

## AN ANALYSIS OF SCHOOL PHYSICAL ACTIVITY IN ADOLESCENT GIRLS

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**BACKGROUND:** It has been well evidenced that physical activity (PA) has a positive effect on human health. It is very likely that a physically active child will grow up to be a physically active adult. Growing older, there is evidence of decreasing PA in children and youth. In the period of adolescence, girls tend to be less physically active than boys and therefore they are understood to be a risk group in relation to PA.

**OBJECTIVE:** The aim of the study was to characterize school related weekly PA in adolescent girls and to identify the influence of participation in physical education lessons (PE) on the structure of weekly PA.

**METHODS:** The study was carried out using the ActiGraph monitor and record sheets in a period of five school days and two weekend days.

**RESULTS:** The results have shown that girls participating in two or more PE lessons show higher overall PA performed at school and also spend more time performing intensive PA at school than girls participating only in one or no PE lessons during the week. At school, the girls spent on average 10 minutes performing moderate PA (3.1–6 MET) and 0.6 minutes intensive PA (> 6 MET). The girls spent most of the time at school in being physically inactive, on average 125 minutes. When we compare these results with health recommendations (seven times a week 60 minutes of moderate PA and 3 times a week 20 minutes of intensive PA), we can argue that PA in adolescent girls really needs to be examined in research. Moreover, the results show that school and PA performed there (physical education lessons) still plays its irreplaceable role in the education system regarding the total level of PA and healthy lifestyle in adolescent girls.

**CONCLUSIONS:** The increase of total PA in adolescent girls can be secured by the increase in school related PA (more PE lessons, introducing at least one physically active recess for 30 minutes during a school day, enhancing active transport to and from school) and by the increase of girls' participation in organized PA outside of school and PA at weekends.

*Keywords: Secondary school, physical education, monitoring of physical activity, girls.*

## INTRODUCTION

The positive effect of physical activity on health is well documented (Strong et al., 2005; USDHHS, 2008). At the same time, it has been proven that a physically active child will grow to be a physically active adult with a high likelihood (Kraut, Melamed, Gofer, & Froom, 2003; McKenzie, 1999; Savelle et al., 2010; Telama et al., 1997).

There is a number of studies that deal with obesity in children and adults and that warn against constantly increasing obesity and physical inactivity (PI) and diseases related to them (Goran, Reynolds, & Lindquist, 1999; Strong et al., 2005).

Along with age, the level of PA in children and youth is decreasing (Duncan, E., Duncan, J., & Schofield, 2008; Riddoch et al., 2004; Tudor-Locke et al., 2009), with the biggest decline in intensive PA (Frömel, Chmelik et al., 2007). Regarding the decline of PA, the most risky group is adolescent girls (Duncan, E., Duncan, J., & Schofield, 2008). Adolescent girls are less active than adolescent boys (Armstrong et al., 1990; CDCP, 2008;

Frömel, Novosad, & Svozil, 1999; Riddoch et al., 2004), however, according to Sigmund, Croix, Miklanková and Frömel (2007), the decline of PA is more apparent in boys than in girls.

Frömel, Chmelik et al. (2007) have found that boys and girls who engage in some form of organized PA meet the health recommendations for PA significantly more frequently than those who do not.

When studying the decline of PA in adolescent girls, it is necessary to monitor the level of PA on weekdays and at weekends. According to Sigmund et al. (2003) who monitored PA in adolescent girls and boys, the decline of PA is apparent mainly at weekends. Similarly, Treuth et al. (2007) who monitored girls using ActiGraph found that girls spent more time in moderate and intensive PA on school days than at weekends.

The decline of PA at weekends (Duncan, E., Duncan, J., & Schofield, 2008) supports to a great extent the role of school regarding the level of PA on school days. School related PA forms an important part of total PA on school days (Wickel & Eisenmann, 2007).

School related PA comprises of transport to and from school, PA during breaks, and PA in PE lessons. Moreover, the longer breaks there are during a school day, the more PA (Verstraete et al., 2006) children perform. Also, the more space children and youth have (m<sup>2</sup>) at school, the more PA they perform (Loucaides et al., 2009). Physical activity during breaks on a school day can have a similar health effect as a physical education lesson (Frömel et al., 2008).

Due to this reason, many authors argue for the potential of schools to increase PA in children and adolescents (Pate et al., 2006; PCPFS, 2009; USDHHS, 2010). In relation to the prevention of obesity and interventions enhancing PA, it is important to pay attention to school related PA (PA in PE lessons, transport to/from school, PA during breaks).

The aim of the study was to characterize school related weekly PA in adolescent girls and to identify the effect of the participation in PE lesson on the structure of weekly PA.

