

SCHOOL AND WEEKEND PHYSICAL ACTIVITY OF 15-16 YEAR OLD CZECH, SLOVAK AND POLISH ADOLESCENTS

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Submitted in September, 2011

BACKGROUND: When it comes to physical activity, adolescents are the group at the highest risk. When monitoring physical activity in adolescents, it is necessary to differentiate school and weekend days. School days are crucial in adolescents' weekly physical activity.

OBJECTIVE: The aim of the study is to identify to what extent the school day and weekend physical activity levels differ in Czech, Polish and Slovak boys and girls with different cultural and education backgrounds in Central Europe.

METHODS: The research was carried out in the Czech Republic in Moravia (11 schools, 383 participants), in Poland in the Katowice region (11 schools, 327 participants) and in Slovakia in the Prešov region (8 schools, 252 participants). In total, 421 boys and 541 girls participated in the study. Participants wore YAMAX pedometers for seven days and recorded measured values onto a record sheet and into the internet Indares system. The results were processed using repeated ANOVA analyses and contingent charts.

RESULTS: Czech, Polish, and Slovak boys and girls showed a significantly higher number of steps on school days than on weekend days. No difference between boys and girls was found on any day of the week in any of the states. The lowest number of steps was found, both in girls and boys, on Sundays. The highest number of daily steps was measured in Czech boys ($n = 14,015 \text{ steps} \times \text{day}^{-1}$), Polish girls ($n = 12,074 \text{ steps} \times \text{day}^{-1}$) and Slovakian girls ($n = 12,040 \text{ steps} \times \text{day}^{-1}$) on Fridays.

CONCLUSIONS: Boys and girls in all three states were more physically active on school days than on weekend days. Wearing pedometers eliminated the differences between weekly physical activity in boys and girls in the Czech Republic, Poland and in Slovakia. Under Central European conditions, it was proven that wearing pedometers positively influences physical activity in girls.

Keywords: Pedometer, steps, secondary school, online data collection.

INTRODUCTION

Many studies have confirmed a decrease in physical activity (PA) in children and adolescents (Nader, Bradley, Houts, McRitchie, & O'Brien, 2008; Brodersen, Steptoe, Boniface, & Wardle, 2007) and an increase in obesity (Fussenegger, Pietrobelli, & Widhalm, 2008; Daniels et al., 2005). Same negative trends have been also observed in the Czech Republic (Kunešová, 2006; Vignerová, Humeníková, Brabec, Riedlová, & Bláha, 2007). The positive influence of PA on mental and physical health (Kunešová, 2006; Vignerová, Humeníková, Brabec, Riedlová, & Bláha, 2007) has also been noted.

The positive influence of PA on mental and physical health has been observed both in the children and youth populations (Meriwether, Lobelo, & Pate, 2008; Strong et al., 2005). Monitoring children attending elementary school with extended PE lessons (sport schools) and

children attending regular school, it has been found that children from sport schools show better physical, drinking and eating regimes and are more frequently non-smokers and teetotalers (Havelková, Kachlík, & Raus, 2006).

Unfortunately, the level of PA decreases along with age (Riddoch et al., 2004; Tudor-Locke, McClain, Hart, Sisson, & Washington, 2009). Pre-schoolers are more physically active than adolescents and young adults both on school and weekend days (Sigmund, Des Ste Croix, Mikláňková, & Frömel, 2007).

Regarding the decrease in PA, the group at the highest risk are adolescents, and girls more than boys because they are less physically active than boys (Armstrong, Balding, Gentle, & Kirby, 1990; CDCP, 2008; Frömel, Novosad, & Svozil, 1999; Riddoch et al., 2004).

There are many factors that influence PA in adolescents; environmental and biological factors such as sex, age, depression, earlier PA, community sports, parental

support, PA in siblings, direct help by parents, and the opportunity to exercise (Sallis, Prochaska, & Taylor, 2000).

