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DIFFERENCES IN LEVEL OF ACTIVITY OF GIRLS AND BOYS IN PHYSICAL EDUCATION CLASS

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Abstract

Interest in the benefits of exercise has prompted increased exploration of the relationship between physical activity and health status in adults. In recent years, a considerable number of studies has explored the role of adopting the habits of physical activity in children, which is defined as the main factor which affects the implementation of regular physical activity in adult age. The purpose of this research is to provide an insight into the level of physical activity of male ($n=35$) and female ($n=31$) pupils, during 30 physical education classes, and analyze them based on the gender criterion. Pupils in second and fourth grades wore Uniqa pedometers for activity assessment during each 45-minute physical education class. During a total of 30 hours it amounted to $n=482$ individual activity data for boys and $n=285$ individual activity data for girls. The pupils were given pedometers at the beginning of the class, and at the end each pupil read a number of steps that he/she made in order to record the steps. T-test indicates a statistically significant difference ($p < .001$) between boys and girls in the average level of activity during the physical education class, i.e. that boys in second and fourth grades make more steps than the girls from the same grades.

Keywords: activity, physical education class, pedometer, pupils

Introduction and work proposition

Physical activity is an integral part of life and one of the main factors for health improvement. It acts as an essential biological stimulus necessary for proper maintenance of structure and function of organs and organ systems. Physical activity is a cure for major public health problems, whilst physical inactivity is their cause. Physical inactivity is the fourth leading risk factor of overall mortality (6% causes of death globally). According to the World Health Organization (WHO, 2010) it is estimated that physical inactivity is one of the main causes of breast cancer and colon cancer (approximately 21-25% of cases), diabetes (27% of cases) and coronary heart diseases (30% of cases).

Furthermore, the World Health Organization estimates that in 2008 as much as 31% of the world's population aged over 15 years was not sufficiently physically active, out of which there was 28% of men and 34% of women. In the same year, approximately 3.2 million of all deaths in the world could be attributed to insufficient physical activity. Current scientific information convincingly indicates that physical inactivity presents a serious threat for functional ability, health and overall quality of life.

Preschool children and primary school pupils spend most of their free time sedentary (McKenzie et al., 1997) and there has been a significant decline in physical activity of children from fourth to fifth grade (Sallis, Alcaraz, McKenzie, & Howell, 1999). A significant percentage of children takes part in less than one moderate to heavy physical activity in duration of 10 minutes or longer (Simons- Morton, O'Hara, Parcel, Huang,

Baranowski, & Wilson 1990), which indicates that many children cannot get an adequate amount of body activity before adolescence. According to the National Survey data (Jureša, Musil, & Brown, 2009), Croatian children are increasingly physically inactive. Studies on the physical activity of first-grade children in primary schools indicate that 19.3% of boys and 19.3% girls spend more than two hours a day watching television, and 12-18% of pupils spend more than two hours a day playing computer games. 61.3% of boys and 57.4% of girls ride a bicycle for 30 minutes or more once a week or less. 19.1% of boys and 28.9% girls go walking or jogging once or less a week. These statistics exhibit a lack of physical activity in children and the necessity for organized physical activity.

Regular physical activity habits developed in early age most commonly remain present in adulthood. According to numerous studies, adults who engage in regular physical activities have adopted this habit in their childhood. The adoption of this habit in childhood is defined as the main factor affecting the implementation of regular physical activity in adulthood (WHO, 2010). The only comprehensive organized exercise system for children is physical education class, where the activity of pupils is monitored and controlled. The question is to what degree is this level of activity actually realized in practice, or how much impact does physical education class, as a basic organizational form of work, have on the activity of the pupils. In addition to insight into the overall level of activity of pupils during physical education class, the purpose of this study is to investigate differences in the activity of between boys and girls.

Gender differences in activity patterns occur after age 13 (Strauss, Rodzilsky, Burack, & Colin, 2001), 10 (Santos, Guerra, Ribeiro, Duarte, & Mota, 2003), and even as young as 3 years of age (Bradley, McMurray, Harrell, & Deng, 2000). Boys tend to be generally more active and engage in higher intensity exercises than girls (Myers, Strikmiller, Webber, & Berenson, 1996; Trost, Pate, Freedson, Sallis, & Taylor, 2000; Trost et al., 1996), thus suggesting that boys are more active due to intensity level during physical activity.

Methods

Study participants were boys $6.90 \pm 0.07s$ ($n=35$, age= 9 ± 1.5) and girls ($n=31$, age= 9 ± 1.5), pupils of two second and one fourth grade from two elementary schools in Slavonski Brod, Croatia. The participants wore a UNIQA pedometer during 30 physical education classes of 45 minutes. The pedometer is very simple to use; it consists of three buttons: Set, Reset, and Mode. Pressing the Set button shows the number of steps made by the pupil during the physical education class. Reset button is used to reset the pedometer, while Mode button converts the obtained steps to miles, kilometers or burned calories. At the start of the study the pedometers were manually checked based on the instructions given by the manufacturer. A number of spare pedometers was supplied in case of breakdown. The pupils were instructed to put the pedometer near the front of the pelvic bone. At the end of the class each pedometer was inspected in order to record the number of steps made by each pupil. If a pedometer was out of order, the steps were not recorded. The pupils wore the pedometers during the three-month period from March to May. Most of the physical education classes took place in the school gym, and only a few classes were held on the outdoor courts.

