PHYSICAL ACTIVITY DROP AFTER LONG SUMMER HOLIDAYS IN 6- TO 8-YEAR-OLD CHILDREN.

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Abstract

The objective of the study was to examine long summer vacation (LSV) effect on physical activity (PA) in 68 children from three Slovenian cities. PA was assessed over five consecutive days using accelerometer in 6- to 8-year-old children (N = 68; 35 girls and 33 boys, mean age 7.0 ± 0.8 years). PA was assessed on two occasions, before and after LSV and showed clear Gaussian distribution model. PA dropped after LSV for boys (9.6%, P = 0.004) and girls (9%, P = 0.014). Furthermore, PA intensity changed significantly after LSV. In boys *inactivity* increased after LSV from 69% to 72.2% (P = 0.009) and in girls from 71.7% to 74.2% (P = 0.031), while *light* PA decreased from 26.9% to 24% (P = 0.005) in boys and from 24.6% to 22.5% (P = 0.035) in girls. In 27% of boys and in just 13% of girls the amount of physical activity in June also determined the amount of physical activity in September. Furthermore, we found a significant drop in physical activity only in boys (P = 0.002) and girls (P < 0.001) with higher initial (June 2007) values. In conclusion we could state that there is a clear negative effect of long summer vacation on physical activity habits and needs further investigations for clear explanation.

Keywords: school children, intensity of physical activity, gender, accelerometer

Introduction

Regular physical activity in different forms is vital for child's development, strengthening and protection of health, keeping an adequate level of fitness and formation of behavioural patterns that ensure regular physical/sport activity throughout all life stages (Baranowski et al., 1992; Malina, 1996). The period of childhood is considered by many as vital in the formation of habits for a life-long physical/sport activity (Simons-Morton, Parcel, O'Hara, Blair & Pate, 1988; Kohl & Hobbs, 1998). Therefore, one of the most important objectives of physical activity in childhood is primarily adaptation to this life style that is supposed to continue into later stages of life, for such behaviour has several positive effects on human health (Sallis et al., 1999; Cavill, Biddle & Sallis, 2001).

Long summer holidays are very important for a child's comprehensive development and preparation for the school year, for during this period children are less burdened by school work and consequently have more time to spend on various free-time activities. Since during the summer holidays there are not as many organized free-time physical/sport activities as during the school year, children tend to spend more time sitting in front of the TV sets and computer monitors (Jurak et al., 2002). So far in Slovenia no investigation has been made into the immediate correlation between physical/sport behaviour during the school year and that during the summer holidays. According to Strel et al. (1993) and Jurak, Kovač and Strel (2001), the tendency of spending the summer holidays passively has increased in 7- to 12-year-old children. Observations have been made on the basis of subjective assessments of the methods of investigating physical activity (Baranowski, Thompson, DuRant, Baranowski & Puhl, 1993) as well as subjective measurements (Kristensen et al., 2007; Riddoch et al.,2007; Volmut, Dolenc, Šetina, Pišot, and Šimunič, 2008a, 2008b) indicating that in comparison with spring the level of activity in autumn is significantly lower. It has also been found that boys are physically more active than girls (Trost et al., 2002; Riddoch, et al., 2007; Volmut et al., 2008a) and that the duration and intensity of physical/sport activity decreases with a child's age (Trost et al., 2002; Šetina et al., 2007). We have, however, found no contribution comparing the influence of summer holidays on children with different physical/sport habits.

The aim of our research was to determine the quantity and intensity of physical/sport activity in younger primary school children before and after the long summer holidays using accelerometers. We were further interested in the way physical activity differs in girls and boys with different physical/sport habits.

