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Usporedba maksimalnog primitka kisika (VO2max) djevojčica dobi 10 i 14 godina

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Apstrakt: Cilj istraživanja bio je utvrditi da li djevojčice u dobi od četrnaest godina imaju više vrijednosti aerobnog kapaciteta od djevojčica u dobi od deset godina. U istraživanju se željelo utvrditi da li se porastom dobi smanjuje razina kardiorespiratornog fitnesa kod djevojčica te da li se smanjuje ukupna tjelesna aktivnost. Niska razina kardiorespiratornog fitnesa očituje se u mnogim istraživanjima već od rane mladosti, a u velikoj je korelaciji sa sedentarnim načinom života. U istraživanju je sudjelovalo 94 djevojčica od četvrtog razreda do osmog razreda osnovne škole. Uzorak varijabli činile su antropometrijske mjere: tjelesna visina, tjelesna težina, opseg struka, opseg bokova. Sve mjere provedene su prema International Biological Program (IBP). Za procjenu postotaka masti u organizmu (BF%) korišten je i instrument Omron (Tip BF511, Japan). Aerobni kapacitet dobiven je višestupnjaskim testom trčanja od 20 metara- Schuttle run testom. Razina tjelesne aktivnosti procijenjena je PAQ-C upitnikom. Vidljivo je da samo 5% učenica zadovoljava preporuke o bavljenju tjelesnom aktivnošću dok se njih 83% bave umjerenom tjelesnom aktivnošću. Statistički značajna razlika pojavila se kod varijable kojom se procjenjivao aerobni kapacitet gdje je utvrđeno da djevojčice u dobi od deset godina (p=0,00) imaju bolji aerobni kapacitet od četrnaestogodišnjih djevojčica. Također, djevojčice u dobi od deset godina značajno više vremena provode u tjelesnoj aktivnosti (p=0,00). Rezultati korelacije između aerobnog kapaciteta (VO^2max) i ukupne tjelesne aktivnosti (PA) pokazuju značajnu pozitivnu povezanost (r = 0,42; p = 0,00). Djevojčice koje ne provode tjelesnu aktivnost u preporučenom vremenu od minimalno 60 minuta imaju potrebu da se usmjeravaju u različite oblike zdravog načina života s posebnim naglaskom na svakodnevno tjelesno vježbanje koje bi trebalo da utječe na povećanje njihovog aerobnog kapaciteta.
Ključne riječi: kardiorespiratorni fitnes, tjelesna aktivnost, VO2max, tjelesna aktivnost, djevojčice.

Comparison of Maximum Oxygen Intake (VO2max) In Ten and Fourteen-Year-Old Girls

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Abstract: The objective of the present research was to determine whether aerobic capacity of fourteen-year-old girls is higher than that of ten-year-old girls. The research aimed to establish if the level of cardio respiratory fitness in girls decreases with age, and if their overall physical activity also decreases. A low level of cardio respiratory fitness from an early age has been confirmed in a number of studies, and it has been highly correlated with a sedentary lifestyle. Research participants were 94 fourth and eighth grade primary school girls. The variables were anthropometric measures for body height, body weight, waist circumference, and hips circumference. All the measurements were done in accordance with the International Biological Program (IBP). Body fat percentage (BF%) was also measured with the Omron (Type BF511, Japan). A multistage 20m shuttle run test was used to obtain the values for aerobic capacity, and PAQ-C questionnaire was used to estimate the level of physical activity. The results indicate that only 5% of female students meet the recommendations for physical activity while 83% engage in moderate physical activity. Statistically significant differences were determined for the variables used to estimate the aerobic capacity, with ten-year-old girls (p=0.00) having better aerobic capacity than the fourteen-year-old girls. Furthermore, ten-year-old girls were found to be significantly more physically active (p=0.00). The results of the correlation test between the aerobic capacity (VO2 max) and the overall physical activity (PA) indicate significant positive correlation (r = 0.42; p = 0.00). Girls who do not engage in physical activity at least for the recommended 60 minutes need to be directed towards various forms of healthy lifestyle with a special emphasis on everyday physical exercise that may increase their aerobic capacity.
Keywords: cardio respiratory fitness, physical activity,VO2 max, physical exercise, girls

