

AN EVALUATION OF IRISH PRIMARY SCHOOL CHILDREN'S PHYSICAL ACTIVITY DURING THE SEGMENTED SCHOOL-DAY

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INTRODUCTION:

Despite evidence that physical activity (PA) provides fundamental health benefits for children (Strong et al., 2005), many Irish (Woods et al., 2010), other European (Riddoch et al., 2007) and American children (Centers for Disease Control and Prevention, 2005) do not meet the PA guideline of 60 minutes of moderate to vigorous physical activity (MVPA) daily (World Health Organisation, 2010), rendering PA promotion essential. The school is a popular location to promote PA as it gives access to the vast majority of children of different ethnic and socio-economic backgrounds (Peterson and Fox, 2007).

A typical day at primary school consists of three main segments: class, break- and lunch-time. An analysis of the segmented school-day highlights PA opportunities for children, trends in school-day PA and times where PA may be beneficial. Four studies assessed primary school children's PA within the segmented school-day (Nettlefold et al., 2011, Tudor-Locke et al., 2006, Brusseau et al., 2011, Bailey et al., 2012). Two US studies assessed the school-day activity of elementary school children. They reported that lunch-time provides the largest source of step counts during the school-day for 9.6-yr-old boys and girls (Brusseau et al., 2011). Eleven year-old boys and girls accumulated the highest steps at lunch-time and physical education (PE) respectively (Tudor-Locke et al., 2006). Pedometers were used to measure PA in these studies. The findings do not show the contribution of school time activity towards meeting the daily PA intensity guideline.

A study of 10- to 14-yr-old British children utilised accelerometers for PA analysis, thus were able to explore PA intensity levels during the segmented school-day (Bailey et al., 2012). The findings of this study showed that girls spent significantly more time in sedentary behaviour and light PA during recess and lunch-times than boys. Boys engaged in more vigorous PA at break-time and moderate PA and vigorous PA at lunch-time than girls. Although this study identified gender PA differences during the segmented school-day, the age range of the sample is not representative of primary level only. It is imperative to identify primary school children's PA alone to detect this age group's PA for future initiatives that will attempt to delay the age-related decline in PA (Waring et al., 2007).

A further Canadian study examined elementary school children's PA during the segmented school-day using accelerometers (Nettlefold et al., 2011). The findings of this study showed that 8- to 11-yr-old boys and girls accumulated the following minutes of MVPA at school: 5.3 and 3.8 at break-time, 15.6 and 12.5 at lunch-time, 4.6 and 5.2 minutes during PE and 39.9 and 33.8 during class time. Overall these boys and girls accumulated a total of 63.5 and 52.9 minutes of MVPA at school, indicating that the children's average school-day minutes of MVPA exceeded or almost reached the daily recommendation of 60 minutes of MVPA. This finding is unusual as studies conducted worldwide indicate that the majority of children do not meet the daily PA

guideline (Riddoch et al., 2007, Woods et al., 2010, Centers for Disease Control and Prevention, 2005).

In summary, previous studies of children's PA during the segmented school-day did not use accelerometers to identify primary school children's PA exclusively where low daily PA levels were previously identified. It is important to identify children's PA levels during the segmented school-day in locations that previously reported low daily PA to determine usual school-day PA behaviours. Thus, the purpose of the present study is to firstly determine the amount of minutes children spend in MVPA during the segmented school-day and secondly identify whether gender differences are evident in the time spent in MVPA in the school-day.

METHODS:

Participants

Participants were recruited from four mixed urban primary schools in Co. Kerry. Third-sixth class children were invited to participate in the study: 165 children from a possible total of 184 volunteered to participate. Informed consent was obtained from parents/guardians. Children provided written assent to participate. Participants were free to withdraw from participating in the research at any stage. Ethical approval was granted by the college's Ethics Committee.

Instrumentation

Actigraph accelerometers (Models GT3X/+, Pensacola, FL32502) were calibrated to measure PA in 5-second epochs (Mc Clain et al., 2008). Exact times for PE, break- and lunch-times were obtained from the class teachers for MVPA analysis. Time filters within Actilife software (Version v6.1.3, Pensacola, FL32502) were applied to extract minutes of MVPA during school-day, break-time, lunch-time, class and PE. To represent differences in the length of time segments, time spent in PA was stated as minutes accumulated and a proportion of the total segment time.

