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Short notice
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Prevalence of Obesity in Younger School-Age Students

Prevalencija gojaznosti učenika mlađeg školskog uzrasta

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Summary: *The primary goal of this research is to objectively determine the actual state of nutrition in younger school-aged students, of both sexes, from four primary schools in the Odžaci municipality of the Republic of Serbia. The sample of respondents consisted of younger school age students from four primary schools from the area of the Odžaci municipality (R. Serbia). The total sample of respondents consisted of 93 students of both sexes, of which 42 were boys and 51 were girls. For research needs, basic anthropometric measurements, body height and body weight were applied, and the body mass index (BMI) was calculated based on the aforementioned. The BMI was used for the purpose of assessing the nutrition of respondents - students in individual groups.*

All collected data was processed using descriptive and comparative statistics. The arithmetic mean, standard deviation, maximum and minimum measurement values were calculated from the descriptive statistics area, while the t test of independent samples was used from the comparative statistics area.

The research results show that the prevalence of obesity among younger school age students is 19.4%, while another 16.1% of students are at risk of obesity. Boys and girls did not differ significantly in BMI. Respondents - older students on average have higher BMI values than younger students, but obesity was not found to be more prevalent in any of the examined age groups.

The obtained results enable the design of strategies for further research on younger school age children, for the purpose of monitoring growth and development, as well as the possibility of determining certain standards of psychophysical preparedness of children for going to school, successful school attendance and inclusion in various physical activity programs.

Keywords: *antopometric measurements, obesity, younger school age, gender, age.*

Sažetak: *Osnovni cilj ovog istraživanja jeste da se transverzalnim presjekom na objektivan način utvrdi stvarno stanje uhranjenosti učenika mlađeg školskog uzrasta oba pola iz četiri osnovne škole sa prostora opštine Odžaci u Republici Srbiji. Uzorak ispitanika činili su učenici mlažeg školskog doba iz četiri osnovne škole sa prostora opštine Odžaci (R. Srbija). Ukupan uzorak ispitanika činilo je 93 učenika oba pola, od čega je 42 dečaka i 51 devojčica. Za potrebe istraživanja primenjene su osnovne antropometrijske mere, telesna visina i telesna težina a na osnovu njih izračunat je Indeks telesne mase (ITM). Indeks telesne mase korišten je u svrhu procenjivanja uhranjenosti ispitanika – učenika pojedinim grupama.*

Svi prikupljeni podaci obrađeni su postupcima deskriptivne i komparativne statistike. Iz prostora deskriptivne statistike izračunata je aritmetička sredina, standardna devijacija, maksimalne i minimalne vrednosti merenja, dok je iz prostora komparativne statistike korišćen t test nezavisnih uzoraka.

Rezultati istraživanja pokazuju da prevalenca gojaznosti kod učenika mlađeg školskog uzrasta iznosi 19,4%, a da rizik od gojaznosti ima još 16,1% učenika. Dečaci i devojčice se nisu značajno razlikovali u indeksu telesne mase. Ispitanici - učenici starije uzrasne dobi u proseku imaju veće vrednosti indekas telesne mase od učenika mlađe uzrasne dobi, ali se gojaznost nije ustanovila kao zastupljenija u nekoj od ispitivanih uzrasnih grupa.

Dobiveni rezultati omogućuju osmišljavanje strategija u daljnjim istraživanjima dece mlađeg školskog uzrasta, u svrhu praćenja rasta i razvoja kao i mogućnost utvrđivanja određenih standarda psihofizičke pripremljenosti dece za odlazak u školu, uspješno pohađanje škole i uključivanje u različite programe fizičkih aktivnosti.

Ključne reči*: antopometrijske mere, gojaznost, mlađi školski uzrast, pol, starosna dob.*

Introduction

We are a witness to the constant growth in childhood obesity which has reached epidemic proportions (Delaš

Uvod

Svedoci smo kako je dečja gojaznost u stalnom porastu i poprima epidemijske razmere (Delaš i sar.,

et al., 2008). The majority of authors believe that it is the result of excessive food intake, a sedentary lifestyle and psychological factors, that is, unhealthy lifestyle habits that are a consequence of the modern lifestyle (Delmas et all, 2007, Basaldua & Chiquete, 2008).

Obesity in children is classified as primary and secondary obesity. Primary (idiopathic, exogenous, nutritional obesity) is the most common cause of obesity in childhood and adolescence. Less than 5% of the causes of childhood obesity is secondary obesity, associated with genetic factors, endocrine disorders, and lesions of the central nervous system (Greenberg & Obin, 2006).

It can be said that the prevalence of obesity among children in Serbia is in line with the data obtained in foreign research, which states that around 20-25% of children are actually obese or suffer from excessive nutrition (Lobstein & Frelut, 2003; Milanović and Radisavljević Janjić, 2015). It is estimated that there are around 150 million obese children in the world today (Wang & Lobstein, 2006). However, what is even more worrying is that this trend is constantly increasing (Shields, 2009).

Critical periods for the development of obesity have been identified in different school ages according to gender, so that in the lower grades of primary school, students are more vulnerable compared to the population of female students, while female students are more vulnerable in higher grades of primary school (Đokić, Međedović and Smiljanić, 2011).

Regular physical activity is of great importance for the proper growth and development of children (Strong et al. 2005), which clearly mitigates many of the health risks associated with being overweight or obese (Blair & Brodney, 1999).

At a younger age, regular physical activity of a directed, systematically guided or unstructured nature, has a positive effect on the child's physical development during the later period of life (Malina & Bouchard, 1991). Moreover, regular physical activity at an early age has a direct and indirect positive effect on health status in adulthood (Twisk, Kemper & VanMenchelen, 2000).

Today, there are ever more sports schools on the global level, which aim to engage children from the earliest age in order to prevent obesity and the occurrence of physical deformities, influence the proper growth and development of children, as well as their sports and technical achievements (Stević et al., 2018).