The biggest decrease in PA during adolescence is found in moderate PA (Nelson, Neumark-Stzainer, Hannan, Sirard, & Story, 2006). As for measuring PA in adolescents, we speak of working (or school) days and weekend days. School related PA is crucial in the weekly physical activity of adolescents. A significant role of PA level on school days is played by physical education lessons, breaks and transport to and from school. Students who are more active in PE lessons reach overall higher levels of weekly PA (Skalik, Frömel, Sigmund, Vašendová, & Wirdheim, 2001). Also active transport (Cooper, Andersen, Wedderkopp, Page, & Froberg, 2005; Tudor-Locke, Ainsworth, & Popkin, 2001) and PA during school recesses increases their weekly PA level (Verstraete, Cardon, De Clercq, & De Bourdeaudhuij, 2006).

Furthermore, there is also a higher level of the PA of adolescents on school days than at weekends (Duncan, E., Duncan, J., & Schofield, 2008; Gavarry, Giacomoni, Bernard, Seymat, & Falgairette, 2003; Sigmund, Frömel, Sigmundová, & Sallis, 2003; Treuth et al., 2007), which applies, too, when addressing only obese individuals (Aires et al., 2007). These findings show that the way adolescents spend weekends does not support the prevalence of a physically active and healthy lifestyle. The aim of the study is to identify the most and the least physically active days in the weekly program under different socio and educational conditions.

METHODOLOGY

Participants

The study was carried out in the Czech Republic in Moravia (11 schools, 383 participants), in Poland in the Katowice region (11 schools, 327 participants) and

in Slovakia in the Prešov region (4 schools, 197 participants) (TABLE 1) in the academic year 2009/2010 and 2010/2011 in the Spring and Autumn periods. In total, 56 randomly selected schools were included in the study. There were only 1.7% of the Czech boys (1.3% Polish; 1.3% Slovak), and 1.5% of the Czech girls (1.2% Polish; 3.4% Slovak) underweight (less than the 5th percentile). Overweight and obese (> 85th percentile) status was declared by 8.3% of the Czech boys (14.7% Polish; 9.1% Slovak) and 7.9% of the Czech girls (5.5% Polish; 5.1% Slovak). Weight status category was generally stated in compliance with the handbook by Centers for Disease control and Prevention. Information on body weight and body height was self-reported by the participants.

Research methods

After testing the functions of YAMAX SW700 pedometers, a secure lock was added. Record sheets included a daily record of the number of steps, distances in kilometers and number of calories expended/burnt. Participants recorded their data at the beginning and at the end of PE lessons, training sessions, or individual activities. The Polish version of the record sheet was translated in compliance with the EORTC "Quality of Life Group" (Cull et al., 2002).

The internet Indares system (www.indares.com) (Křen et al., 2007) allows for an analysis of the recorded number of steps during the week as related to recommendations and the average in the group. Further, one can register his/her physical activities including those done while not wearing pedometers. A great advantage of the system is the function providing immediate feedback to each participant individually. The system is suitable for research purposes (Chmelík et al., 2008).

Design

A trained team visited each school in all the countries. During one lesson, the participants registered

TABLE 1
Sample characteristics

Country	Gender	n	Age		Body Weight		Body Height		BMI	
			M	SD	M	SD	M	SD	M	SD
Czech Republic	Boys	181	15.71	0.76	66.92	9.00	178.54	7.66	20.98	2.39
	Girls	202	15.27	0.62	56.63	8.81	167.14	6.59	20.24	2.58
Poland	Boys	163	15.74	0.77	66.74	10.10	175.90	8.19	21.53	2.73
	Girls	164	15.80	0.66	57.51	8.60	166.99	7.16	20.60	2.59
Slovakia	Boys	77	15.55	0.85	63.12	10.28	174.32	7.88	20.71	2.71
	Girls	175	15.56	0.92	55.38	7.25	166.12	5.89	20.07	2.50

Legend: M – mean, SD – standard deviation

themselves into the Indares system and they were instructed on how to use the pedometers and record the data.

Participants wore pedometers for seven consecutive days except while swimming, showering and sleeping. They recorded the measured values into their record sheets and directly into the Indares system.