Methods

CHILDREN: This study was conducted along with the target-research project of the Slovenian Research Agency and the Slovenian Ministry of Education and Sport entitled *"Children Amidst Influences of Modern Lifestyle – Motor Abilities, Physical Characteristics and Health Status of Slovene Children"* and coordinated by the Institute of Kinesiology Research, Science and Research Centre of Koper, University of Primorska. Sixty-eight randomly selected children were included in the study, aged 6 years (N = 21, 10 boys and 11 girls), 7 years (N = 23, 10 boys and 13 girls) and 8 years (N = 24, 13 boys and 11 girls). The sample was equally distributed among three Slovenian cities (Koper, Ljubljana and Maribor). Parents and children were pre-informed of the protocol and a written consent was obtained from parents.

ACCELEROMETRY: Accelerometers (Actilife, USA) were attached with elastic strap to the right hip and worn for five consecutive days – three weekdays and two weekend days. Accelerometers were not used during sleep, bathing and swimming. Children wore accelerometers on two occasions in two time periods in June 2007 (before long summer holidays – Jun2007) and in September 2007 (after long summer holidays – Sep2007).

DATA PROCESSING: The average data for one-minute epochs (in counts per minute – cpm) were stored in the accelerometer memory chip and downloaded to computer after each 5-day experiment. Furthermore, only data collected from 8 am until 8 pm were included in the analysis and filtered to exclude data collected when accelerometer was not worn (bathing, swimming). Inclusion criteria for data validation were: (i) at least four hours/day for valid day record, (ii) at least two valid weekdays and one valid weekend day for valid experiment, (iii) both valid experiments in Jun2007 and Sep2007.

To divide the time series of counts per minute, we used cut-off points suggested by Puyau et al. (2002) and associated energy expenditure (MET) estimated by equation of Freedson et al. (1998), whereas sedentary physical activity was below 800 cpm (< 2 MET), 800 cpm < light < 3200 cpm ($2 \leq$ MET < 4), 3200 cpm < moderate < 8200 cpm ($4 \leq$ MET < 8), and vigorous above 8200 cpm ($\geq$ 8 MET).

For the comparison of physical activity change after long summer holidays in children with higher and children with lower physical activity amounts we divided children into two groups. Half of the children (16 boys and 17 girls) with the lower amount of physical activity were labelled as children with lower physical activity amount, while the rest of them as children with higher physical activity amount.

STATISTICS: All data were analysed using Microsoft Excel (Microsoft Office 2003, Microsoft Co., USA), filtered with Matlab 5.3 (Mathworks Co., USA) and statistically analysed with SPSS for Windows 12.0 (SPSS Inc., USA). Average data are presented with standard error. Histograms are presented with fitted Gaussian distributed model. Linear model is showing Pearson correlations of data from before and after long summer vacations. For hypothesis testing, a repeated measures ANOVA was used with the level of significance $P < 0.05$.

Results

From eighty-four children included in this study sixty-eight of them completed the test successfully. Frequency distributions of the average physical activity results are presented in Figure 1. Gaussian trend has been observed in all four graphs. Clear shift toward smaller values could be observed from both vertical comparisons before and after long summer holidays.

Tables 1 and 2 summarize the results of the study for boys and girls, respectively. Physical activity dropped after long summer holidays in boys for 9.6% ($P = 0.004$) and in girls for 9% ($P = 0.014$). Furthermore, time spent in inactivity increased in boys for 3.2% ($P = 0.009$), while in girls for 2.5% ($P = 0.031$). Drop in light activity in boys for 2.9% ($P = 0.005$) and in girls for 2.5% ($P = 0.035$) compensated physical activity intensity shift towards lower intensities. Time spent in moderate and vigorous physical activity did not change significantly.