Methods of data analysis

The data was processed and analyzed using a statistical program SPSS 17.0. Basic statistical parameters for each variable were obtained using descriptive statistics. The analysis of the basic descriptive statistics parameters was followed by the analysis of the difference between arithmetic means using a t-test for independent samples for analysis of the difference in the average activity between boys and girls. The level of significance was taken to be 5%.

Results

Table 1. Descriptive statistical parameters and results of Kolmogorov-Smirnov normality distribution test for activity variables between male and female pupils

Variables	N	Mean	Minimum	Maximum	Std. Dev.	max D	p
Activity boys	482	1183,5	167	3344	521,4	0,0621	$p > 0.20$
Activity girls	285	952	107	2138	427,9	0,0624	$p > 0.20$

LEGEND: -arithmetic mean (Mean), minimal result (Minimum), maximal result (Maximum), standard deviation (Std.Dev), maximal distance between cumulative frequencies of normal distribution and cumulative frequency of empirical distribution, calculated using Kolmogorov-Smirnov test (max D), the probability of random occurrence of the maximum distance equal to or greater than the calculated (p).

The data show that boys make more steps than girls during the physical education class, i.e. they reach a higher level of activity than girls. Figure 1 shows the arithmetic mean of the number of steps made by the boys (1183.5 steps), and the arithmetic mean of the number of steps made by girls (952 steps). Table 1. displays the results of the basic descriptive parameters in the activity variables of girls and boys during the physical education class. Kolmogorov-Smirnov test was applied in order to investigate the normality of distribution of variables for activity assessment. The maximum distance between the cumulative frequency of the normal distribution and the cumulative frequency of empirical distribution (D max) was obtained using SPSS 17.0 software system. It was compared in all variables with the limit value criterion of the Kolmogorov-Smirnov test for $n=482$ boys and $n=285$ girls, which amounts to $p < .05$ on the level of significance. According to these values, none of the tested variables of activity deviate significantly from the normal distribution of results according to the Kolmogorov-Smirnov test.

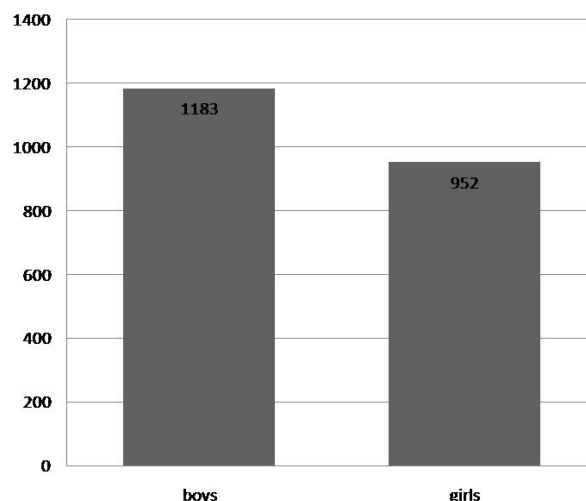


Figure 1. The average number of steps made by girls and boys during a Physical Education Class

Having established the normality of distribution, statistically significant difference ($p < .001$) between the arithmetic means of activities of boys and girls was tested and confirmed using t-test. This confirmed that there exists a statistically significant difference between boys and girls regarding the level of activity during the physical education class.

Table 2. T-test table for independent samples between activity variables of boys and girls

Variables	t	df	p
Activity boys	49,83	481	p<0,001
Activity girls	37,55	284	p<0,001

LEGEND: - t-value (t), - degrees of freedom (df), - proportion of errors (p)

Discussion

When using pedometers to measure the level of physical activity during physical education class, children should accumulate at least 1800 steps during a 30-minute period, or 60 steps per minute (Scruggs, Beveridge, Eisenman, Watson, Shultz, & Ransdell, 2003). In this study the pupils, reached an average of 1067.75 steps during the 45-minute period or 23.73 steps per minute, which is well below expected.