This study was approved by the Ethical Committee at the Faculty of Physical Culture, Palacký University, Olomouc.

Statistics

In order to process the data, we used the statistical program Statistica 9 and SPSS 19 software. We considered basic characteristics, contingent charts, and repeated ANOVA analyses.

RESULTS

In all three geographical regions, the participants showed a significantly higher number of daily steps on school days than at weekends (TABLE 2). The interaction of sex \times school and weekend days was: in Czech boys ($p < .001$; $d = 0.407$) and girls ($p < .001$; $d = 0.433$), Polish boys ($p < .001$; $d = 0.332$) and girls ($p < .001$; $d = 0.205$) and Slovak boys ($p = 0.002$; $d = 0.377$) and girls ($p < .001$; $d = 0.418$).

The differences in the daily number of steps between Czech boys and girls were not significant on any day (Fig. 1). The daily number of steps on Sunday was significantly lower in comparison to any other day of the week ($p < .01$). On the other hand, the highest number of steps was recorded on Friday ($n = 14,015 \text{ steps} \times \text{day}^{-1}$), it was significantly higher than on Monday, Tuesday, Saturday and Sunday ($p < .01$). The highest number of steps was recorded on Friday by boys ($n = 14,015 \text{ steps} \times \text{day}^{-1}$).

The difference in the daily number of steps between Polish boys and girls was not significant on any day

(Fig. 2). The daily number of steps on Sunday was significantly lower than on Friday ($p < .01$). The highest number of steps was recorded by girls on Friday ($n = 12,074 \text{ steps} \times \text{day}^{-1}$).

Fig. 1

Average daily number of steps in Czech boys and girls ($n = 383$)

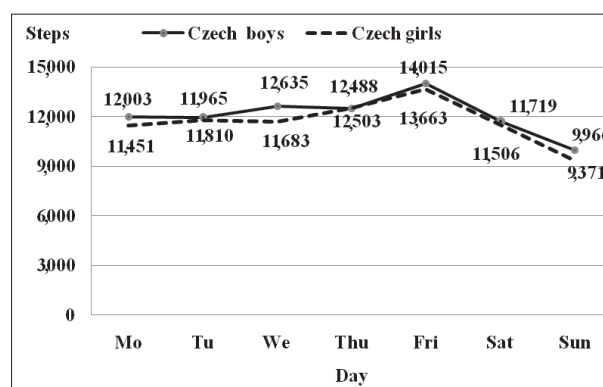


Fig. 2

Average number of daily steps in Polish boys and girls ($n = 327$)

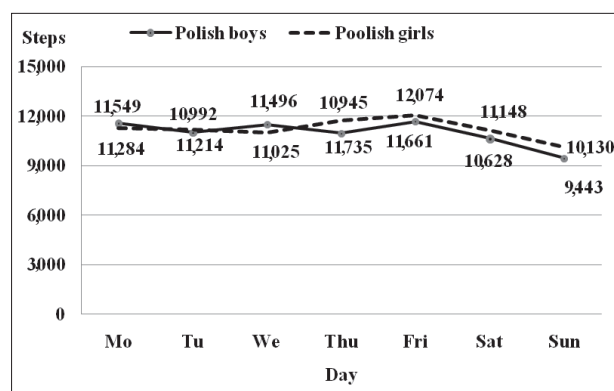


TABLE 2

Average number of steps on school and weekend days

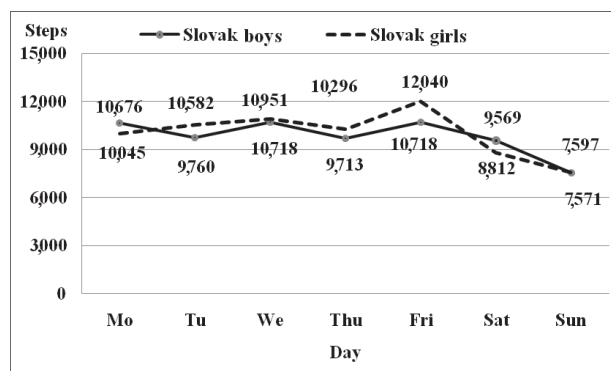
Country/Gender	n	Schooldays		Weekend		F	p	ω^2
		M	SD	M	SD			
Czech boys	181	12,621	3,922	10,842	4,775	66.64	< .001	0.14
Czech girls	202	12,222	3,352	10,438	4,770			
Polish boys	163	11,328	3,104	10,035	4,553	23.17	< .001	0.06
Polish girls	164	11,466	3,334	10,639	4,625			
Slovak boys	77	10,317	3,718	8,672	4,923	42.33	< .001	0.14
Slovak girls	175	10,783	3,389	9,104	4,559			