It is at this age that many children begin to develop a love for a particular sport and begin to train, considering that there are children who belong to the group of children with excessive body weight and obesity.

2008). Većina autora smatra kako je to rezultat prekomernog unosa hrane, sedentarnog načina života i psiholoških faktora, dakle ne zdravih životnih navika koje su posledica savremenog načina života (Delmas et all, 2007., Basaldua & Chiquete, 2008).

Gojaznost kod dece se klasifikuje kao primarna i sekundarna gojaznost. Primarna (idiopatska, egzogena, nutritivna gojaznost) je najčešći uzrok gojaznosti u detinjstvu i adolescenciji. Manje od 5% uzroka gojaznosti u detinjstvu je sekundarna gojaznost, povezana sa genetskim faktorom, endokrinim poremećajima kao i lezijama centralnog nervnog sistema (Greenberg & Obin, 2006).

Može se reći da je prevelanca gojaznosti kod dece u Srbiji u skladu i sa podacima koji se dobijaju u inostranim istraživanjima, u kojima se govori o tome da je oko 20-25% dece zapravo gojazno ili pati od prekomerne uhranjenosti (Lobstein & Frelut, 2003; Milanović i Radisavljević Janjić, 2015). Procenjuje se da danas u svetu ima oko 150 miliona gojazne dece (Wang & Lobstein, 2006). Međutim, ono što je još više zabrinjavajuće jeste da je taj trend konstantno u porastu (Shields, 2009).

Kritični periodi za razvoj gojaznosti su identifikovani u različitom školskom uzrastu prema polu, tako da su u nižim razredima osnovne škole ugroženiji učenici u odnosu na populaciju učenica, dok su učenice ugrožene u višim razredima osnovne škole (Đokić, Međedović i Smiljanić, 2011).

Redovna fizička aktivnost je od velikog značaja za pravilan rast i razvoj dece (Strong et al. 2005), jasno ublažava mnoge zdravstvene rizike povezane sa prekomernom težinom ili gojaznošću (Blair & Brodney, 1999).

Redovna fizička aktivnost, usmerenog, sistematski vođenog ili nestrukturiranog karaktera, u mlađem životnom dobu, pozitivno se odražava na fizički razvoj deteta u kasnijem periodu njegovog života (Malina & Bouchard, 1991). Štaviše, redovna fizička aktivnost u ranom dobu ima direktan i indirektan pozitivan uticaj na zdravstveni status u odraslom dobu (Twisk, Kemper & VanMenchelen, 2000).

Danas su u svetu sve više zastupljene školice sporta, koje imaju za cilj angažovanje dece od najranijeg uzrasta, kako bi se preventivno delovalo na gojaznost i nastanak telesnih deformiteta, uticalo na pravilan rast i razvoj dece kao i na sportsko-tehnička postignuća (Stević i sar., 2018).

Dosta dece u ovom uzrastu počinje da razvija ljubav prema određenom sportu i počinju da treniraju s

Bearing in mind the importance of sports school for the proper growth and development of preschool and younger school age children, the Sports Association of the Odžaci municipality in Serbia launched a project for the establishment and operation of a sports school for younger school age students (Board of Education Decision No. 1-1309/2016 of September 13, 2016), which was financed by the local community. The mission behind the establishment of the sports school was to improve the physical growth and development of children and to improve the overall anthropological status of children. Special attention at the sports school is dedicated to the prevention and correction of body deformities, obesity and improving the general health of children.

Research Method

Sample of respondents

The total sample of respondents consisted of 93 respondents of both sexes - students of lower grades from the following primary schools: Public Institution Bora Stanković Primary School in Karavukovo, Public Institution Ratko Pavlović Ćićko Primary School in Ratkovo, Public Institution Vuk Karadžić Primary School in Deronje, and Public Institution Nestor Žučni Primary School in Lalić.

Structure of respondents:

According to gender: 42 boys (45.2%) and 51 girls (54.8%).

According to the place of primary school attendance: Primary School Karavukovo: 16 students (M=9; F=7), 41 students (44%) Primary School Ratkovo: 41 students (M=12; F=29), Primary School Deronje: 20 students (M=9; F=11) and Primary School Lalić 16 students (M=11; F=5).

According to grades: I grade=30 students (M=13; F=17), II grade=14 (M=4; F=10), III grade=26 (M=10, F=16), IV grade=23 (M=14; F=9).

Consent for conducting the research was obtained from the parents of the tested children. The research was conducted during the month of October of the 2016/2017 school year, at the beginning of the implementation of the sports school program.

Sample variables

Children who underwent testing had their body height (ATEVIS) and body mass (ATEMAS) measured. We used a *Seca 217* medical altimeter to measure body height, while an *Omron BF 511* digital scale was used to measure body mass.

Body Mass Index (BMI) is a height-weight indicator of an individual's nutrition and is a valid measure of

obzirom da ima dece koja pripadaju grupi dece sa prekomernom telesnom masom i gojaznošću.

Imajući u vidu značaj školice sporta za pravilan rast i razvoj dece predškolskog i mlađeg školskog uzrasta Sportski savez opštine Odžaci u Srbiji pokrenuo je Projekat za osnivanje i rad školice sporta za učenike mlađeg školskog uzrasta (Odluka UO broj 1-1309/2016 od 13.09.2016. godine) koji je finansiran sredstvima lokalne zajednice. Misija osnivanja školice sporta je unapređenje telesnog rasta i razvoja dece i poboljšanje celokupnog antropološkog statusa dece. Posebna pažnja rada školice sporta usmerena je na prevenciju i korekciju telesnih deformacija, gojaznosti i poboljšanje opšteg zdravlja dece.

Metod istraživanja

Uzorak ispitanika

Ukupan uzorak ispitanika činilo je 93 ispitanika oba pola – učenika nižih razreda iz sljedećih osnovnih škola: JUOŠ „Bora Stanković" u Karavukovu, JUOŠ „Ratko Pavlović Ćićko" u Ratkovu, JUOŠ „Vuk Karadžić" u Deronjama i JUOŠ „Nestor Žučni" u Laliću.