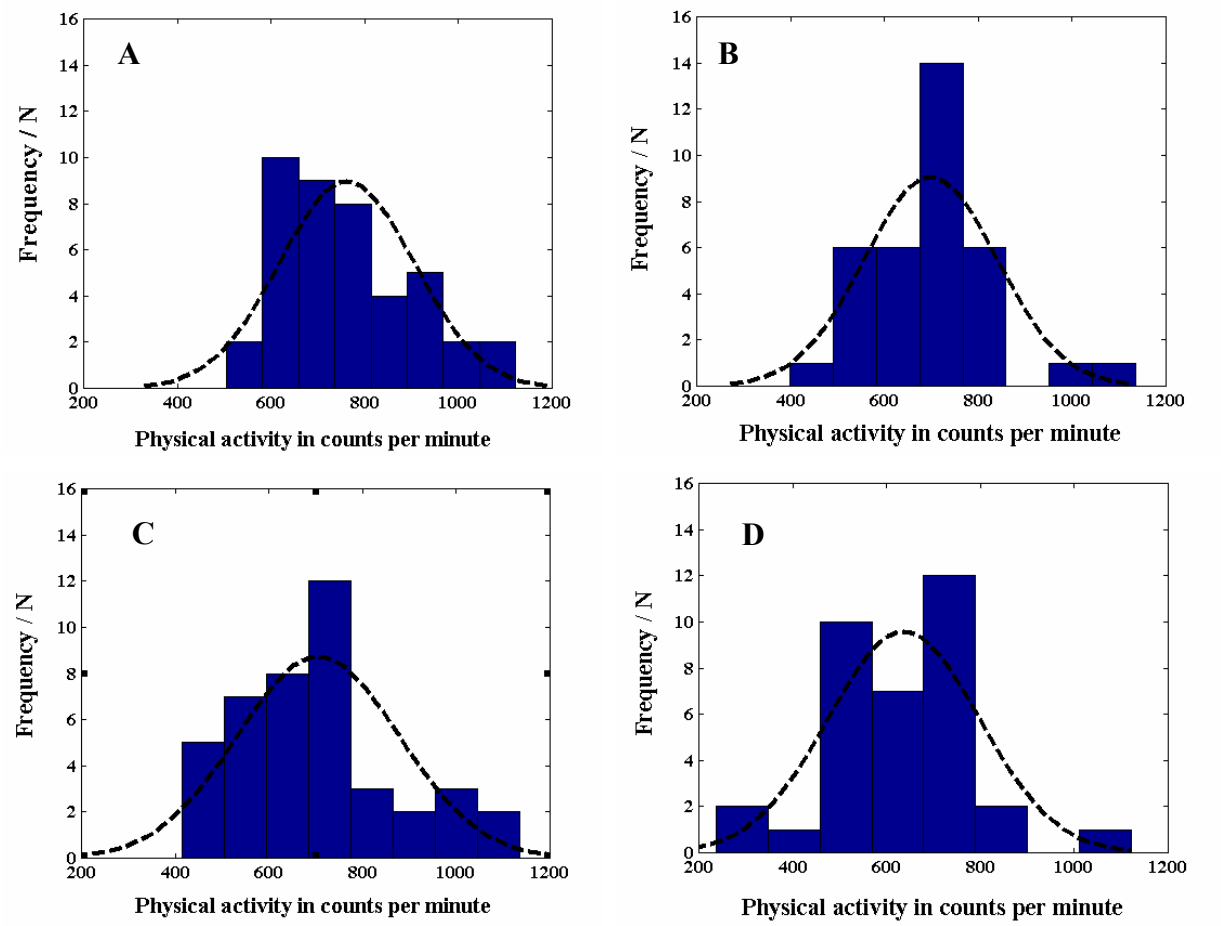

Figure 1: Frequency distribution of the average physical activity for 33 boys (A, C) and for 35 girls (B, D), before (A, B) and after (C, D) long summer holidays.

Table 1: Age, number, average physical activity (in counts per minute – cpm), percent time spent in inactivity, light, moderate and vigorous activity for boys.