Uvod

Aerobni kapacitet (VO^2 max) odnosi se na intenzitet aerobnog postupka te ukazuje na maksimalnu sposobnost za prijenos i iskoristivosti kisika tijekom vježbanja koje se obavlja uz povećanje intenziteta (Shete, Bute i Deshmukh 2014). Aerobni kapacitet, također naziva se i kardiorespiratorni ili kardiovaskularni fitnes, te se smatra da je jedna od najvažnijih dimenzija povezanih sa zdravstvenim fitnesom (Welk GJ, Laurson KR, Eisenmann JC, Cureton KJ., 2011). Aerobni kapacitet (aerobna izdržljivost, kardiorespiratorna izdržljivost ili aerobni fitnes) definira se kao sposobnost obavljanja rada kroz duži vremenski period u uvjetima aerobnog metabolizma. Prihvaćeni parametri za procjenu aerobnoga kapaciteta je maksimalni primitak kisika (VO^2max), a označava količinu kisika koju organizam može potrošiti u vremenu od jedne minute (Vučetić, V., Šentija, D., 2005). Aerobni kapacitet (VO^2 max) je "maksimalna količina kisika koje ljudsko tijelo može iskoristiti po minuti aktivnosti ili fizičkog rada" (Dhara & Chatterjee, 2015, str. 9). Aerobni kapacitet je zajedno s krvnim tlakom i otkucajima srca jedan od ključnih markera u procjeni kardiorespiratornog fitnessa (Magutah, 2013., Grant, Corbett, Amjad, Wilson & Aitchison, 1995) koja procjenjuje kardiorespiratornu izdržljivost pojedinca (Dhara & Chatterjee, 2015)

Dosadašnja istraživanja pokazala su da ispitanici sa prekomjernom tjelesnom masom imaju lošije rezultate u kardiorespiratornim testovima od ispitanika sa normalnom tjelesnom masom, te je dokazana niska do umjereno visoka obrnuta korelacija između kardiorespiratornog fitnesa i debljine (Winsley i sur., 2006; Ara i sur., 2007). Niska razina kardiorespiratornog fitnesa i pretilosti u adolescenciji, povezana je s većim rizikom od smrtnosti u odrasloj dobi (Apor, 2011). Činjenice govore da je kardiorespiratorni fitness samostalna determinanta zdravog načina života (Ferreira, Twisk, van Mechelen, Kemper & Stehouwer, 2005). Viša vrijednost aerobnog kapaciteta u djetinjstvu i adolescenciji snažno je povezana sa trenutačnom razinom zdravlja, ali i sa velikom predikcijom u budućnosti (Ruiz et al., 2007, Ortega i sur., 2011).

Aktivan stil života, uključuje i provođenje tjelesne aktivnosti na preporučenim razinama ili uključenosti u organizirano provođenje tjelesne aktivnosti, od temeljne je važnosti za njihovu promociju, a povezana je sa zdravljem među mladima. Izbjegavanje sedentarnog načina života čak i u vrijeme vikenda, može spriječiti nisku razinu kardiorespiratornog fitnesa, osobito kod djevojčica (Barbosa Filho VC, Lopes Ada S, Bozza R, Rech CR, de Campos W. 2014).

Introduction

The aerobic capacity (VO2max) refers to the intensity of the aerobic process and indicates the maximum capability for transfer and **usability** of oxygen during exercise with increasing intensity (Shete, Bute, & Deshmukh, 2014). Aerobic capacity, also called cardio respiratory or cardiovascular fitness, is considered to be one of the most important dimensions in connection to health-related fitness (Welk, Laurson, Eisenmann, & Cureton, 2011). The aerobic capacity (aerobic endurance, cardio respiratory endurance or aerobic fitness) can be defined as the ability to perform an activity over a longer period of time under conditions of aerobic metabolism. The accepted parameter for assessing the aerobic capacity is the maximum oxygen intake (VO^2max), which indicates the amount of oxygen the body can use in one minute (Vučetić, & Šentija, 2005). The aerobic capacity (VO^2max) is the "maximal amount of oxygen that human body can utilize per minute of activity or physical workout" (Dhara & Chatterjee, 2015, p. 9). Aerobic capacity, along with blood pressure and heart rate, is one of the key markers in the assessment of cardio respiratory fitness (Grant, Corbett, Amjad, Wilson, & Aitchison, 1995; Magutah, 2013), which is used in the assessment of cardio respiratory endurance of individuals (Dhara & Chatterjee, 2015).