Struktura ispitanika:

Prema polu: 42 dečaka (45,2%) i 51 devojčica (54,8%).

Prema mestu pohađanja osnovne škole: JUOŠ Karavukovo: 16 učenika (M=9; Ž=7), 41 učenik (44%) JUOŠ Ratkovo: 41 učenik (M=12; Ž=29), JUOŠ Deronje: 20 učenika (M=9; Ž=11) i JUOŠ Lalići 16 učenika (M=11; Ž=5).

Prema razredima: I razred=30 učenika (M=13; Ž=17), II razred=14 (M=4; Ž=10), III razred=26 (M=10, Ž=16), IV razred=23 (M=14; Ž=9).

Saglasnost za sprovođenje istraživanja je dobijena od starne roditelja ispitivane dece. Istraživanje je sprovedeno u mesecu oktobru školske 2016/2017 godine na početku realizacije programa školice sporta.

Uzorak varijabli

Deci koja su podvrgnuta testiranju merene su telesna visina (ATEVIS) i telesna masa (ATEMAS). Za merenje telesne visine koristili smo medicinski visinomer *Seca 217*, dok je za merenje telesne mase korišćena digitalna vaga *Omron BF 511*.

Indeks telesne mase ITM (eng. Body Mass Index: BMI) predstavlja visinsko-težinski pokazatelj uhranjenosti pojedinca i validna je mera gojaznosti kako kod odraslih, tako i kod dece. Izračunava se kada težinu tela u kilogramima podelimo sa kvadratom visine u metrima

obesity in both adults and children. It is calculated when an individual's body weight in kilograms is divided by the square of their height in meters: BMI=BM [kg]/TV^2 [m^2] (Ostojić and Đorđić, 2013:133).

The choice of BMI to measure the level of obesity among children is supported by the International Obesity Task Force.

According to the criteria of the Centers for Disease Control and Prevention (CDC), 2000, BMI can be categorized into four broad groups: undernourished (below the 5th percentile), normal nutrition (from the 5th to the 84th percentile), obesity risk (from the 85th to the 94th percentile) and obesity (above the 95th percentile). This distribution of nutrition in relation to BMI in children of early primary school age was also used in this research.

Data processing methods

All collected data was processed using descriptive and comparative statistics. From the space of descriptive statistics, the arithmetic mean (MEAN), standard deviation (St. Dev.), the maximum value of the measurement (Max), and the minimum value of the measurement (Min), was calculated in order to gain insight into the distribution of variables and the frequency of representation of obese younger school age children.

From the area of comparative statistics, the t test of independent samples and one-factor analysis of variance were used to determine the differences in BMI between the two groups of respondents (boys and girls) with regard to gender and age. Determination of differences was performed at the level of statistical significance Sig<0.05.

The SPSS for Windows 20.0 application statistics program for personal computers was used for all calculations.

Results and Discussion

The younger school age period (7 to 11 years) represents the first phase of slowed growth. It has been proven that the increase in body height is relatively slow, and the annual increase in height is relatively uniform until the end of this period. Growth in height is accompanied by a corresponding increase in body mass. During this period, children grow approximately five centimeters per year, gaining an average of two to three kilograms in body weight (Medved, 1987).

Table 1 shows the basic statistical parameters for all applied anthropometric measures of respondents-younger school age students, shown by sub-samples with regard to age and grade. Looking at the obtained results (Table 1), it can be seen that the average height of ten-year-old students (IV grade) is 144.73+/-6.48 cm, body

pojedinca: ITM=TM [kg]/TV^2 [m^2] (Ostojić i Đorđić, 2013:133).

Izbor ITM za merenje nivoa gojaznosti među decom podržava Međunarodna radna grupa za gojaznost (International Obesity Task Force).

Prema kriterijumima Centra za kontrolu bolesti i prevenciju (Centers for Disease Control and Prevention, 2000), indeks telesne mase se može kategorizovati u četiri široke grupe: neuhranjensot (ispod 5. percentila), normalna uhranjenost (od 5 do 84. percentila), rizik od gojaznosti (od 85 do 94. percentila) i gojaznost (iznad 95. percentila). Ovakva raspodela uhranjenosti u odnosu na indeks telesne mase kod dece ranog osnovnoškolskog uzrasta je korišćena i u ovom istraživanju.

Metode obrade podataka

Svi prikupljeni podaci obrađeni su postupcima deskriptivne i komparativne statistike. Iz prostora deskriptivne statistike izračunata je i utvrđena aritmetička sredina (MEAN), standardna devijacija (St. Dev.), maksimalna vrednost merenja (Max) i minimalna vrednost merenja (Min), kako bi se stekao uvid u distribuciju varijabli i frekvenciju zastupljenosti gojazne dece mlađeškolskog uzrasta.

Iz prostora komparativne statistike korišćen t test nezavisnih uzoraka i jednofaktorska analiza varijanse, kako bi se utvrdile razlike u indeksu telesne mase između dve grupe ispitanika (učenika i učenica) s obzirom na pol i uzrasnu dob. Utvrđivanje razlika izvršeno je na nivou statističke značajnosti Sig<0,05.

Za sva izračunavanja koristio se aplikacioni statistički program za personalne računare SPSS for Windows 20.0.

Rezultati i diskusija

Period mlađeg školskog uzrasta (7 do 11 godina), predstavlja prvu fazu usporenog rasta. Dokazano je da je porast visine tela relativno usporen, a godišnji priraštaj visine relativno ujednačen do pred kraj ovog perioda. Priraštaj u visinu praćen je odgovarajućim priraštajem u masi tela. U ovom periodu deca okvirno, godišnje porastu oko pet cantimetara, u masi tela dobijaju prosečno dva do tri kilograma (Medved, 1987).