Boys	**June 2007**	**September 2007**	**% change**	**P**
Age / years	6 to 8 years	6 to 8 years		
Number	33	33		
Average physical activity / cpm	766 ± 26	693 ± 26	9.6	0.004**
Time spent in inactivity / %	69.0 ± 5.4	72.2 ± 5.2	3.2	0.009**
Time spent in light activity / %	26.9 ± 4.2	24.0 ± 4.0	-2.9	0.005**
Time spent in moderate activity / %	4.07 ± 2.3	3.72 ± 2.2	-0.35	0.446
Time spent in vigorous activity / %	0.03 ± 0.1	0.04 ± 0.1	0.01	0.721

** *$P < 0.01$; Physical activity intensity levels estimated at < 2 MET, $2 \leq$ MET < 4, $4 \leq$ MET < 8 and ≥ 8 MET, for inactivity, light, moderate, and vigorous physical activity, respectively.*

Table 2. Age, number, average physical activity (in counts per minute – cpm), percent time spent in inactivity, light, moderate and vigorous activity for girls.

Girls	June 2007	September 2007	% change	P
Age / years	6 to 8 years	6 to 8 years		
Number	35	35		
Average physical activity / cpm	699 ± 26	636 ± 26	-9.0	0.014*
Time spent in inactivity / %	71.7 ± 6.8	74.2 ± 5.6	2.5	0.031*
Time spent in light activity / %	24.6 ± 5.6	22.5 ± 4.7	-2.1	0.035*
Time spent in moderate activity / %	3.56 ± 1.9	3.14 ± 1.6	-0.42	0.219
Time spent in vigorous activity / %	0.11 ± 0.2	0.07 ± 0.1	-0.04	0.277

* *$P < 0.05$; Physical activity intensity levels estimated at < 2 MET, $2 \leq$ MET < 4, $4 \leq$ MET < 8 and ≥ 8 MET, for inactivity, light, moderate, and vigorous physical activity, respectively.*

From figure 2 it is evident that in 27% of boys and in just 13% of girls the amount of physical activity in June also determined the amount of physical activity in September. Pearson correlations for both boys ($R = 0.52$, $P < 0.01$) and girls ($R = 0.36$, $P < 0.05$) were significant. Furthermore, in Table 3 we found a significant drop in physical activity only in boys ($P = 0.002$) and girls ($P < 0.001$) with higher initial (June 2007) values.

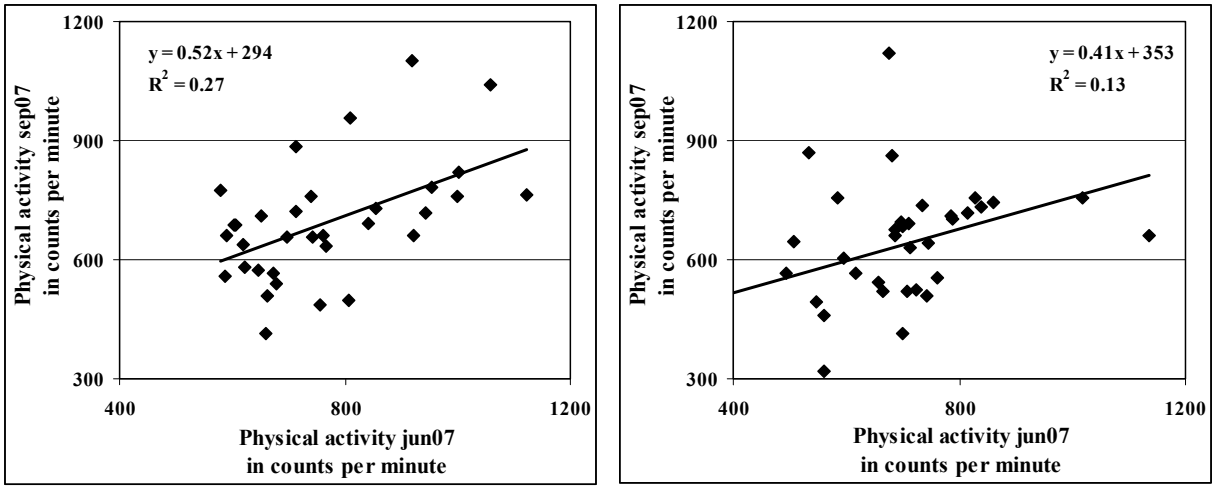

Figure 2: Individual analysis of the physical activity shift for boys (left graph) and girls (right graph).