Previous studies have shown that overweight research participants had worse results on cardio respiratory tests than the participants with normal weight. In addition, studies have confirmed low to moderately high inverse correlation between cardio respiratory fitness and obesity (Winsley et al., 2006; Ara et al., 2007). Low levels of cardio respiratory fitness and obesity in adolescence have been associated with a higher risk of mortality in adulthood (Apor, 2011). Cardio respiratory fitness has been found to be an independent determinant of a healthy lifestyle (Ferreira, Twisk, van Mechelen, Kemper, & Stehouwer, 2005). Higher values of aerobic capacity in childhood and adolescence have been strongly associated with the current level of health, but have also been found to be highly predictive of future development (Ruiz et al., 2007; Ortega et al., 2011).

Active lifestyle also implies participation in physical activity at recommended levels or involvement in organized implementation of physical activity; it is essential for the promotion of health-related physical fitness and is associated with health among young people. Avoiding sedentary lifestyle, even during the weekends, can prevent low levels of cardio respiratory fitness, especially in girls (Barbosa Filho, Lopes Ada, Bozza, Rech, & de Campos, 2014).

Cilj istraživanja bio je utvrditi da li djevojčice u dobi od četrnaest godina imaju više vrijednosti aerobnog kapaciteta od djevojčica u dobi od deset godina. U istraživanju se željelo utvrditi da li se porastom dobi smanjuje razina kardiorespiratornog fitnesa kod djevojčica, te da li se smanjuje ukupna tjelesna aktivnost.

Metode

U istraživanju je sudjelovalo 94 djevojčice od čega 52 učenice četvrtog razreda i 42 učenice osmog razreda osnovne škole. Učenice su pohađale tri osnovne škole u gradu Petrinji, Republika Hrvatska. Istraživanje je provedeno u školskoj godini 2015/2016. Sve učenice bile su zdrave te je za njihovo sudjelovanje u ispitivanju dobivena suglasnost roditelja prema Etičkom kodeksu istraživanja sa djecom. Uzorak varijabli činile su antropometrijske mjere: tjelesna visina, tjelesna težina, opseg struka, opseg bokova. Sve mjere provedene su prema International Biological Program (IBP). Visina tijela izmjerena je uz pomoć antropometra. Za procjenu tjelesne mase i postotaka masti u organizmu (BF%) korišten je instrument Omron (Tip BF511, Japan). Uređaj radi metodom bioelektrične impedancije temeljem tjelesnog otpora na osnovu kojeg se indirektno izračunava postotak masti u organizmu. Prije same provedbe mjerenja potrebno je unijeti vrijednosti tjelesne visine i tjelesne težine, dob i spol za svakog ispitanika. Aerobni kapacitet dobiven je višestupanjskim testom trčanja od 20 metara- Schuttle run testom (Leger & Lambert, 1982). Body mass indeks izračunat je temeljem formule BMI (kg/m2 = weight (kg) / (height (m))

Razina tjelesne aktivnosti procijenjena je PAQ-C upitnikom (Crocker i sur. 1997). Upitnik je konstruiran za djecu mlađe školske dobi (od 8 do 14 godina). Cilj upitnika je procjena ukupne razine tjelesne aktivnosti učenika u posljednjih sedam dana. Upitnik se sastoji od 9 pitanja, a ukupni rezultat tjelesne aktivnosti predviđa se na temelju aritmetičke sredine dobivenih odgovora vrednovanih na ljestvici Likertova tipa od 1 do 5, gdje 1 označava nisku razinu tjelesne aktivnosti, a 5 označava visoku razinu tjelesne aktivnosti (Kowalski, Crocker i Donen, 2004). Isto tako učenici su procjenjivali vrijeme koje provedu pred televizijskim ekranom i na internetu.

Obrada podataka je obavljena programom STATISTICA (data analysis software system), version 7.1. Za sve istraživane varijable izračunati su osnovni deskriptivni parametri: aritmetička sredina (AS), standardna devijacija (SD), minimalan (MIN) i maximalan (MAX) rezultat, te Skewness i Kurtosis. Značajnost razlika iz-

The **purpose** of this study was to determine whether aerobic capacity of fourteen-year-old girls is higher than that of ten-year-old girls. In addition, the study aimed to establish whether the levels of cardio respiratory fitness among girls decreases with age, and whether overall physical activity decreases as well.

