diet.

Keywords: *students, motor skills, physical status, physical activity, diet*

INTRODUCTION

Diet and the amount of physical activity directly affect the health status of adults and children. Studies carried out in Serbia, which compared the differences in body composition between athletes and nonathletes, male and female adolescents, showed statistically significant differences between the groups, finding that the main reasons for this include a long-term lack of adequate physical activity, poorly balanced nutrition and gender differences (Stanimirov & Zvekic-Forcan, 2012; Drum et al., 2013; Simic et al., 2015) Also, overweight and obese children feature significantly lower motor skills in relation to normally nourished children, particularly in the domain of strength (Kostic et al., 2010; Djokic, Medjedovic, 2013). Greater bone density and lower amount of fat tissue are present in children who are actively involved in sports in relation to inactive children (Obradovic et al., 2009). These data suggest that the situation in our country is not significantly different than in other parts of the world, where economically more developed America and Europe lead in terms of obesity, but the rest of the world keeps scoring increased obesity percentages as well (Cole et al., 2000; Lobstein et al., 2004).

Serbia has two large social systems that make available controlled engagement in physical activity: the education system and the sports and recreation system. On the other hand, the health care system is there to take care of the health of the nation. The connection between these systems is supposed to improve the quality of life of every individual (Radojevic, 2004). According to the 2006 report of the Ministry of Health, 54.5% of Serbia's population falls into the category of "pre-obesity" or "obesity". The 2013 data indicated a mild rise to 55.3%, but the percentage of obese people went from 17.3% to 21.2%. The share of pre-obesity and obesity in children is similar to the one in adults (Ministry of Health of the Republic of Serbia, 2007; 2008; 2014).

In the past decade, the problem that has been frequently present in adults, and more and more often in children as well, is a group of bodily dysfunctions collectively called "metabolic syndrome". The risk factors of metabolic syndrome include high blood pressure, dyslipidemia (higher level of triglycerides and lower HDL levels), hyperglycemia, and central obesity (Alberta et al., 2009). The prevalence of metabolic syndrome is very high in children in the United States (Ford et al., 2002) and in Europe (Bokor et al., 2008), regardless of the criterion used.

Aerobic capacities, i.e. the capacity of the cardio-vascular system has long been seen as the primary factor that indicates the health of the individual. In the

past decade, science has made a small turn to muscle capacity (different types of strength) as an important (or the most important) factor that has a positive impact on numerous aspects of health (Smith et al., 2014). In accordance with that, a precisely determined amount of muscle mass may complete the picture about the health of an individual.

Taking into account Body Mass Index (BMI), studies unambiguously point to the connection between high BMI and reduced level of motor skills in children of different age (Graph et al., 2004; D'Hondt at al., 2009; Krneta et al., 2011; Djokic & Medjedovic, 2013). Keeping track of the physical status of children is very important for a timely prevention of obesity complications or early treatment (Lesović, 2010; Ostojic et al., 2011).

There is a significant relationship between obesity and lower limb deformities, and body mass significantly correlates with bad scoliotic posture (Purenović, 2007).

The positive effects of controlled physical activity and moderate diet on human body have been evident in the past decades. Modern way of life that involves numerous sedentary activities, along with bad diet, significantly deteriorates the health of the nation, especially its children and youth.

"There are numerous definitions, which differ more or less depending on the author, but everyone seems to agree on one thing – that motor skills represent complex human capabilities to manifest movement structures that bring together psychological characteristics, biochemical and functional processes." (Milanović & Radisavljević Janic, 2015).