Table 3: Change of the average physical activity (PA) after long summer holidays for boys and girls with lower and higher initial physical activity.

		June 2007	September 2007	% change	P
Boys with lower PA	**Average PA / cpm**	643 ± 11	635 ± 28	-1.3	0.786
Boys with higher PA	**Average PA / cpm**	882 ± 29	748 ± 40	-15.2	0.002**
Girls with lower PA	**Average PA / cpm**	597 ± 21	623 ± 51	4.4	0.559
Girls with higher PA	**Average PA / cpm**	795 ± 27	649 ± 24	-18.4	0.000#

** *$P < 0.01$;* # *$P < 0.001$;*

Discussion

Children should daily engage in at least 0.6% of high-intensity physical activity and 1.5% of moderate-intensity physical activity to meet the recommendations suggested by Trost (2007). The results show that younger primary school children engage in physical activity similar in intensity to that of the university student population (Cradock et al., 2004), which means that their lifestyle is predominantly sedentary and that they engage mainly in light-intensity physical/sport activities.

We have found that after long summer holidays, in comparison with the period before the holidays, children are physically less active, which also coincides with findings of other researches (Baranowski et al., 1993; Jurak, Kovač, Strel & Bednarik, 2003; Kristensen idr., 2007; Volmut, Dolenc, Šetina, Pišot & Šimunič, 2008a, 2008b). Girls and boys spend most of their time inactively or in physical/sport activities of low intensity both before and after the summer vacation. Similar results are stated also in the study conducted by Riddoch et al. (2007), where it was found that 11-year-old children spend most of their time in physical/sport activities of low intensity.

Furthermore, we found significant correlations between the amount of physical activity before and after long summer holidays. Even more, children with higher initial physical activity before long summer holidays lost a significant percentage (boys 15.2% and girls 18.4 %) after holidays, while others did not.

It is difficult to correlate the results of researches conducted in Slovenia with our research findings, for no comparison of results between physical/sport activity of children during the school year and during summer holidays has been made with comparable measurement instruments. According to previous studies conducted in Slovenia (Strel et al., 1993; Jurak, Kovač & Strel, 2001), where questionnaires were used to study free time activities during the summer holidays, only 7,7% of primary school children did not engage in any sport activity, while 33,2% of children engaged in sport activities on daily bases. 12-year-olds were physically most active. Authors of similar studies (Jurak et al., 2002) state certain possible explanations for the more passive way od spending free time during the summer break highlighting the increasingly sedentary and lying position of spending free time, differences in interests and motives for sport activity during the summer break and non-participation in organized sport programmes.

The decrease in the quantity of physical/sport activity after long summer holidays can also be explained by the increase of obligations related to school work upon re-entering the school environment and curricular and extracurricular sport programmes not yet taking place at the beginning of the school year. In September, the quantity of physical/sport activity can also decrease due to unfavourable weather conditions, which was not specifically recorded in our measurement.

Physical/sport activity of younger primary school children is left predominantly to the interests and motivation of children and encouragement of parents. Since during the summer holidays there are not as many organized physical/sport activities taking place as during the school year and there are also no physical education classes, children tend to be less physically active. This is precisely the reason why it would be sensible to promote physical/sport activity through different sport events and workshops and to enable the use of school sport surfaces and gyms also in summer. It would be useful to organize physical activities that would follow modern sport trends and would therefore be appealing to children.

Conclusion

The objective measurement instrument such as accelerometer is a suitable tool for modelling various measures to increase the level of physical/sport activity of children as well as other age groups. We believe it would be necessary to perform additional in-depth investigation to examine the influence of the seasons of the year on physical/sport activity while at the same time considering also other related variables (e.g. the level of outdoor activity, weather conditions). Since the research sample was small and geographically limited it would be reasonable to adequately enlarge the sample in future research and to systematically monitor the influence of the seasons of the year on physical/sport activity of Slovenian children using accelerometers.

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