Methods

Research participants were 94 schoolgirls, of which 52 were fourth grade pupils, while 42 were eight graders. The pupils attended three primary schools in the town of Petrinja, in the Republic of Croatia. The research was conducted during 2015/2016 school year. All the participants were healthy at the time of the research, and their participation was approved by the parents, in accordance with the Code of Ethics for Research Involving Children. The sample of variables included the following anthropometric measures: body height, body weight, waist circumference, and hips circumference. All the measurements were conducted according to the International Biological Program (IBP). Body height was measured with an anthropometer, and body weight and body fat percentage (BF%) were measured with the Omron (Type BF511, Japan). The device uses the method of bioelectrical impedance and body resistance on the basis of which body fat percentage is indirectly calculated. Prior to the measurement it is necessary to enter the data for body height, body weight, age and sex for each participant. A multistage 20m shuttle run test (Leger & Lambert, 1982) was used to obtain the values for aerobic capacity, and body mass index was calculated using the BMI formula, i.e. weight in kilograms divided by height in meters square (kg/m2 = weight (kg) / height (m)).

PAQ-C questionnaire (Crocker et al., 1997) was used to estimate the level of physical activity. The questionnaire was constructed for primary school children (eight to fourteen-year-olds) for the purpose of estimating the overall level of pupils' physical activity for the previous seven days. There are 9 questions in the questionnaire, and the overall result for the physical activity is estimated on the basis of the mean result of the obtained responses assessed on a five point Likert type scale, with 1 indicating a low and 5 indicating a high level of physical activity (Kowalski, Crocker, & Donen, 2004). The participants were also asked to estimate the time they spend in front of the television or on the Internet.

Data was processed with the STATISTICA (data analysis software system), version 7.1. Basic descriptive parameters were calculated for all of the variables: mean (M), standard deviation (SD), minimum (MIN) and maximum results (MAX), as well as Skewness and

među subuzoraka definiranih prema dobi kod rezultata sa normalnom distribucijom izračunata je t-testom, dok je kod rezultata koji su pokazali nenormalnost distribucije korišten neparametrijski Mann-Whitney U test. Relacije između funkcionalnog kapaciteta i razine tjelesne aktivnosti utvrđivane su Pearsonovim koeficijentom korelacije. Statistička značajnost razlika testirana je na razini značajnosti $p < 0,05$.

Rezultati

Rezultati u tablici 1. za istraživane učenice prema razini tjelesne aktivnosti pokazuju da se njih 83% bave umjerenom tjelesnom aktivnošću (PA) odnosno da samo djelomično zadovoljavaju preporuke u participiranju svakodnevne tjelesne aktivnosti za djecu školske dobi.

Tabela 1. *Rezultati učenica prema razini tjelesne aktivnosti*

	Niska razina tjelesne aktivnosti / *Low level of physical activity*	%	Umjerena razina tjelesne aktivnosti / *Moderate level of physical activity*	%	Visoka razina tjelesne aktivnosti / *High level of physical activity*	%
Broj učenica / *Number of pupils*	11	12	78	83	5	5

Vidljivo je da samo 5% učenica zadovoljava preporuke o bavljenju tjelesnom aktivnošću, dok je 12% učenica potpuno tjelesno neaktivno što je vrlo visok postotak u odnosu na istraživani uzorak.

Tabela 2. *Rezultati deskriptivnih pokazatelja za ukupan uzorak učenica*

	N	Mean	Std.dev.	Min.	Max.	max D	K-S test
Age (years)	94	12,10	2,05	10,00	15,00		
Height (cm)	94	156,89	10,49	136,00	178,60	0,0951	p > .20
Weight (kg)	94	51,22	15,35	23,40	104,40	0,0687	p > .20
BMI-body mass index (kg/m2)	94	20,48	4,58	12,65	35,66	0,1096	p > .20
Body fat (%)	94	23,90	9,50	3,00	41,90	0,0660	p > .20
Waist circumference (cm)	94	67,96	11,48	19,00	104,00	0,0907	p > .20
Hip circumference (cm)	94	88,77	12,20	62,00	121,00	0,0784	p > .20
VO_2max (mL/kg/min)	94	39,26	5,17	31,40	51,10	0,1279	p < ,10
Daily TV watching (hours)	94	1,89	1,02	0,00	4,00	0,2245	p < ,01
Daily internet (hours)	94	1,88	1,09	0,00	4,00	0,2706	p < ,01
PA level 7 days	94	2,79	0,63	1,70	4,15	0,0950	p > .20