Motor skills are dependent on the structure of the motor properties that change throughout life, or during organised exercise - training (Kukolj, 2006). Different classifications sum up motor characteristics in the following properties: strength, speed, endurance, flexibility, coordination, accuracy and balance (Milanović & Radisavljević Janic, 2015). In the manifestation of the motor skills in children, there is a significant difference between genders (Malacko et al., 2015). Thanks to increased body mass (muscle mass) and the volume of the forearm, boys score better in explosive strength, body coordination, repetitive strength and force, while girls scored better only in terms of flexibility. The overall conclusion is that on average, boys score 25% better results than girls (Sallis, 1993). Obese children and adolescents with better motor skills feature a healthier cardiovascular profile than their compared to their obese peers with weaker motor skills. Also, the same children (with better motor skills) show a similar profile to children with normal weigh and weaker motor skills. This speaks in favour of the fact that the development of motor skills in obese children can neutralize the negative consequences of excess body fat and have a positive impact on their health (Ortega et al., 2013).

There is irrefutable evidence that regular physical activity is efficient in primary and secondary prevention of a number of chronic diseases (cardiovascular diseases, diabetes, cancer, high blood pressure, obesity,

depression and osteoporosis) and early death (Warburton et al., 2006). Physical activity should be matched with nutritional needs, while monitoring the nutritional status of adolescents (Maksimović et al., 2009; Stanimirov & Zvekić-Forcan, 2012). Some of the variables that are directly related to the amount of physical activity among children and adolescents are: gender, age, competence for a particular activity (whether they know how to play a game or sport), the success they achieve in the activities, the physical status of parents, the availability of playgrounds, the time spent outside, interest in a particular activity (Sallis et al., 2000). Boys are 15 to 25% more active than girls. Throughout their school years, a continuous decline can be seen in the amount of physical activity: 2.7% per year for boys, and 7.4% per year for girls. These data suggest that older children face higher risk of obesity due to sedentary way of life (Sallis et al., 1993).

Healthy and nutritious diet positively impacts the growth and development of young people. It contains enough energy and all the necessary nutrients in accordance with nutritional needs, ensuring a balanced relationship between solid and liquid foods that are easy to digest, and providing the feeling of satiety and satisfaction after dining. A healthy diet helps prevent the occurrence of high cholesterol levels and high blood pressure, reduces the risk of developing chronic diseases, obesity, osteoporosis, lack of iron (Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010).

The aim of this study was to examine the physical status, motor skills, diet and physical activity of primary school students in relation to gender.

METHOD

The sample of respondents consisted of 75 students from 5th to 8th grade of elementary school "Svetozar Miletic" from Vrbas. According to the gender structure, the sample consisted of 46 (61.33%) boys and 29 (38.67%) girls, whose average age was 13.2 ± 1.2. The school has the conditions to conduct physical education classes in line with the Elementary School Curriculum, and all the students who participated in the sample in this study regularly attend physical education classes.

For the purpose of the research, the authors implemented measurement techniques for the evaluation of body growth, development and composition, which provided indicators of: body height, body weight and body composition (Body Mass Index).

Body height

Body height was measured by a stadiometer (Seca Instruments Ltd., Hambuurg, Germany) by Martin. During the measuring, the students were barefoot, wearing their PE clothes, standing in an upright position on a solid surface. Their task was to straighten their back as much as possible, put their feet together, with their head in the Frankfurt plane position. The examiner was

standing to the left of the subjects, making sure that the spine is aligned with the stadiometer scale, and then lowering a horizontal stopper until it touches the top of the respondent's head. The result was read from the scale at the level of the top of the triangular slit on the stopper, with an accuracy of 0.1 cm.

Body weight was measured by InBody Model 370 scale (Biospace Co. Ltd, Korea) with accuracy of 0.1 kg. The device was mounted on a solid horizontal surface and self-calibration was carried out. The students were barefoot, dressed in their PE clothes.

Body mass index - BMI

BMI was calculated based on the results of height and body weight (BMI-Body Mass Index), as the quotient of the weight and the height in meters squared (kg/m^2).

Classification of students according to their physical status

The criteria for the classification of students according to their physical status (optimum body weight, overweight and obese) involved the values proposed by the Work Group for Child Obesity, within the framework of the International Guidelines for Obesity Prevention. Borderline BMI values were derived from the data obtained on a large international sample, using regression techniques, and in relation to the borderline values for adults over 18 (Cole et al., 2000).