Legend: M – mean, SD – standard deviation, F – test criterion of repeated ANOVA analyses, p – level of statistical significance, ω^2 – “effect size” coefficient

The differences in daily number of steps between Slovak boys and girls were not significant on any day (Fig. 3). The daily number of steps on Sunday was significantly lower than on any other day ($p < .01$) except for Saturday. The daily number of steps on Saturday was significantly lower than on Friday ($p < .01$). The highest number of daily steps were recorded by girls on Friday ($n = 12,040$ steps \times day $^{-1}$).

Fig. 3

Average number of daily steps in Slovak boys and girls ($n = 252$)



DISCUSSION

The recommended level of PA positively influencing health in an adult is 10,000 steps/day, which can be accumulated during the whole day (Tudor-Locke & Bassett, 2004). In adolescents, the number should be higher i.e. 10,000–11,700 steps a day, which corresponds to the 60 minutes of moderate PA (Tudor-Locke et al., 2011), which is recommended to adolescents (USDHHS, 2008). A number of studies show that the average number of steps a day is between 8,000–9,000 steps (Tudor-Locke et al., 2011). Similar values are met by Slovak girls at weekends (9,104 steps) and Slovak boys (8,672 steps). In Czech and Polish participants, the average number of steps did not decrease below 10,000 steps at weekends. Comparing the average number of steps in Czech, Polish and Slovakian participants on school days, the highest number of 12,422 was measured in Czech adolescents, in Polish adolescents it was 11,397 and 10,550 in Slovakian. However, due to the low number of participants in Slovakia, we cannot generalize the differences between the countries. Accordingly, along with the results of international studies (Duncan, E. et al., 2008; Gavarry et al., 2003; Rowlands, Pilgrim, & Eston, 2008; Treuth et al., 2007), we have found that the PA level at weekends is lower than on school days in all participants in the research. The lowest number of steps is taken by girls on Sundays, yet this is not however due

to Sunday being the last day of monitoring because the start of monitoring varied in starting on various days of the week. The same conclusions were found in a study of the adult population by Sigmund et al. (2008), which shows that no group, classified according to their BMI, surpassed the number of 10,000 steps.

Gavarry et al. (2003) found that girls and boys were more inactive during their free days than during school days, which is in compliance with our findings. Girls, according to Mota, Santos, Guerra, Ribeiro, and Duarte (2003), have a tendency to be more active during school time, while boys are more active after school. The decline of PA at weekends in girls and boys actually supports the role of school in the enhancement of daily PA on school days (Pate et al., 2006). We expect that some environmental and other factors, e.g. the influence of family and peers and the opportunities to carry out PA are especially at the front line with regard to PA at weekends.

On the other hand, the highest number of steps was for all three groups, Czech, Polish and Slovak participants, taken on Fridays. Preparation for lessons usually takes place on Sundays, while Friday afternoon and night is usually spent in leisure time activities, enjoying hobbies, parties, etc. Since Saturday is a free day, it makes Friday a day that brings more PA into this age group as school PA is combined with PA in other activities.