Rezultati u tablici 2. prikazuju deskriptivne parametre istraživanih djevojčica koje pohađaju četvrti i osmi razred osnovne škole. P**rosječna dob je 12**,10±2,05 godina. Vidljivo je da su djevojčice prosječne visine

Kurtosis. The significance of the differences between the subsamples defined according to age was calculated using the t-test for the normally distributed results, and nonparametric Mann Whitney test was used to calculate the results which were not normally distributed. Pearson coefficient of correlation was used to calculate the correlations between the functional capacity and the level of physical activity. Statistical significance of the differences was tested at the level of significance $p < 0.05$.

Results

The results for the level of physical activity presented in Table 1 show that in the target group of schoolgirls 83% participate in moderate physical activity (PA), in other words, they only partially meet the recommended level of participation in daily physical activities prescribed for school-aged children.

Table 1. *Girls' results according to the level of physical activity*

It may also be observed that only 5% of the schoolgirls meet the recommendations for the level of physical activity while 12% of the schoolgirls are completely physically inactive, which is a significant percentage in comparison to the total sample of participants in this research.

Table 2. *Descriptive parameters for the total sample of girls*

The results presented in Table 2 show the descriptive parameters for the fourth and eighth grade primary school girls. The average age was 12.10 ± 2.05 years. It may be observed that the girls' average height was 156.89 ±

156,89±10,49 cm što ih svrstava u djecu normalne tjelesne visine prema referentnim vrijednostima na razini Republike Hrvatske (Jureša, Kujundžić Tiljak i Musil, 2011). Gledajući rezultate tjelesne težine (51,22±15,35 kg), vidljivo je da istraživane učenice imaju veće vrijednosti tjelesne mase od referentnih vrijednosti na razini Republike Hrvatske (Jureša i sur., 2011). Rezultati postotka masti (%BF) iznosi 23,90 % što djevojčice ukupnog uzorka svrstava u normalno uhranjene ispitanike prema referentnima vrijednostima (McCarthy HD, Cole TJ, Fry T, Jebb SA i Prentice AM, 2006). Vrijednosti Body Mass Indeksa su nešto više u odnosu na referentne vrijednosti Republike Hrvatske (Jureša i sur., 2011). Rezultati opsega struka su u skladu sa referentnim vrijednostima, dok su rezultati opsega bokova viši od referentnih vrijednosti (Jureša i sur., 2011).

Tabela 3. *Results of t-test and Mann Whitney test of anthropometric measures, aerobic capacity and physical activity between girls 10 and 14 age*

	10 years	14 years		
	52	42		
	Mean±SD	Mean±SD	t-test/p*	M-W test*
Age (years)	10,31±0,47	14,31±0,47		
Height (cm)	150,28±8,44	165,07±6,08		
Weight (kg)	45,40±14,28	58,43±13,59		
Waist circumference (cm)	65,50±12,15	71,00±9,90		
Hip circumference (cm)	83,95±11,78	94,74±9,95		
BMI-(kg/m2)	19,79±4,73	21,34±4,30	0,10	/
Body fat (%)	22,48±10,49	25,66±7,87	0,11	/
VO_2max (mL/kg/min)	42,78±3,42	34,90±3,32	0,00	/
Daily TV watching	2,06±1,06	1,69±0,95	/	0,19
Daily internet	1,46±0,85	2,40±1,13	/	0,00
PA level 7 days	2,98±0,60	2,54±0,59	0,00	/

**t-test p=level of significance (p< 0.05); **Mann-Whitney U-test p=level of significance (p< 0.05)*

Rezultati u tablici 3. prikazuju usporedne rezultate djevojčica prema njihovoj dobi. Vidljivo je da su starije učenice očekivano više tjelesne visine i tjelesne težine te da imaju više vrijednosti opsega struka i bokova što je sukladno rastu i razvoju čovjekova organizma i ove vrijednosti nisu bile predmet utvrđivanja razlika s obzirom na te činjenice. Za utvrđivanje razlika između ostalih varijabli koristio se t-test za nezavisne uzorke