Students whose BMI values corresponded adult BMI values up to 25, were placed in the optimum body weight group. Adolescents with BMI values that match adult BMI values between 25 and 30, were placed in the excessive body weight group, while adolescents whose BMI corresponds adult BMI greater than 30 fell into the obese group (Cole et al., 2000).

Motor skills

Motor skills were assessed using a battery of tests for monitoring the physical abilities of elementary school students during physical education classes (Milanović & Radisavljević Janić, 2015).

KIDMED questionnaire (Serra-May et al., 2004), which contains 16 questions related to the students' diet was used in this research.

The research was conducted during the regular physical education classes in February 2016 with the permission of the teaching and school council. Prior to testing, the students were introduced to the aim and procedure of the testing. Measuring was conducted over the course of three weeks. In the first week, body height and weight were measured and the information about the students' physical activity level and dietary habits collected. In the second and third week, the students' motor skills testing was conducted.

During data processing, the basic descriptive statistical parameters were calculated using the t-test, chi square test and variance analysis. The data were

processed in the SPSS 19.0 statistical program.

RESULTS

Table 1 presents the basic descriptive parameters of body height, body weight and BMI (mean and standard deviation) in relation to the students' gender.

Table 1. *Basic descriptive indicators in relation to students' gender (M,SD)*

Variables	Girls N=(29)	Boys N=(46)	Total N=(75)
Height	161.00 (0.076)	163.91 (0.107)	162.79 (0.097)
Weight	54.56 (10.659)	55.54 (14.552)	55.16 (13.114)
BMI	20. 90 (2.998)	20.72 (4.373)	20.79 (3.878)

Legend: BMI- Body Mass Index

In order to examine potential differences in terms of body height, weight and BMI in relation to gender, univariant analysis was conducted for each of these values. Variance analyses pointed that gender does not play statistically significant role in these variables. Boys and girls did not show statistically significant differences in terms of body height ($F(1,75) = 1.613$; $p>.05$), weight ($F(1,75) = 0.097$; $p>.05$) and BMI ($F(1,75) = 0.609$; $p>.05$).

Table 2. *Obesity prevalence by gender*

Physical status	Girls N=(29)	Boys N=(29)	Total N=(75)
Optimum weight	18 (62.1%)	33 (71.7%)	51 (68.0%)
Overweight	11 (37.9%)	9 (19.6%)	20 (26.7%)
Obese	0 (0%)	4 (8.7%)	4 (5.3%)

To examine potential differences in the prevalence of the students' obesity by gender, the chi square test was conducted in order to compare whether the percentage of overweight and obese children varies depending on their gender. The overall prevalence of obesity in girls is higher than in boys. The percentage of overweight girls was higher than the percentage of overweight boys, while the percentage of obese boys was statistically significantly higher than that of girls ($\chi^2 2\ (2)= 45.680$; $p<.05$).

Table 3 shows the descriptive indicators of the results of all motor skills tests achieved by the students, as well as the results of the variance analysis, the direction of differences between boys and girls, and the effect size.

Table 3. *Descriptive indicators of results of motor skills tests conducted on girls and boys and relevance of gender differences*

Variables	N=29		N=46				
	M	SD	M	SD	F	p	pη2
Sit and reach (cm)	23.62	6.44	17.64	8.47	10.580	<	.127
Long jump (cm)	145.59	35.82	173.63	31.43	16.242	>	.182
Crunches (n)	21.93	4.23	25.07	4.55	8.903	>	.109
4 x 10m (s)	12.90	0.88	11.63	1.17	25.346	>	.258
Shuttle run (s)	196.69	57.14	278.59	121.25	11.566	>	.137

Legend: M – arithmetic mean; The SD standard deviation; ">"-statistically significantly better results achieved by boys; "<"-vice-versa; pη2- effect size

Gender proved to be an important factor in all the tests. The resulting differences are in favour of boys in all tests, except for the sit and reach test where the differences work in girls' favour. Based on the effect size, the differences were found to be significant.