According to the results of one of the previous studies, students in Arizona chronologically aged 11.85 achieved an average of 1419.5 steps or 47.32 steps per minute during physical education class in the time interval of 30 minutes. Third and fourth graders from Dallas reached an average of 1683 steps or 56.1 steps per minute during physical education classes. This difference can be attributed to the differences between the physical education curriculum in Croatia and in the US. Physical education classes in the US are differently structured. Furthermore, the type of content together with manner and intensity of performance greatly affects the level of activity. It is assumed that physical education classes in the US are mostly comprised of elementary games and team sports that require a high level of physical effort and which consequently result in high levels of activity. In the course of 30 physical education classes, each lasting 45 minutes, the boys in this study made more steps than girls. The results of similar studies show that girls were significantly less active than boys during all of the measured physical education classes. A study on 54 fourth-grade students in rural Pennsylvania (28 girls, M age 06.09, SD = .56; 26 boys, M age 09.05, SD = .51) who wore accelerometers during physical education classes indicated that the girls were less active than the boys (LeMura, Andreacci, Carlonas, Klebez & Chelland, 2000). In Portugal, 157 students (boys n = 64 and n = 93 girls) aged 8-15 years wore accelerometers during physical education classes. A statistically significant difference in the level of activity between boys and girls was confirmed, and indicates that the boys are more active than the girls (Santos Guerra, Ribeiro, Duarte & Mota, 2003). In Florida, a total of 281 preschool children from nine different preschools wore accelerometers for an average of 4.4. hours per day, during a time period of 6.6 days on average. The studies have confirmed that the boys have a higher level of activity than the girls, and that they spend more time doing moderate and heavy activities (Pate, Pfeiffer, Trost, Ziegler & Dowda 2004). A total of 81 sixth-grade pupils in Arizona (28 boys, M age = 11.9, 53 girls, M age = 11.8), wore a pedometer during physical education classes, during recess, and

before and after school hours. The devices showed that the boys made significantly more steps per day than the girls, but there was no significant difference in number of steps made during the hours of structured physical education class. (Tudor-Locke, Lee, Morgan, Beighle & Pangrazi, 2006). A total of 136 third and fourth-grade pupils (boys n=62 and n=74 girls, age 8-10) from a private elementary school in Dallas wore pedometers during physical education classes in the time period of 114 days. ANOVA factorial showed that the third- and fourth-grade boys make significantly more steps than girls from the same grades (Smith, Nichols, Biggerstaff & DiMarco, 2009). The cause of this difference in activity level may possibly be a stronger perception of sports skill and power in boys, compared with the perception of girls (Crocker, Eklund, & Kowalski, 2000). The nature of the physical education program may be more inclined to teaching sports skills, which may contribute to lower levels of physical activity by girls (Scruggs, Beveridge & Watson, 2001). The differences in activity levels between boys and girls during the hours of physical education can also be attributed to the lack of aesthetic components, such as dance or rhythmic movements, during physical education classes (Hicks Wiggins, Crist, & Moode, 2001). Girls are usually involved in these types of movements, but they are usually not offered in physical education curricula as often as sports movements and skills (Smith, Nichols, Biggerstaff & DiMarco, 2009). These results indicate that the contents of physical education curricula should be more closely adjusted to the needs of girls.

Conclusion

This study provides insight into the level of activity of second- and fourth-grade primary school pupils during the physical education class. The pupils from two primary schools in Croatia have made significantly fewer steps than their counterparts in the United States. The cause of this difference is different content of the physical education class in the US, and the types of educational content and the manner and intensity of their performance greatly affects the level of activity of students. During 30 physical education classes the boys in this study made on average a higher number of steps than the girls. The level of activity is likely to be affected by educational content which is more appropriate for boys than for girls. Given the fact that children are becoming less physically active, versatile educational content in P.E. class should motivate their movement in order for them to develop in an appropriate manner and raise the overall energy consumption during the day.

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RAZLIKE U AKTIVITETU DJEVOJČICA I DJEČAKA NA SATU TJELESNE I ZDRAVSTVENE KULTURE

Sažetak

Interesi o prednostima vježbanja potaknuli su povećano istraživanje odnosa između fizičke aktivnosti i zdravstvenog statusa kod odraslih. U novije vrijeme, značajan broj istraživanja usmjeren je prema ulozi usvajanja navike tjelesne aktivnosti kod djece što je definirano kao osnovni čimbenik koji utječe na provođenje redovite tjelesne aktivnosti u odrasloj dobi. Svrha ovog istraživanja je uvid u razinu fizičkog aktiviteta učenika (n=35) i učenica (n=31) na 30 sati tjelesne i zdravstvene kulture prema kriteriju spola. Učenici 2. i 4. razreda nosili su uređaje za procjenu aktiviteta, pedometre Uniqa, tijekom svakog 45-minutnog sata tjelesne i zdravstvene kulture, što je na ukupno 30 sati iznosilo n=482 pojedinačna podataka kod dječaka i n=285 pojedinačnih podataka aktiviteta kod djevojčica. Učenicima su pedometri podijeljeni na početku sata, a na kraju sata svaki učenik pročitao je broj koraka koje je napravio kako bi se koraci mogli zabilježiti. T-test pokazuje da postoji statistička značajnost razlika ($p < ,001$) između dječaka i djevojčica u razini prosječnog aktiviteta na satu tjelesne i zdravstvene kulture, odnosno da dječaci 2. i 4. razreda naprave više koraka od djevojčica 2. i 4. razreda.

Ključne riječi: aktivitet, sat tjelesne i zdravstvene kulture, pedometar, učenik

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