U tabeli 1 prikazani su osnovni statistički parametri za sve primenjene antropometrijske mere ispitanika-učenika mlađeg školskog uzrasta prikazanih po subuzorcima s obzirom na uzrasnu dob i razred koji pohađaju. Uvidom u dobivene rezultate (tabela 1) može se videti da je prosečna vrednost telesne visine učenika desetogodišnjaka (IV razred) 144,73+/-6,48 cm, telesne težine 42,81+/-

weight is 42.81+/-14.88 kg, and BMI is 20.17+/-5.89 kg/m2. The average height of nine-year-old students (III grade) is 137.76+/-5.30 cm, body weight 34.15+/-7.95 kg, and BMI 17.86+/-3.11 kg/m2. The average height of eight-year-old students (II grade) is 136.07+/-4.92 cm, body weight 34.06+/-6.45 kg, and BMI 18.28+/-3.01 kg/m2. The average height of seven-year-old students (I grade) is 128.93+/-5.03 cm, body weight 28.10+/-4.04 kg, and BMI 16.88+/-2.16 kg/m2. Observing the sample of respondents in total, it is visible that the average value of body height is 136.38+/-8.07 cm, body weight 34.40+/-10.60 kg, and BMI 18.19+/-3.92 kg/m2.

Based on the results presented in Table 1, an increase in the average values of body height (ATEVIS), weight (ATETEŽ) and standard deviation (St.dev.) of the respondents is visible with the age of the respondents. The values of standard deviation (St. Dev.) show that the value of the measured parameters is the smallest in the seven-year-old respondents and the largest in the ten-year-old respondents, which is not surprising given that it is during this period that children enter a new phase of development.

Table 1. *Basic statistical parameters for anthropometric measurements of subjects according to age (grade)*

Age-grade / **Uzrasna dob-razred**		***Min***	***Max***	***MEAN***	***St. Dev.***
10 years (IV grade) / 10 god. (IV raz.)	ATEVIS	128	154	144.73	6.48
	ARETEŽ	22.6	92.9	42.81	14.88
	BMI	13.20	40.74	20.17	5.89
9 years (III grade) / 9 god. (III raz)	ATEVIS	129	152	137.76	5.30
	ATETEŽ	23.7	56.1	34.15	7.95
	BMI	13.90	24.28	17.86	3.11
8 years (II grade) / 8 god. (II raz.)	ATEVIS	128	143	136.07	4.92
	ATETEŽ	24.5	45.9	34.06	6.45
	BMI	14.30	22.60	18.28	3.01
7 years (I grade) / 7 god. (I raz.)	ATEVIS	120	140	128.93	5.03
	ATETEŽ	20.20	37.70	28.10	4.04
	BMI	13.40	21.60	16.88	2.16
Total / Ukupno	ATEVIS	120	154	136.38	8.07
	ATETEŽ	20.20	92.90	34.40	10.60
	BMI	13.20	40.74	18.19	3.92

In children, the BMI value is compared with centile curves. A BMI between the 90-97th centile indicates overweight, and a BMI above the 97th centile is considered obesity. The value of BMI is recommended as an objective diagnostic criterion of obesity in children and adolescents. The WHO Child Growth Standards (WHO) recommends the z-value of the BMI for

14,88 kg, a indeks telesne mase 20,17+/-5,89 kg/m2. Prosečna vrednost telesne visine učenika devetogodišnjaka (III razred) iznosi 137,76+/-5,30 cm, telesne težine 34,15+/-7,95 kg, a indeks telesne mase 17,86+/-3,11 kg/m2. Prosečna vrednost telesne visine učenika osmogodišnjaka (II razred) iznosi 136,07+/-4,92 cm, telesne težine 34,06+/-6,45 kg, a indeks telesne mase 18,28+/-3,01 kg/m2. Kod učenika uzrasne dobi od sedam godina (I razred) prosečna vrednost telesne visine iznosi 128,93+/-5,03 cm, telesne težine 28,10+/-4,04 kg, a indeks telesne mase 16,88+/-2,16 kg/m2. Posmatrajući uzorak ispitanika u totalu vidljivo je da prosečna vrednost telesne visine iznosi 136,38+/-8,07 cm, telesne težine 34,40+/-10,60 kg, a indeks telesne mase 18,19+/-3,92 kg/m2.

Na osnovu rezultata prikazanih u Tabeli 1 vidljivo je povećanje prosečnih vrednosti telesne visine (ATEVIS), težine (ATETEŽ) i standardne devijacije (St.dev.) ispitanika sa uzrasnom dobi ispitanika. Vrednosti standardne devijacije (St. Dev.) pokazuju da je najmanja raspršenost vrednost merenih parametara kod ispitanika od sedam godina a najveća kod ispitanika od deset godina što ne predstavlja iznenađenje obzirom da upravo u ovom periodu deca ulaze u novu fazu razvoja.

Tabela 1. *Osnovni statistički parametri antropometrijskih mera ispitaniak prema uzrastu (razredu)*

Kod djece vrijednost ITM-a se uspoređuje sa centilnim krivuljama. ITM između 90-97 centila ukazuje na prekomjernu težinu, a ukoliko je ITM iznad 97 centila govori se o pretilosti. Vrijednost ITM-a preporučuje se kao objektivni djagnostički kriterij pretilosti u dječijoj i adolescentnoj dobi. WHO Child Growth Standards (SZO) kao dijagnostički kriterij pretilosti preporučuje z-vrijednost indeksa tjelesne

length/height as a diagnostic criterion for obesity: a z-value of +1 SD (standard deviation) indicates a risk of overnutrition, a z-value of +2SD indicates overweight, a z-value of +3SD indicates obesity, and the values of the 85th and 95th percentiles of BMI for age and gender have been highlighted. There are several anthropometric procedures for assessing the degree of obesity.

For newborns and infants, the simplest way is to weigh and measure the length (height) of the child and record an increase in height and weight. One of the possibilities for younger children (preschool and school age) is also the possibility of weighing and comparing body mass with reference values for age or height.

For older children and adolescents, there are several anthropometric methods and measurement procedures, starting with the measurement of skin folds or measuring the circumference of the extremities in certain places, all the way to modern measurement procedures involving an analysis of the bioelectrical resistance of the body (Bioelectrical Impedance Analysis m - BIA).