Table 4 shows the percentage of students who failed to achieve acceptable results above the minimum fitness levels based on the proposed criteria reference standards (Milanović & Radisavljević Janic, 2015).

Table 4. *Percentage of students who failed to achieve acceptable results above minimum fitness levels*

Variables	Girls	Boys	Total
Sit and reach (cm)	20.7%	28.3%	25.3%
Long jump (cm)	17.2%	19.6%	18.7%
Crunches (n)	6.9%	13.0%	10.7%
4 x 10m (s)	10.3%	13.0%	12.0%
Shuttle run (s)	17.2%	23.9%	21.3%

Both in the entire sample and separately observed in terms of gender, most students failed to achieve acceptable results that exceed minimum fitness levels when performing sit and reach and shuttle run. According to these results, special attention should be dedicated to improving students' stamina and flexibility.

Table 5. *Level of physical activity obtained by applying Physical Activity Questionnaire for Adolescents (PAQ-A)*

Level of physical activity	Girls	Boys	Total
PAQ-A score	2.64	2.84	2.76
% "active students"	37.93%	36.96%	37.33%

Note: students with score < 3.00 are classified as "less active" and students with score > 3.00 are classified as "more active"

Table 6. *Level of physical activity in certain segments of overall physical activity and significance of differences observed between groups of students verified by t-test*

PAQ-A variables	Girls	Boys
Free time	3.40	3.50
Physical Education classes	4.41	4.35
Around lunch time	1.45	1.72
After school	2.24	2.89*
Evening hours	2.31	2.35
During the weekend	2.34	2.85*

*p<.05

Table 7. *Diet for total sample*

Diet	N	%
Optimal diet	31	41.3
Need to improve diet	31	41.3
Poor diet	13	17.3

The results of the chi square test indicate that there is no statistically significant difference in the students' diet based on their gender ($\chi^2(2)= .250$; $p>.05$).

DISCUSSION

The results of this study make it possible to draw certain conclusions. They show that girls and boys do not differ in terms of the assessed morphological characteristics, but they need to be monitored since early childhood in order to prevent obesity. When it comes to the relation of body weight to gender, the results obtained on a small sample of students in this research do not point out any differences perceived in the research (Ostojic et al., 2011). The overall prevalence of student obesity in this study obtained from a small sample of 32% (26.7% overweight and 5.3% obese children) is higher than the total prevalence of obesity obtained from a representative sample of 3rd to 8th grade students from the Republic of Serbia (Milanović & Radisavljević Janic, 2015) that amounts to 24.8% (19,8% overweight and 5,0% obese children). This may leave the impression that the distribution in this group of students is better than if it had more obese students, however this information must not be ignored because this category of students has potentially great chances of becoming obese. The overall prevalence of obesity in terms of gender in this study is higher for girls than for boys, while on the representative sample of Serbia it is higher for boys (Milanovic & Janic Radisavljevic, 2015). Overweight girls in this research belong to the category of students which require finding adequate and affordable solutions for their involvement in additional exercising programs both in school and during their free time. The overall prevalence of obesity in girls amounted to 37.9% and while in boys it was 28.3%. When it comes to motor skills, the obtained results