10.49cm, which means that according to the benchmark values determined for the Republic of Croatia (Jureša, Kujundžić Tiljak, & Musil, 2011) their height is normal. However, the results for body weight (51.22 ± 15.35 kg) indicate that the body mass of the schoolgirls in the present research was higher than the benchmark values determined for the Republic of Croatia (Jureša et al., 2011). The percentage of fat (BF%) in the target sample was 23.90%, which means that the total sample of schoolgirls, according to the benchmark values, may be classified as having normal body weight (McCarthy, Cole, Fry, Jebb, & Prentice, 2006). The body mass index values were slightly higher compared to the benchmark values for the Republic of Croatia (Jureša et al., 2011). Finally, the results for waist circumference were in line with the benchmarks while the results of the hips circumference were higher than the benchmark values (Jureša et al., 2011).

Table 3. *Results of t-test and Mann Whitney test for anthropometric measures, aerobic capacity and physical activity between girls aged 10 and 14*

**t-test p=level of significance (p< 0.05); **Mann-Whitney U-test p=level of significance (p< 0.05)*

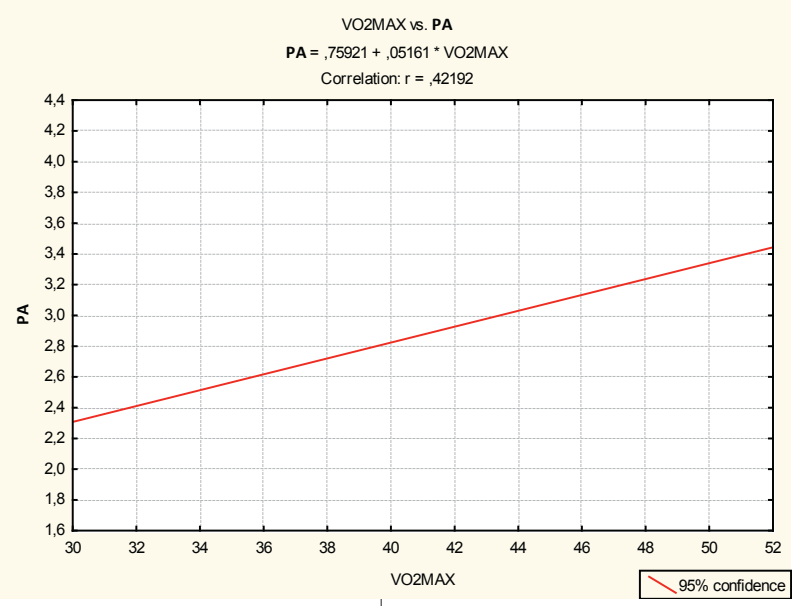
Table 3 shows the comparison of the schoolgirls' results according to age. It is apparent that the values for body height and weight, as well as for waist and hips circumference, as expected, were higher for older pupils, which is in line with the growth and development of the human organism, therefore these values were not included in determining the differences between the two groups. In the between-group comparison of other variables the t-test

kod varijabli koje su pokazale normalnost distribucije, dok se kod varijabli koje su pokazale nenormalnost distribucije koristio neparametrijski Mann-Whitney U-test. Kod varijabli BMI (body mass indeks) i postotak masti (BF%) nisu utvrđene statistički značajne razlike. Razlika se pojavila kod varijable kojom se procjenjivao aerobni kapacitet gdje je utvrđena statistička značajnost u korist djevojčica u dobi od deset godina (p=0,00). Također, djevojčice u dobi od deset godina značajno više vremena provode u tjelesnoj aktivnosti (p=0,00), dok starije djevojčice dnevno više vremena provode na internetu (p=0,00).

for independent samples was used for the variables that showed normality of the distribution, while for the variables that did not show a normal distribution the nonparametric Mann-Whitney U-test was used. For the variables BMI (body mass index) and body fat percentage (BF%) no statistically significant differences were found. The difference was determined for the variables that were used to evaluate aerobic capacity, and the difference was statistically significant in favour of ten-year-old girls (p = 0.00). Also, the ten-year olds reportedly spend significantly more time in physical activity (p = 0.00) while the older girls spend more time daily on the Internet (p = 0.00).

Figure 1. *Relations between the total phyisical activity (PA) and indicators of aerobic capacity (VO^2max) in girls*

Figure 1. *Relations between the total physical activity (PA) and indicators of aerobic capacity (VO^2max) in girls*



Temeljem rezultata prikazanih u slici 1. vidljivo je da korelacija između aerobnog kapaciteta (VO^2max) i ukupne tjelesne aktivnosti (PA) pokazuje značajnu pozitivnu povezanost (r = 0,42; p = 0,00).