## METHODS

The sample comprised 136 randomly selected girls (age  $17.97 \pm 0.6$  years; body weight  $57.76 \pm 8.15$  kg; body height  $166.92 \pm 6.9$  cm; BMI  $20.72 \pm 2.52$  kg/m<sup>2</sup>) from eight secondary schools in Poland in Katowice region in the school year 2009/2010. All girls gave their consent to the study. The girls were divided into three groups according to their participation in PE lessons. The division was made on the basis of results from ActiGraph and from record sheets of participating girls. Group 0PE – without participation in PE lessons ( $n = 36$ ), group 1PE with participation in one PE lesson ( $n = 45$ ) and group 2PE – with participation in two or more PE lessons ( $n = 55$ ) during five school days.

The girls' PA was monitored for one week (5 school days and 2 weekend days) using the ActiGraph GT1M accelerometer, along with record sheets into which

the girls recorded the time they put on and took off the monitor, the type and time of PA and PI (physical inactivity). This accelerometer is considered reliable for the monitoring of physical activity in adolescents (Kohl, Fulton, & Caspersen, 2000). The girls were monitored for 14 hours ( $\pm 2.14$  hours) per day. The results from ActiGraph were processed using specially designed software „ActiPa2006“ (Chytil, 2006), which described PA in girls according to their energy expenditure, PA intensity, number of steps, and the time spent doing each type of PA or PI. After the data had been processed, the girls received feedback in written form with comments.

School related PA (PA realized in the time period between entering the school in the morning and leaving the school in the afternoon) was divided into four categories according to its intensity in compliance with Pate et al. (1995), physical inactivity  $\approx 1$  MET, low PA = 1.1–3 MET, moderate PA = 3.1–6 MET and intensive PA = 6.1–12 MET. In no participants did we measure PA higher than 12 MET.

To carry out the statistical analysis of the data, STATISTICA 9.0 program was used. To compare the groups with different participation in PE, Kruskal-Wallis ANOVA and coefficient „effect size“  $\eta^2$  (Morse, 1999) were applied. Statistical significance was set at the level of  $p < .05$ .

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

## RESULTS

School related physical activity accounts for 32% of total daily PA (steps/day) in the group 0PE, 33% in 1PE group, and 38% in 2PE group of the total daily PA.

Comparing the 0PE, 1PE, and 2PE groups regarding the PA intensity expressed in METs, we observe gradual growth of PA, with the 2PE group showing the highest intensities in all school related PAs (TABLE 1).

**TABLE 1**

Physical activity of girls ( $n = 136$ ) at school according to its intensity (min.) in each group

Intensity PA (MET)	Group 0PE ( $n = 36$ )				Group 1PE ( $n = 45$ )				Group 2PE ( $n = 55$ )				H	p	$\eta^2$
	Mdn	IQR	M	SD	Mdn	IQR	M	SD	Mdn	IQR	M	SD			
$\approx 1$ MET	119.6	46.9	118	36.8	122.2	39.7	122	29.9	133.4	41.1	136	31.5	5.97	.050	.04
1.1–3 MET	16.1	7.5	17.2	6.3	16.8	9.7	18.9	9.4	22.4	7.8	24.3	6.2	29.59 <sup>a,b</sup>	< .001	.22
3.1–6 MET	7.6	8.7	8.6	6.7	10	7.7	11.2	8.6	9.4	9.6	11.5	7.7	4.29	.117	.03
6.1–12 MET	0	0.3	0.3	0.7	0	0.6	0.5	1	0.4	0.4	0.8	1	26.46 <sup>a,b</sup>	< .001	.20

Legend: group 0PE – a group without participation in PE lessons, group 1PE – a group with participation in one PE lesson, group 2PE – a group with participation in two or more PE lessons, Mdn – median, IQR – interquartile range, M – mean, SD – standard deviation  
H – Kruskal-Wallis test, P – statistical significance,  $\eta^2$  – coefficient “effect size”, a – a statistically significant difference between groups 0 and 2, b – a statistically significant difference between groups 1 and 2

Statistically and logically significant differences between groups are found in low PA (1.1–3 MET) and intensive PA (6.1–12 MET). In the case of moderate PA (3.1–6 MET) no statistically and logically significant differences were found between the groups. In physical inactivity ( $\approx 1$  MET) no statistically and logically significant differences were found between the groups either.

When we compare the groups among themselves, there is a statistically significant difference between 0PE and 2PE ( $p < .001$ ) and 1PE and 2PE ( $p < .001$ ) in low PA, and also between 0PE and 2PE ( $p < .001$ ) and 1PE and 2PE groups ( $p < .001$ ) in intensive PA.