are consistent with the current knowledge and research according to which boys do better in all motor skills, except flexibility where girls are more dominant at all ages (Malina & Bouchard, 2004; Malacko et al., 2015). The obtained results, which are related to the students' physical activity, indicate that there is no difference between boys and girls in the level of physical activity, observed through the active score, as well as in relation to the observed groups of "active" and "less active". In relation to this result, most research suggests that in the self-assessment of the levels of their own exercise, boys achieve higher scores than girls, i.e. that they are physically more active (Kowalski et al., 1997; Radisavljevic Janic, 2010; Radisavljevic Janic et al., 2012). The absence of gender differences in the level of physical activity in this research can be partly explained by the disproportion of the number of boys and girls in the sample. The perceived greater activity of boys than girls, after school and during weekends, makes room to encourage female students to engage in physical exercise in these times of the week, which are significant for the accumulation of overall physical activity. The level of physical engagement in certain segments of the overall physical activity, regardless of the perceived gender differences in favour of boys, was the highest during physical education classes. This result indicates that physical education has the potential to make a significant contribution to youth participation in regular physical activity as well as the potential improvement of physical exercise of students out of school (Sallis & McKenzie, 1991). The obtained results about the students' diet are satisfactory in comparison with the results of high school students (Inic et al., 2016) which show that there is a significantly smaller percentage of students with a satisfactory diet and a higher percentage of students whose diet is not adequate. The more adequate diet of elementary school students in comparison to high school students can be explained by the influence of family to nutrition, which is still strong at elementary school level. Research that would involve a larger sample of students of primary and secondary education could provide a more precise and clearer insight into students' diet and arguments in favour of compulsory education about healthy diet in school. Bad diet featured among 17.3% of the students covered by this research is also a fact that requires taking educational measures in order to reduce this percentage as soon as in primary school age. There were no differences in diet by gender at elementary school age, which is in line with the results of dietary habits of high school students (Inic et al., 2016). Adopted dietary habits obviously do not depend significantly on the students' gender, but it can be assumed that other factors in the environment have a more significant impact.

CONCLUSION

The overall prevalence of obesity of students in this study amounts to 32% and it is higher in girls than in boys, amounting to 37.9%. The obtained results about the students' diet are satisfactory and there are those that indicate a significantly smaller percentage of students whose diet is at a satisfactory level. The obtained results in relation to the students' physical activity indicate that there is no difference in the level of physical activity. Future research, focused on

physical status, motor skills, physical activity and diet of students at elementary school age, should cover a larger sample, thus ensuring the assessment of their potential interrelation.

REFERENCES

1. Alberti, M., Eckel, R.H., Grundy, S.M., Zimmet, Z. (2009). Harmonizing the metabolic syndrome a joint interim statement of the international diabetes federation task force on epidemiology and prevention; national heart, lung, and blood institute; American heart association; world heart federation; international atherosclerosis society; and international association for the study of obesity. Circulation. 120(16), 1640-1645
2. Bokor, S., Frelut, M., Vania, A., Hadjiathanasiou, C.G., Anastasakou, M., Malecka-Tendera, E., Matusik, P., Molnar, D. (2008). Prevalence of metabolic syndrome in European obese children. International journal of pediatric obesity. 3, Suppl 2: 3-8.
3. Bubanj, S., Zivković, M., StankoviC, R., ObradoviC, B., PurenoviC-Ivanovic, T., Dosic, A. (2013). Body composition in a high school population of athletes and non-athletes. Facta Universitatis. 11(3):197-208.
4. Cole, T. J., Bellizzi, M.C. Flegal, K.M., Dietz, W.H. (2000). Establishing a standard definition for child overweight and obesity worldwide: International survey. British Medical Journal. 320(7244): 1240–3.
5. D'Hondt, E., Deforche, B., De Bourdeaudhuij, I., Lenoir M. (2009). Relationship between motor skill and body mass index in 5- to 10-year-old children. Adapted Physical Activity Quarterly. 26(1): 21-37.
6. Dietary Guidelines Advisory Committee. Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010, to the Secretary of Agriculture and the Secretary of Health and Human Services. Washington, DC: U.S. Department of Agriculture; 2010.
7. Diethelm, K., Huybrechts, I., Moreno, L., De Henauw, S., Manios, Y., Beghin, L., González-Gross, M., Le Donne, C., Cuenca-García, M., Castillo, M.J., Widhalm, K., Patterson, E., Kersting, M. (2014). Nutrient intake of European adolescents: results of the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study. Public health nutrition. 17(03): 486-497.
8. Dokic, Z., Mededovic, B. (2013): Povezanost prekomerne uhranjenosti i gojaznosti sa motoričkim sposobnostima dece od 9-12 godina. Fizička kultura. 67(2): 91-102.
9. Ford, E. S., Giles, W. H., Dietz, W. H. (2002). Prevalence of the metabolic syndrome among US adults: findings from the third National Health and Nutrition Examination Survey. The Journal of the American Medical Association. 287(3), 356-359.
10. Graf, C., Koch, B., Kretschmann-Kandel, E., Falkowski, G., Christ, H., Coburger, S., Lehmacher, W., Bjarnason-Wehrens, B., Platen, P., Tokarski,