Based on the results presented in Figure 1, it may be observed that there is a significant positive correlation (r = 0.42; p = 0.00) between the aerobic capacity (VO2 max) and the overall physical activity (PA).

Diskusija i zaključak

Dobiveni rezultati pokazuju da samo 12% istraživanih učenica zadovoljava preporuke o provođenje dnevne tjelesne aktivnosti. Uspoređujući dobivene rezultate sa istraživanjem (Currie i sur., 2012), gdje je vidljivo da su djevojčice u Republici Hrvatskoj u dobi od 11-15 godine participirali između 19% i 8% u preporučenoj tjelesnoj aktivnosti, može se utvrditi da su učenice ostale na istim razinama u odnosu na prošle godine. Temeljem cilja istraživanja vidljivo je da djevojčice u dobi od deset godina imaju značajno bolji aerobni kapacitet od starijih djevojčica. Neke dosadašnje studije pokazale su da djevojčice u dobi od 14-15 godina imaju niže vrijednosti VO_2max

Discussion and Conclusion

The results show that only 12% of the investigated schoolgirls meet the recommendations on the participation in daily physical activity. Comparing the obtained results with another research (Currie et al., 2012), which indicated that between 8% and 19% of eleven to fifteen-year-old schoolgirls in the Republic of Croatia met the recommended level of physical activity, it can be determined that the girls have remained at the same levels compared to previous years. Pertaining to the objective of the research, it may be observed that ten-year-old girls have significantly better aerobic capacity than the older girls. Some previous studies have also shown that girls

(Ruiz et al., 2007; Lobelo et.al., 2009; Adegboye et.al., 2011; Ortega et.al., 2011; Barbosa Filho et.al., 2014) od djevojčica mlađe dobi. Također, vidljivo je da djevojčice u dobi od deset godina imaju vrijednosti kardirespiratornog fitnessa (CF) 42,78 (mL/kg/min) što je nominalno viša vrijednost od istraživanja Gahche i suradnika (2014) koji su kod djevojčica dobi 12-13 godina dobili vrijednosti 35,7 (mL/kg/min), a kod djevojčica dobi 14-15 godina 31,8 (mL/kg/min) što je nešto niža vrijednost u odnosu na ovo istraživanje (34,90 mL/kg/min). Razlog značajnog smanjivanja aerobnog kapaciteta osim tjelesne neaktivnosti prema Dencker et al. (2007) ogleda se u razvoju spolnih hormona i distribucije tjelesne masti. Promatrajući vrijeme koje djeca provode u sedentarnim aktivnostima, uočljivo je da su mlađe djevojčice više vremena provodile gledajući televizor, ali nije utvrđena statistička značajnost, dok se kod vremena koje djevojčice provode na internetu pojavila značajna razlika u korist starijih djevojčica. Naravno, mlađe djevojčice još uvijek su zainteresirane za zabavu pred televizijskim ekranima dok su starije djevojčice više orijentirane na internet, gdje se razlog može tražiti u povezivanju sa svojim prijateljima bilo da se radi o povezivanju preko socijalnih mreža ili igranju online igrica preko interneta. Isto tako, mlađe djevojčice prema samoprocjeni tjelesne aktivnosti, značajno više vremena dnevno provode u nekom od oblika tjelesne aktivnosti od starijih djevojčica. Kada se usporedi vrijeme koje starije djevojčice provode ispred TV ekrana i interneta, onda je jasno da su njihove preferencije usmjerene na sedentarne aktivnosti odnosno da daju prednost aktivnostima koje ne zahtijevaju energetsku potrošnju. Ova činjenica može se ogledati i u nalazu istraživanja gdje mlađe djevojčice imaju značajno bolje rezultate aerobnog kapaciteta. Pearsonovim koeficijentom korelacije utvrđena je značajna pozitivna korelacija između aerobnog kapaciteta i dnevne tjelesne aktivnosti kod istraživanih djevojčica. Slične rezultate dobivena su u istraživanju (Collings et.al 2016). Aerobni kapacitet značajno se povećava participiranjem u tjelesnoj aktivnosti. Bez obzira što drugi čimbenici, kao što su spol, dob, sastav tijela i zdravstveno stanje mogu značajno utjecati na razinu kardiorespiratornog fitnessa, no najvažnija odrednica koja može mijenjati razinu aerobnog kapaciteta je tjelesna aktivnost (Parikh i Stratton, 2011).