Walking and housework in second place are the types of PA which the girls spent the most time with. When we compare these types of PA in each group, there is a different order than in the case of school related PA. Group 0PE spent the most time with them, 1PE in second place and 2PE spent the least time (Fig. 1). The comparison of groups regarding the types of PA shows differences between the groups regarding their participation in PA and the types of PA they perform (Fig. 2).

## DISCUSSION

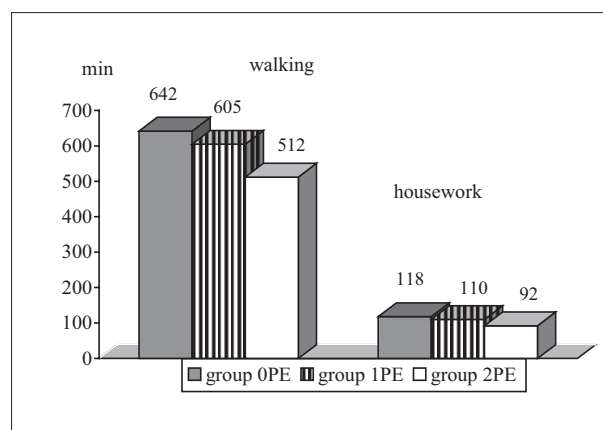
The results show that girls participating in two or more PE lessons show higher levels of school related PA in total and spend more time performing intensive PA at school than girls participating in one or no PE lesson.

At the same time, the school related PA expressed in percentage forms a larger part of total daily PA in the former group of girls than in the later two ones.

Frömel et al. (1999) monitored PA in PE lessons at secondary and elementary schools, and identified the lowest average PA intensity in girls at elementary

**Fig. 1**

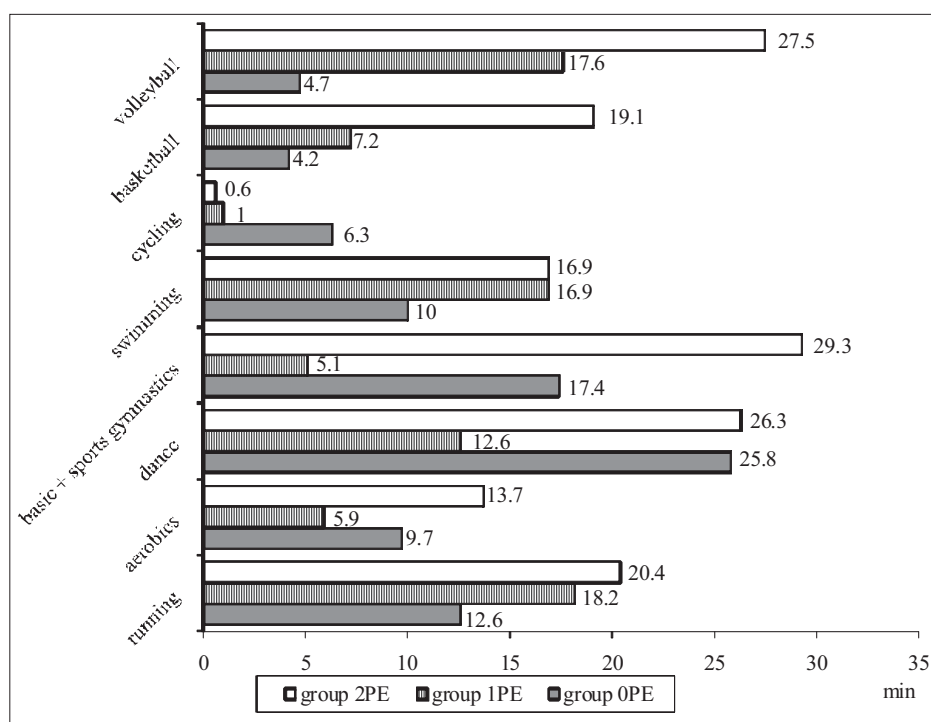
Total time in girls ( $n = 136$ ) spent walking or in housework



Legend: Group 0PE – a group without participation in PE lessons, Group 1PE – a group with participation in one PE lesson, Group 2PE – a group with participation in two or more PE lessons

**Fig. 2**

Total time in girls ( $n = 136$ ) spent in various kinds of PA



Legend: Group 0PE – a group without participation in PE lessons, Group 1PE – a group with participation in one PE lesson, Group 2PE – a group with participation in two or more PE lessons

schools (4.53 MET) and the highest in boys at secondary schools (5.28 MET). The measured values of PA were between 3.1–6 MET: moderate PA, e.g. gymnastics (4 MET), tennis-double (6 MET), basketball (not a competitive game – 6MET), volleyball (not a competitive game: 6–9 players, 3 MET), golf (4.5 MET) (Ainsworth et al., 2000). Adolescent girls at Polish secondary schools spent, at school, only 10 minutes on average in PA of such intensity (group OPE 8.6 min.; group 1PE 11.2 min.; group 2PE 11.5 min.).