The BMI is most often used to diagnose obesity in adults, and it represents the standard recommended by the WHO, the World Obesity Federation and the CDC.

Based on insight into the BMI values, the treated sample of respondents - students, can be grouped into one of four categories based on the standard tables of the CDC, which view the BMI in the context of the child's age, *i.e.*, in the context of the already described correction for age and gender on the standardized BMI score. According to this distribution, the treated sample of respondents can be classified into groups as shown in Table 2.

Table 2. *Categorization of respondents - students in relation to BMI*

Respondent category / **Kategorija ispitanika**	***Number of respondents /*** **Broj ispitanika**	***Percentage of respondents /*** **Procenat ispitanika**
Malnutrition / Neuhranjenost	6	6.5%
Normal nutrition / Normalna uhranjenost	54	58%
Risk of obesity / Rizik od gojaznosti	15	16.1%
Obesity / Gojaznost	18	19.4%

Based on the analysis of the results shown in Table 3, it can be concluded that 54 (58%) of the students - respondents have a normal body weight. The risk of obesity was recorded in 15 (16.1%) respondents - students, while the group of obese respondents - students was at 18 (19.4%). In addition, the table in question shows that 6 (6.5%) respondents - students belong to the category of malnourished.

mase za dužinu/visinu: z-vrijednost od +1 SD (standardnu devijaciju) označava rizik preuhranjenosti, z-vrijednost od +2SD označava prekomjernu tjelesnu masu, z-vrijednost od +3SD označava pretilost, a istaknute su i vrijednosti 85. i 95. centile ITM-a za uzrast i pol. Za procjenu stepena pretilosti postoji nekoliko antropometrijskih postupaka.

Za novorođenčad i dojenčad najjednostavniji način je vaganje i mjerenje dužine (visine) djeteta i bilježenje prirasta u visini i masi djeteta. Jedna od mogućnosti za malu djecu (predškolska i školska djeca) je i mogućnost vaganja i poređenje tjelesne mase s referentnim vrijednostima za uzrasnu dob ili za tjelesnu visinu.

Za stariju djecu i adolescente postoji više antropometrijskih metoda i postupaka mjerenja, počev od mjerenja kožnih nabora ili mjerenja obima ekstremiteta na određenim mjestima, pa sve do savremenih mjernih postupaka mjerenja analizom bioelektričnog otpora tijela (Bioelectrical Impedance Analysis m – BIA).

Za dijagnostiku pretilosti odraslih najčešće se koristi Indeks tjelesne mase IMT (engl. Body Mass Index – BMI), koji predstavlja standard koji preporučuju Svjetska zdravstvena organizacija (WHO), Svjetska federacija za pretilost i Američki centar za kontrolu i prevenciju bolesti (CDC).

Na osnovu uvida u vrednosti indeksa telesne mase, tretirani uzorak ispitanika - učenici mogu se grupisati u jednu od 4 kategorije na osnovu standardnih tabela Američkog centra za kontrolu bolesti i prevenciju (CDC), koje indeks telesne mase posmatraju u kontekstu uzrasta deteta, odnosno u kontekstu već opisane korekcije za starost i pol na standardizovanom skoru indeksa telesne mase. Prema ovoj raspodeli tretirani uzorak ispitanika ovog istraživanja može se razvrstati u grupe kao što je prikazano u tabeli 2.

Tabela 2. *Kategorizacija ispitanika - učenika u odnosu na indeks telesne mase (ITM)*

Na osnovu analize rezultata prikazanih u tabeli 3 može se konstatovati da normalnu telesnu težinu ima 54 (58%) učenika – ispitanika. Rizik od gojaznosti zabeležen je kod 15 (16,1%) ispitanika - učenika, dok grupu gojaznih ispitanika – učenika čini njih 18 (19,4%). Takođe, iz date tabele je vidljivo da 6 (6,5%) ispitanika – učenika pripada kategoriji neuhranjenih.

The state of nutrition of school children in the Republic of Croatia, between the ages of 7 and 14 and conducted during the period from 2000 to 2005, shows that 23% of the respondents included in the survey had increased body weight, while 7.2% were obese (HZJZ, 2007). Applying the anthropometric index of body mass for height according to HZJZ, 11.9% of subjects had excessive body mass and 6.9% of subjects were obese during the same period.

In their research, Antonić et al. (2004) indicate an increased risk for developing obesity in children aged 7 to 15 in Croatia, 11.2% of boys and 9.8% of girls, while 5.7% of boys and 5.4% of girls are obese.

Abazović et al. (2016) conducted research with the aim of determining the obesity status of children in primary schools in Sarajevo Canton/Federation of Bosnia and Herzegovina. The sample of respondents consisted of 33,200 children of both sexes, primary school students, of which 16,240 were girls and 16,960 were boys. Based on the obtained results, the authors state that out of the total number of students included in this research, as many as 39.6% (13,159) are obese. Based on the results, the authors conclude that every other child in Sarajevo Canton/ Federation of Bosnia and Herzegovina has a nutritional disorder (49.3%), which is a worrying situation. It was determined that 55.5% of children have a normal body mass, while 44.5% of children have an increased or decreased BMI. Out of the total 44.5% of children, or 822 children, found to have a deviation from the normal body weight, 19.46% (8.7% of the total sample) were undernourished, 26.16% (11.65% of the total sample) were moderately malnourished, 27.01% (12% of the total sample) were overweight and 27.37% (12.2% of the total sample) were obese. The authors point out that such studies should be done every year in order to systemically monitor the state of nutrition and the trend in the development of obesity in children and, in this regard, create an adequate strategy to fight obesity.

Čolakhodžić et al. (2017) conducted a study on a sample of 1,800 respondents, primary school students of both sexes in the City of Mostar, who participated in a regular systematic review in 2016 with the aim of determining physical growth and development, and the state of nutrition of students. The obtained results showed that 36.4% of students are overweight or obese. Almost every other child (43.9%) has a nutritional disorder, which is worrying and alarming.