Wearing pedometers is considered to increase PA level (Bravata et al., 2007; Lubans, Morgan, & Tudor-Locke, 2009) in all age groups in intervention attempts varying in their duration, especially with bigger effects in women (Kang, Marshall, Barreira, & Lee, 2009). In participants who used pedometers, there was a decrease of their BMI and systolic blood pressure (Bravata et al., 2007). Moreover, there are only a few studies that focus only on men, and, although the study includes, both men and women, women prevail (Kang et al., 2009). Since several studies (Brodersen et al., 2007; Riddoch et al., 2004) have documented higher levels of PA in boys than in girls and because in our study the differences in the average daily number of steps between Czech, Polish and Slovak boys and girls were not significant, we assume that wearing pedometers could eliminate the differences in weekly PA of boys and girls in all three nations.

Strengths and limitations of the study

The strength of the study is a large sample size obtained across three countries, using the same study design and research methods. An objective measure of PA was used to collect the data.

The results of the study are limited by a lower number of participants in the Prešov region and by a lower number of participating boys than girls.

CONCLUSIONS

Our findings suggest that wearing pedometers is stimulating, especially for girls, and thus they may contribute to a decrease in the differences in PA between boys and girls. Sunday is the most critical day regarding PA in the week in all three regions, both in boys and girls. Therefore the more active use of Sundays may provide improved possibilities for increasing PA levels in adolescents.

ACKNOWLEDGMENT

The study has been supported by the research grant from the Ministry of Education, Youth and Sports of the Czech Republic (No. MSM 6198959221) "Physical Activity and Inactivity of the Inhabitants of the Czech Republic in the Context of Behavioral Changes".

This study was carried out within the research grant funded by the Faculty of Physical Culture at Palacký University, Olomouc "School related active transport in 15 to 16 years old students, FTK_2011_017" and within the research grant funded by AWF Katowice "Physical activity: An irreplaceable element of healthy lifestyles of young people".

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**ŠKOLNÍ A VÍKENDOVÁ POHYBOVÁ AKTIVITA
15-16LETÝCH ČESKÝCH, POLSKÝCH
A SLOVENSKÝCH ADOLESCENTŮ**
(Souhrn anglického textu)

VÝCHODISKA: Z hlediska poklesu pohybové aktivity jsou za nejvíce rizikovou skupinu označováni adolescenti. Při monitoringu pohybové aktivity u adolescentů je nutné rozlišovat školní a víkendové dny. Školní dny jsou rozhodující v týdenní pohybové aktivitě adolescentů.

CÍLE: Cílem studie je zjistit, do jaké míry se liší školní a víkendové dny českých, polských a slovenských chlapců a děvčat v rozdílných socioekonomických a kulturně-edukačních středoevropských podmínkách.

METODIKA: Výzkum byl realizován v České republice v Moravském regionu (11 škol, 383 participantů), v Polsku v Katowickém regionu (11 škol, 327 participantů) a na Slovensku v Prešovském regionu (8 škol, 252 participantů). Celkem se do výzkumu zapojilo 421 chlapců a 541 děvčat. Participantů nosili sedm dnů pedometry YAMAX a naměřené hodnoty zaznamenávali do zápisového listu a do internetového systému Indares. Výsledky byly zpracovány použitím opakované ANOVA a kontingenčních tabulek.

VÝSLEDKY: Čeští, polští a slovenští chlapci i děvčata měli signifikantně vyšší počet kroků ve školních dnech na rozdíl od dnů víkendových. Diference mezi chlapci a děvčaty nebyly zjištěny v žádném dnu v týdnu, a to ve všech třech státech. Nejnížší denní počet kroků byl zaznamenán u chlapců i děvčat v neděli. Nejvyšších hodnot denního počtu kroků dosáhli čeští chlapci (14 015 kroků/den), polská děvčata (12 074 kroků/den) a i slovenská děvčata (12 040 kroků/den) v pátek.

ZÁVĚRY: Chlapci i děvčata ve všech třech státech byli pohybově aktivnější ve školních dnech než ve víkendových dnech. Nošení pedometrů eliminovalo rozdíly v týdenní pohybové aktivitě chlapců a děvčat v České republice, Polsku i na Slovensku. I ve středoevropských podmínkách se potvrdilo se, že nošení pedometru pozitivně ovlivňuje pohybovou aktivitu děvčat.

Klíčová slova: krokoměr, kroky, střední škola, online sběr dat.

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