Činjenice dobivene ovim istraživanjem govore da se aerobni kapacitet kod djevojčica ulaskom u pubertet smanjuje i u korelaciji sa tjelesnom neaktivnošću može uzrokovati ozbiljne zdravstvene probleme. Nalazi temeljeni na provedenim interventnim studijama pokazuju da se razina kardiorespiratornog fitnessa može poboljšati u

aged fourteen to fifteen had lower values of VO2max than the younger girls (Ruiz et al., 2007; Lobe et al., 2009; Adegboye et al., 2011; Ortega et al., 2011; Barbosa Filho et al., 2014). Moreover, it was found that the value of cardio respiratory fitness (CF) of ten-year-old girls was 42.78 (mL/kg/min), which is nominally a higher value than the values obtained in the research by Gahche et al. (2014), who found that twelve to thirteen-year-old girls' value was 35.7 (mL/kg/min) and fourteen to fifteen-year-old girls' value was 31.8 (mL/kg/min), which is a slightly lower value compared to our study (34.90 mL/kg/min). The reason for the significant reduction of aerobic capacity, in addition to physical inactivity, according to Dencker et al. (2007), may be the development of sex hormones and the distribution of body fat. Upon the analysis of the time children spend in sedentary activities, it is evident that the younger girls spent more time watching television, although there was no statistically significant difference, while the older girls spent statistically significantly more time on the Internet. Naturally, the younger girls are still interested in the entertainment provided by the television while the older girls are more oriented to the Internet, which enables them to connect with their friends through social networks, or to play online games. In addition, according to their self-report, the younger girls spend significantly more time participating in some form of physical activity than the older girls. When the time that the older girls spend in front of TV screens and the Internet is compared, it is clear that their preferences are aimed at sedentary activities, i.e. they give priority to activities that do not require energy consumption. This finding is confirmed by the result indicating that younger girls have a significantly better aerobic capacity. Pearson correlation coefficient confirmed a significant positive correlation between aerobic capacity and daily physical activity in the studied sample of schoolgirls. Similar results were obtained in the study by Collings et al. (2016). Aerobic capacity significantly increases through participation in physical activity. Irrespective of other factors, such as sex, age and body composition, state of health can significantly affect the level of cardio respiratory fitness. Nevertheless, the most important factor that can change the level of aerobic capacity is physical activity (Parikh & Stratton, 2011).

The results obtained in the present study show that aerobic capacity in schoolgirls decreases as they enter puberty, and in correlation with physical inactivity it can cause serious health problems. Results based on some intervention studies indicate that the level of cardio respiratory fitness can be improved in youth through aerobic

mladosti kroz aerobni trening (Parikh i Stratton, 2011).

Djevojčice koje ne provode tjelesnu aktivnost u preporučenom vremenu od minimalno 60 minuta dnevno trebale bi se uključiti kroz različite interventne programe u dodatno tjelesno vježbanje. Sudjelovanje samo u nastavi tjelesne i zdravstvene kulture nije dovoljno za podizanje razine aerobnog kapaciteta kod djevojčica u dobi između desete i četrnaeste godine.

Na kraju može se zaključiti da djevojčice istraživane dobi imaju relativno nisku razinu aerobnog kapaciteta te se ukazuje na potrebu njihova usmjeravanja u različite oblike zdravog načina života s posebnim naglaskom na svakodnevno tjelesno vježbanje.

Izjava autora
Autori pridonijeli jednako.

Konflikt interesa
Mi izjavljujemo da nemamo konflikt interesa.

training (Parikh & Stratton, 2011).

Girls who do not participate in physical activity at least for the recommended time of a minimum of 60 minutes a day should be involved in additional physical exercise through various intervention programmes. More participation in physical education lessons is not enough to raise the level of aerobic capacity in girls between the ages of ten and fourteen.

Finally, it may be concluded that girls of the target age (fourteen years) have relatively low levels of aerobic capacity, and therefore there is a need to direct them towards various forms of healthy lifestyle with special emphasis on daily physical exercise.

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The authors have contributed equally.

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