As part of a research project entitled "Prevalence of overweight and obesity in children aged 6 to 9 years", Ljubojević et al. (2020) conducted research on a sample of 2,039 male students attending nine primary schools in

Stanje uhranjenosti školske dece u Republici Hrvatskoj u uzrastu od 7 do 14 godina u periodu od 2000. do 2005. godine, pokazuju da je povećanu telesnu masu imalo je 23% ispitanika obuhvaćenih ispitivanjem, dok je 7,2% bilo pretilih (HZJZ, 2007). Primenjujući antropometrijski indeks telesne mase za visinu prema HZJZ-u, u istom periodu je bilo 11,9% ispitanika s prekomernom telesnom masom i 6,9% pretile dece.

Antonić i sar. (2004) u svom istraživanju ukazuju na povećani rizik za razvoj pretilosti dece u uzrastu od 7 do 15 godina u Hrvatskoj, ima 11,2% dečaka i 9,8% devojčica, dok je pretilo 5,7% dečaka i 5,4% devojčica.

Abazović i sar. (2016) izvršili su istraživanje s ciljem utvrđivanja stanja pretilosti dece u osnovnim školama Kantona Sarajevo/Federacije Bosne I Hercegovine. Uzorak ispitanika činilo je 33.200 dece oba pola, učenika osnovnih škola, od čega je 16.240 devojčica i 16.960 dečaka. Na osnovu dobijenih rezultata autori konstatuju da je od ukupnog broja učenika obuhvaćenih ovim istraživanjem, čak 39,6% (13.159) pretilo. Autori na osnovu rezultata zaključuju da svako drugo dete u Kantonu Sarajevo/Federacije BiH ima poremećaj uhranjenosti (49,3%), što predstavlja stanje koje zabrinjava. Utvrđeno je da 55,5% dece ima normalnu telesnu masu, a 44,5% dece ima povećan ili umanjen indeks telesne mase. Od ukupnih 44,5% dece ili njih 822 kod kojih je utvrđeno odstupanje od normalne telesne mase, njih 19,46% (8,7% ukupnog uzorka) je pothranjeno, 26,16% (11,65% ukupnog uzorka) je umereno pothranjeno, 27,01% (12% ukupnog uzorka) ima prekomernu telesnu masu i 27,37% (12,2% ukupnog uzorka) je pretilo. Autori ističu da bi ovakve studije trebalo raditi svake godine kako bi se sistemski moglo pratiti stanje uhranjenosti i trend razvoja pretilosti dece te s tim u vezi kreirati adekvatnu strategiju borbe protiv pretilosti.

Čolakhodžić i sar. (2017) su na uzorku 1800 ispitanika koji su činili učenici osnovnih škola oba pola u Gradu Mostaru, a koji su učestvovali u redovnom sistematskom pregledu u toku 2016. godine, izvršili istraživanje s ciljem utvrđivanja telesnog rasta i razvoja, te stanje uhranjenosti učenika. Dobijeni rezultati su pokazali da 36,4% učenika ima prekomernu telesnu težinu ili je pretilo. Gotovo svako drugo dete (43,9%) ima poremećaj uhranjenosti, što je zabrinjavajuće i alarmantno.

Ljubojević i sar. (2020) su u sklopu projektnog istraživanja pod nazivom „Prevalencija prekomerne težine i gojaznosti dece od 6 do 9 godina", izvršili istraživanje na uzorku od 2039 učenika muškog pola u devet osnovnih škola grada Banja Luka. Kod ispitanika su merene

the city of Banja Luka. The subjects' height and weight were measured, with BMI calculated based on those two measurements. The obtained results indicate that 9.26% of the tested primary school children in Banja Luka are overweight, and 5.37% are obese. Overall prevalence of overweight and obesity among Banja Luka children amounts to almost 15%, which is not a small percentage. The authors point out that the overall prevalence of overweight and obesity among children of primary school age in the city of Banja Luka is somewhat lower compared to the results of a similar sample in other European countries (available: http://www.euro.who.int). However, what is worrying is the increasing trend of overweight and obesity with age.

The aforementioned research results show that the increase in obesity in the child population is increasing compared to the results of previous studies (Gajić, 1993; Kisić Tepavčević et al., 2008).

According to data from the International Obesity Task Force for 2005, over the last ten years Serbia has been at the very top of countries experiencing a sudden increase in the prevalence of obesity in children (Wang & Lobstein, 2006).

Determining differences in BMI values in relation to gender

To determine the differences in the values of the BMI in relation to gender, an analysis of the t test results for independent samples was applied. Based on the obtained t test results shown in Table 3, it can be concluded that there is no significant difference in BMI values be-

telesna visina i telesna težina, a na osnovu te dve mere izračunat je Index telesne mase. Dobijeni rezultati ukazuju da od ukupnog broja testirane dece osnovnih škola u Banja Luci prekomernu težinu ima 9,26% testirane djece, a 5,37% je gojazno. Ukupna prevalencija prekomerne telesne težine i gojaznosti banjalučke dece iznosi skoro 15% što nije mali procenat. Autori ističu da je ukupna prevalencija prekomerne težine i gojaznosti dece osnovnoškolskog uzrasta grada Banja Luke u poređenju sa rezultatima sličnog uzorka u drugim evropskim zemljama nešto niža (dostupno: http://www.euro.who.int). Međutim, ono što zabrinjava jeste trend porasta prekomerne telesne težine i gojaznosti sa godinama.

Rezultati navedenih istraživanja pokazuju da je porast gojaznosti u dečijoj populaciji u porastu u odnosu na rezultate predhodnih studija (Gajić, 1993; Kisić Tepavčević i sar., 2008).

Prema podacima Međunarodne radne grupe za gojaznost (International Obesity Task Force) za 2005. godinu, Srbija se nalazi u samom vrhu zemalja s naglim povećanjem prevalencije gojaznosti kod dece u poslednjih deset godina (Wang & Lobstein, 2006).