W., Predel, H.G., Dordel, S. (2004). Correlation between BMI, leisure habits and motor abilities in childhood (CHILT-Project). International Journal of Obesity. 28 (1): 22–26.

11. Inic, L., Vukicevic, V., & Milickovic, V. (2016). Physical activity and examination of middle school students. Glasnik Antropološkog društva Srbije, (52), 95-104.
12. Janssen, I., LeBlanc, A. G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. International journal of behavioral nutrition and physical activity. 7(1): 7-40.
13. Kowalski, K.C., Crocker, P.R.E., Kowalski, N.P. (1997): Convergent Validity of the Physical Activity Questionnaire for Adolescents. Pediatric Exercise Science. 342-352.
14. Krneta, Z., Keric, M., Pelemis, M. (2011). Analiza motoričkog statusa mlađih adolescenata oba pola u odnosu na vrednosti Indeksa telesne mase. Sport i zdravlje. 6(1): 80-85.
15. Kukolj, M. (2006). Antropomotorika. Fakultet sporta i fizičkog vaspitanja. Beograd.
16. Lesović, S. (2010). Metabolički sindrom kod učesnika programa Čigotica. Medicinski glasnik.15(33): 20-35.
17. Lobstein, T., Baur, L., Uauy, R. (2004). Obesity in children and young people: a crisis in public health. Obesity reviews. 5(s1), 4-85.
18. Maksimovic, M., Ristic, G., Maksimovic, J., Backovic, D., Vukovic, S., Ilic, T., Malacko, J., Stankovic, V., Doder, D., Pejcic, A. (2015). Polne razlike u morfološkim karakteristikama i motoričkim sposobnostima dece starosti 7-11 godina. Facta universitatis - series: Physical Education and Sport, 13(1): 115-125.
19. Malina, R., and Bouchart, C. (2004). Growth, Maturation and Physical Activity. Human Kinetics, Champaign, IL.
20. Milanović, I. Radisavljević Janic, S. (2015). Praćenje fizičkih sposobnosti učenika osnovne škole u nastavi fizičkog vaspitanja. Fakultet sporta i fizičkog vaspitanja, Beograd. 66-68.
21. Ministarstvo zdravlja Republike Srbije. (2007). Istraživanje zdravlja stanovnika Republike Srbije, 2006. godina. Institut za javno zdravlje „Dr Milan Jovanović Batut“, finalni izveštaj. Beograd.
22. Ministarstvo zdravlja Republike Srbije. (2008). Zdravlje stanovnika Srbije - analitička studija 1997-2007. Institut za javno zdravlje „Dr Milan Jovanović Batut“, finalni izveštaj. Beograd.
23. Ministarstvo zdravlja Republike Srbije. (2014). Rezultati istraživanja zdravlja stanovništva Srbije, 2013. godina. Institut za javno zdravlje „Dr Milan Jovanović Batut“, finalni izveštaj. Beograd