All the girls spent most of their time in PI, on an average of 125 minutes (group OPE 118 min.; group 1PE 122 min.; group 2PE 136 min.). Physical inactivity included lying down, listening to music, reading in a vehicle, sitting, standing, watching TV, writing while lying down, etc. (Ainsworth et al., 2000).

Girls spent, in intensive PA of 6.1–12 MET at school, on an average of 0.3 minutes – group OPE, 0.5 minutes – group 1PE and 0.8 minutes – group 2PE.

Based on comparison with health recommendations, which suggest seven times a week of 60 and more minutes of moderate PA, and at least three times a week 20 minutes of intensive PA (USDHHS, 2008), we can argue that if the girls spent only 10 minutes on the average in moderate PA related to school, it seems to be rather an alarming finding.

In both moderate PA and intensive PA, our findings show that adolescent girls are a group at risk threatened by an inactive lifestyle and the diseases caused by it (DH, 2004; Riley & Jones, 2007).

#### Limits of the study

The results from ActiGraph were assessed together with using the record sheets into which the girls recorded at what time they put on and took off the monitor and the type and time of PA and PI. This procedure depends on the responsibility and precision of the participating girls and their perception of PA.

More detailed information about the mental state, psychological state and physical fitness of the participants was not ascertained.

The content of physical education classes was not observed.

#### CONCLUSION

The study has confirmed that school related PA (especially PE lessons) plays a significant role in education and is irreplaceable regarding the level of total daily PA in adolescent girls. Further, it is necessary to establish such material and legislative conditions which would enhance adolescent girls' participation in PE lessons and other types of organized PA. School related PA in Polish girls accounts for 34% of their total daily PA in school days. Considering the fact that adolescent girls spend

about half a day at school, we can argue that interventions carried out in the school environment are crucial.

Among the interventions that would enhance school related PA in adolescent girls, we can suggest introducing at least one physically active 30 minute long break during the school day, maintaining the number of PE lessons, or other types of organized PA. Further, girls' participation in organized PA outside of school should also be enhanced.

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### ANALÝZA ŠKOLNÍ POHYBOVÉ AKTIVITY ADOLESCENTNÍCH DÍVEK (Souhrn anglického textu)

**VÝCHODISKA:** Je dostatečně prokázané, že pohybová aktivita (PA) má pozitivní vliv na zdraví člověka. Z pohybově aktivního dítěte s vysokou pravděpodobností vyroste i pohybově aktivní dospělý jedinec. Se zvyšujícím se věkem zaznamenáváme u dětí a mládeže pokles PA. V období adolescence jsou dívky prokazatelně méně pohybově aktivní než chlapci a z tohoto důvodu jsou označovány z hlediska PA za rizikovou skupinu.

**CÍLE:** Cílem studie je charakterizovat školní týdenní PA adolescentních dívek a zjistit vliv participace ve vyučovacích jednotkách tělesné výchovy (VJTV) na skladbu týdenní PA.

**METODIKA:** Výzkum byl realizován za pomoci přístroje ActiGraph společně se zápisem do záznamního archu po dobu pěti školních a dvou víkendových dní.

**VÝSLEDKY:** Výsledky ukazují, že dívky účastníci se dvou nebo více VJTV vykazují celkově vyšší úroveň školní PA a i více času ve škole stráví intenzivnější PA, než dívky účastníci se jedné nebo žádné VJTV v průběhu týdne. Středně zatěžující PA (3–6 MET) strávily všechny dívky ve škole průměrně 10 minut a intenzivní PA (6–12 MET) průměrně 0,6 minut. Nejvíce času ve škole strávily dívky pohybovou inaktivitou, průměrně 125 minut. S přihlédnutím ke zdravotním doporučením určeným této věkové kategorii (sedmkrát týdně 60 minut středně zatěžující a třikrát týdně 20 minut intenzivní PA) naše výsledky potvrzují, že PA adolescentních dívek je oprávněně předmětem řady výzkumů a studií. Zároveň výsledky naznačují, že škola a s ní spojená PA (vyučovací jednotky TV) má stále v edukačním systému nezastupitelnou roli z hlediska celkové úrovně PA a zdravého životního stylu adolescentních dívek.

**ZÁVĚRY:** Zvýšení úrovně PA adolescentních dívek spatřujeme v navýšení PA související se školou (více VJTV, zavedení alespoň jedné pohybově aktivní 30minutové přestávky v průběhu školního dne, aktivní transport do školy a ze školy) a ve zvýšení participace dívek na mimoškolní organizované PA, a to včetně víkendů.

*Klíčová slova: střední škola, tělesná výchova, monitoring pohybové aktivity, dívky.*

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