Utvrđivanje razlika u vrednostima indeksa telesne mase (ITM) u odnosu na pol

Za utvrđivanje razlika u vrednostima indeksa telesne mase (ITM) u odnosu na pol primenjena je analiza rezultata t testa za nezavisne uzorke. Na osnovu dobijenih rezultata t testa prikazanih u Tabeli 3 može da se zaključi da ne postoji značajna razlika u vrednostima ITM

Table 3. *Differences in BMI values in relation to the gender of the respondents*

Tabela 3. *Razlike u vrednostima ITM u odnosu na pol ispitanika*

	MEAN	***T***	***P***
IV grade - 10 years / **IV raz. - 10 godina**			
Male / Muški *(N=14)*	21.32 ± 6.45	1.183	0.250
Female / Ženski *(N=9)*	18.37 ± 4.68		
III grade - 9 years / **III raz. - 9 godina**			
Male / Muški *(N=10)*	18.19 ± 2.94	0.412	0.684
Female / Ženski *(N=16)*	17.66 ± 3.29		
II grade - 8 years / **II raz. - 8 godina**			
Male / Muški *(N=4)*	16.47 ± 1.51	-2.000	0.070
Female / Ženski *(N=10)*	19.01 ± 3.21		
I grade - 7 years / **I raz. - 7 godina**			
Male / Muški *(N=13)*	16.66 ± 2.18	-0.519	0.608
Female / Ženski *(N=17)*	17.08 ± 2.19		
Entire sample / **Celokupan uzorak**			
Male / Muški *(N=42)*	18.56 ± 4.59	0.822	0.413
Female / Ženski *(N=51)*	17.88 ± 3.27		

**Statistical significance at the 0.05 level*

**Statistička značajnost na nivou od 0,05*

tween boys and girls, for the total sample as well as for each age group of children separately.

The results, that there are no statistically significant differences in morphological variables by gender, coincide with the research of domestic (Nićin and Stjepić, 2008; Krsmanović B., Batez and Krsmanović T., 2011) and foreign authors (Basaldua & Chiquete, 2008).

Abazović et al. (2016) conducted research on a sample of 33,200 primary school age children, of which 16,240 were girls and 16,960 were boys, with the aim of determining differences in nutrition (obesity) of children with regard to gender. The authors state that obesity is more present in boys compared to girls, *i.e.*, out of 16,960 boys, 7,451 or 43.9% of them had increased body weight or were obese, while out of a total of 16,240 girls, 5,798 or 35.2% had an increased body weight or were obese.

Determining differences in BMI values in relation to age

One-factor analysis of variance (ANOVA) was used to determine differences in BMI values in relation to the age of the subjects. Based on the ANOVA results presented in Table 4, it can be concluded that there is a statistically significant difference in the values of the BMI in relation to the age of the subjects (p=0.023).

Table 4. *Differences in BMI values in relation to the age of the respondents*

	MEAN	F	P
10 years / godina	20.17 ± 5.89	3.330	0.023*
9 years / godina	17.86 ± 3.11		
8 years / godina	18.28 ± 3.01		
7 years / godina	16.88 ± 2.16		

**Statistical significance at the 0.05 level*

The post hoc test (Table 5) was applied with the aim of determining the existence of differences between the subsamples of respondents with regard to age. Based on the results of the post hoc test, a statistically significant difference was found between ten-year-olds and seven-year-olds (p=0.013), where older subjects have significantly higher BMI values.

Obesity in younger school age children is a problem that reached epidemic proportions at the end of the 20th century. Due to such a situation, it is very important to identify children who are at risk for obesity, mainly because this problem can negatively affect both the physical health and the psychological well-being of students.

u odnosu na dečake i devojčice za ukupan uzorak kao i za svaki uzrast dece posebno.

Rezultati da ne postoje statistički značajne razlike u morfološkim varijablama po polu se poklapaju sa istraživanjima domaćih (Nićin i Stjepić, 2008; Krsmanović B., Batez i Krsmanović T., 2011) i stranih autora (Basaldua & Chiquete, 2008).

Abazović i sar. (2016) su na uzorku od 33.200 dece oba pola, učenika osnovnih škola, od čega je 16.240 devojčica i 16.960 dečaka s ciljem utvrđivanja razlika uhranjenosti (pretilosti) dece s obzirom na pol. Autori konstatuju da je pretilost više prisutna kod dečaka u odnosu na devojčice, odnosno od 16.960 dječaka, njih 7.451 ili 43,9% ima povećanu tjelesnu masu ili je pretilo, dok od ukupno 16.240 djevojčica, njih 5.798 ili 35,2% ima povećanu tjelesnu masu ili je pretilo.

Utvrđivanje razlika u vrednostima indeksa telesne mase (ITM) u odnosu na uzrasnu dob

Za utvrđivanje razlika u vrednostima indeksa telesne mase (ITM) u odnosu na uzrasnu dob ispitanika primenjena je jednofaktorska analiza varijanse (ANOVA). Na osnovu rezultata jednofaktorske analize varijanse (ANOVA) prikazanih u Tabeli 4 može se konstatovati da postoji statistički značajna razlika u vrednostima indeksa telesne mase (ITM) u odnosu na uzrasnu dob ispitanika (p=0,023).

Tabela 4. *Razlike u vrednostima ITM u odnosu na starosnu dob ispitanika*

**Statistička značajnost na nivou od 0,05*

Post hoc test (Tabela 5) je primenjen sa ciljem da se utvrdi postojanje razlika između subuzoraka ispitanika s obzirom na uzrasnu dob. Na osnovu rezultata post hoc testa statistički značajna razlika utvrđena je između desetogodišnjaka i sedmogodišnjaka (p=0,013) gde stariji ispitanici imaju značajnije više vrednosti indeksa telesne mase (ITM).