24. Mitić, D. (2011). Značaj fizičke aktivnosti u prevenciji i terapiji gojaznosti u detinjstvu i adolescenciji. Medicinski glasnik. Specijalna bolnica za bolesti štitaste žlezde i bolesti metabolizma, Zlatibor. 16 (39): 107-112.
25. Obradovic, B., Madic, D., Milosevic, Z., Maksimovic, N., Mikalacki, M., Kovacev-Zavisic, B. (2009): Uticaj različitih kineziološkihtretmana na telesnu kompoziciju i mineralni koštani sadržaj dečaka prepubertetskog uzrasta. Medicinski pregled. 62(1-2): 23-26.
26. Ortega, F. B., Ruiz, J. R., Castillo, M. J. (2013). Physical activity, physical fitness, and overweight in children and adolescents: evidence from epidemiologic studies. Endocrinología y Nutrición (English Edition). 60(8): 458-469.
27. Ostojic, S. M., Stojanovic, M. D., Stojanovic,V., Maric, J., Naradi, N. (2011). Correlation between fitness and fatness in 6-14-year old Serbian school children. Journal of Health, Population and Nutrition. 29(1): 53-60.
28. Petrovic-Oggiano, G., Damjanov, V., Gurinovic, M., Glibetic, M. (2010). Physical activity in prevention and reduction of cardiovascular risk. Medicinski pregled. 63(3-4): 200-207.
29. Purenovic, T. (2007). Pregled domaćih i inostranih istraživanja iz oblasti posturalnih poremećaja-period od 2000. do 2007. godine. Facta universitatis - series: Physical Education and Sport. 5(2): 39-152.
30. Radisavljevic, D., Ulic, D., i Arunovic, D. (1997). Senzitivni period razvojamotoričkih sposobnosti dece mlađeg školskog uzrasta. Fizička kultura, 60(2), 34–37.
31. Radisavljevic, M. (2001). Korektivna gimnastika sa osnovama kineziterapije Beograd: Fakultet fizičke kulture.
32. Radojevic, J. (2004). Fizička aktivnost i zdravlje iz drugog ugla. Godišnjak Fakulteta sporta i fizičkog vaspitanja. 12(1): 17-28.Sallis, J., McKenzie, T. (1991). Physical education's role in public health. Research Quarterly for Exercise and Sport, 62, 124-137.
33. Sallis, J. F., Prochaska, J. J., Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. Medicine and science in sports and exercise. 32(5): 963-975.
34. Sallis, J. F., Buono, M. J., Roby, J. J., Micale, F. G., & Nelson, J. A. (1993). Seven-day recall and other physical activity self-reports in children and adolescents. Medicine and science in sports and exercise, 25(1), 99-108.
35. Serra-Majem, L., Ribas, L., Ngo, J., Ortega, R. M., García, A., Pérez-Rodrigo, C., & Aranceta, J. (2004). Food, youth and the Mediterranean diet in Spain. Development of KIDMED, Mediterranean Diet Quality Index in children and adolescents. Public health nutrition, 7(07), 931-935.
36. Simić, M., Vuković, J., Marković, S., Vukadinović, M. (2015). Morphological characteristics and motor abilities of physically active and inactive female high-school students. SportLogia. 11(1): 34-42.

37. 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(9): 1209-1223.
38. Stanimirov, B., Zvekić-Forcan, J. (2012). Pozitivan uticaj sporta na prevenciju gojaznosti kod adolescenata. Zdravstvena zaštita. 41(2): 28-32.
39. Strong, W. B., Malina, R. M., Blimkie, C. J., Daniels, S. R., Dishman, R. K., Gutin, B., Hergenroeder, A.C., Must, A., Nixon, P.A., Pivarnik, J.M., Rowland, T., Trost, S., Trudeau, F. (2005). Evidence based physical activity for school-age youth. The Journal of pediatrics. 146(6): 732-737
40. Warburton, D. E., Nicol, C. W., Bredin, S. S. (2006). Health benefits of physical activity: the evidence. Canadian medical association journal. 174(6): 801-809.