Gojaznost kod dece mlađeg školskog uzrasta predstavlja problem koji je poprimio epidemijske razmere još krajem XX veka. Usled takve situacije, veoma je važno identifikovati decu koja su pod rizikom za gojaznost, najviše iz razlogašto ovaj problem može negativno da se odrazi kako na fizičko zdravlje, tako i na psihološko bla-

Table 5. *Post hoc test to examine differences between individual groups*

Age of the respondents / **Uzrasna dob ispitanika**	***p***
7 - 8 years / godina	0.666
7 -9 years / godina	0.769
7 - 10 years / godina	0.013*
8 -9 years / godina	0.987
8 - 10 years / godina	0.458
9 - 10 years / godina	0.152

**Statistical significance at the 0.05 level*

Tabela 5. *Post hoc test za ispitivanje razlika između pojedinačnih grupa*

**Statistička značajnost na nivou od 0.05*

These research findings indicate that older male and female students, although not obese to a significant degree, tend to increase their BMI, which may indicate a potential trend of obesity at older ages. In this regard, it should be emphasized that almost 20% of younger school-aged students who participated in this research were recognized as obese, and the trend may increase considering that positive attitudes towards exercise and physical education classes decrease as the child progresses through schooling.

Previous research has shown that the BMI increases from birth to the first year of life, then decreases until the preschool period, after which it shows an increase again until the end of primary education (Demerath et al., 2006). In addition, previous research results have clearly shown that a higher BMI is evident with an increase in the age of children, as well as that there is an ever-increasing number of children who have excessive nutrition or can be characterized as obese.

Conclusion

Our research results show that one third of the treated respondents - younger school age students were recognized as obese or at risk of developing obesity, 15 (16.1%) of the respondents belong to the risk group of obesity and 18 (19.4%) of the respondents are obese. The obtained results point to a significant number of obese or at-risk obese younger school age students, which is why it is necessary to take timely preventive measures in order to prevent obesity and its negative consequences for children's health.

The danger of the consequences of obesity is constantly present because previous studies have shown a decrease in children's physical activity, and a decline in interest and positive attitudes towards physical exercise as the child progresses through schooling. That is why it is extremely important to increase participation in physical activities as children age, through various sports school programs, as a form of additional training in addgostanje učenika. Nalazi ovog istraživanja ukazali su da stariji učenici i učenice, iako nisu gojazni u značajnom stepenu, imaju tendenciju porasta indeksa telesne mase (ITM), što može ukazati na potencijalni trend javljanja gojaznosti na starijim uzrastima. S tim u vezi, potrebno naglasiti i da je skoro 20% učenika mlađeg školskog uzrasta u ovom istraživanju bilo prepoznato kao gojazno, a trend se može uvećavati s obzirom na to da pozitivni stavovi prema vežbanju i nastavi fizičkog vaspitanja opadaju kako dete napreduje kroz školovanje.

Dosadašnja istraživanja su pokazala da indeks telesne mase (ITM) raste od rođenja do prve godine života, a zatim opada do predškolskog perioda, nakon čega opet ispoljava rast do kraja osnovnog obrazovanja (Demerath et al., 2006). Takođe, rezultati dosadašnjih istraživanja ne dvosmislenopokazuju da je sa uzrastom dece evidentan veći indeks telesne mase (ITM), kao i da sve više dece ima prekomernu uhranjenost ili se može okarakterisati kao gojazno.

Zaključak

Rezultati istraživanja pokazuju da jedna trećina tretiranih ispitanika – učenika mlađeg školskog uzrasta je je prepoznato kao gojazno ili predstavlja rizik za nastanak gojaznosti (15 (16,1%) ispitanika pripada rizičnoj grupi od nastanka gojaznosti a 18 (19,4%) ispitanika je gojazno). Dobiveni rezultati upozoravaju na izražen broj gojaznih ili rizično gojaznih učenika mlađeg školskog uzrasta zbog čega je neophodno preduzimanje preventivnih mera kako bi se gojaznost i njene negativne posledice za zdravlje dece prevenirale na vreme.

Opasnost posledica gojaznosti je stalno prisutna jer su dosadašnja istraživanja pokazala na smanjenu fizičku aktivnost dece i opadanje interesa i pozitivnih stavova prema fizičkom vežbanju kako dete napreduje kroz školovanje. Zbog toga je izuzetno važno sa uzrastom dece povećati njihovo učešće u fizičkim aktivnosima, pored redovne nastave fizičkog i zdravstvenog vaspitanja i kroz različite programe školice sporta kao vid dodatnog

dition to regular physical and health education classes. The greatest transformation under the influence of exogenous factors (the process of sports training) is possible in fatty tissue, the coefficient of innateness is 0.50 (Mikić, 2000:102).

In order to regularly monitor the growth and development of school children and, therefore, monitor the level of nutrition, it is important to take appropriate measures such as training teachers to systematically monitor the growth and development of children through regular physical education classes.

For more effective implementation of preventive programs, greater cooperation is needed not only from children and their parents, but also from teachers and physical education teachers, in order to ensure the conditions for the proper growth and development of students, with the aim of eliminating obesity as a problem that affects the school population in the Republic of Serbia.

treninga. Najveća transformacija pod uticajem egzogenih faktora (procesom sportskog treninga) moguća je kod masnog tkiva, koeficijent urođenosti 0,50 (Mikić, 2000:102).

Kako bi se redovno pratio rast i razvoj kod školske dece a samim tim i pratio i stepen uhranjenosti, važno je preduzeti odgovorajuće mere kao što su obuka učitelja i nastavnika za sistematsko praćenje rasta i razvoja dece kroz redovnu nastavu fizičkog vaspitanja.

Za efikasnije sprovođenje preventivnih programa potrebna je veća saradnja ne samo dece, već i njihovih roditelja, ali i učitelja i nastavnika fizičkog vaspitanja, kako bi se sa sigurnošću mogli obezbediti uslovi za pravilan rast i razvoj učenika, u cilju eliminisanja gojaznosti kao problema koji pogađa školsku populaciju u Republici Srbiji.

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