Procedures

Children's anthropometric measurements were taken the day before PA monitoring began according to standardised procedures (Lohman et al., 1988) using a portable stadiometer (Seca, Leicester, UK) and electronic personal scale (model 899, Seca, UK). Body Mass Index (BMI) for each child was calculated and assigned to normal, overweight and obese categories according to age- and sex-specific BMI values (Cole et al., 2000).

PA data was collected at one school (n=37) in March 2012 and another three schools (n=128) in September/October 2012. Participants were fitted with an accelerometer on an elastic belt and instructed to wear the same device during school hours only for five consecutive school-days (PE scheduled on one day). Participants were instructed to wear the accelerometer at the centre of the right hip (over/under the school jumper), remove it for water based activities and to follow their normal daily routine. The day before the PA testing period, children wore it during school time to minimise the influence of possible behaviour change. The researcher checked the position of the accelerometers on the first day of PA monitoring. Accelerometers were collected at the end of the last school-day monitored.

Statistical Analysis

The day after data collection testing period, accelerometer data was downloaded and screened for extremely high values and compliance with the monitoring protocol using Actilife software. The inclusion criterion was at least two school-days (300 minutes daily). Sustained 20-minute periods of zero counts were defined as non-wear time and were excluded from the analysis (Treuth et al., 2003).

Evenson et al. (2008) age-specific cut points, recommended by Trost et al. (2011), were used to determine participants' MVPA (≥ 2296 cpm). Statistical analysis was performed using SPSS v20 and the significance accepted at $P < 0.05$. PA data was not normally distributed, thus Mann Whitney U tests were used to determine whether there was a significant gender difference for minutes of MVPA for the whole school-day, PE, class, break- and lunch-times.

RESULTS:

116 participants of a total 165 participants met the wear-time criteria and were included in the final analysis. Six participants were not included in the PE data analysis as they did not have data for this segment. Final sample sizes were 110 for PE and 116 for class, break-, lunch-times and the whole school-day.

Descriptive characteristics

Descriptive characteristics of participants are presented in Table 1. Five participants (one girl, four boys) were classified as obese, 27 participants (16 girls, 11 boys) were overweight and 81 participants (40 girls, 41 boys) were of normal weight. There was no significant gender difference for BMI. Anthropometric measurements of three children (two boys, one girl) are unavailable as they were absent when measurements were taken.

Table 1. The mean (SD) values for the anthropometric characteristics of Irish primary school children.

	Total sample (n=116)	Boys (n=58)	Girls (n=58)
Age (years)	11.2 (1.2)	11.2 (1.1)	11.1 (1.3)
Weight (kg)	42.1 (9.8)	42.0 (9.7)	42.2 (9.9)
Height (m)	1.5 (0.1)	1.5 (0.1)	1.5 (0.1)
BMI (kg/m²)	19.3 (3.0)	19.5 (3.1)	19.1 (3.0)

School environmental factors and practices

All schools had a hall for PE lessons, playground markings and loose equipment available at break-/lunch-times. All schools permitted students to use the bathroom during playground time. Three schools designated time to eat before the scheduled playground time. One school used half of the scheduled break-/lunch-times for eating.

Segmented school-day MVPA

The school-day consisted of 330-340 minutes with 15-20 minutes for break time, 30 minutes for lunchtime, 30-60 minutes for PE scheduled once weekly, 285-290 minutes for class time on days without PE and 225-255 minutes for class time on days with scheduled PE. Boys spent significantly more time than girls in MVPA in the whole school-day, break-, lunch-time and PE (see table 2). No significant gender differences were found for class MVPA. Figure 1 illustrates the proportion of time boys and girls spent in MVPA during each school-day segment.

Table 2. The mean (SD) values of Irish primary school children’s minutes of MVPA during the whole school-day, PE, class, break- and lunch-times.

Minutes of MVPA	Boys	Girls	p-value
Whole school-day	22.6 (6.8)	14.7 (4.8)	0.000
Break-time	4.5 (2.4)	2 (1.2)	0.000
Lunch-time	7.7 (3.3)	3.8 (2.4)	0.000
Class time	8.6 (4.9)	7.4 (4.3)	0.102
PE time	10.5 (5.2)	8.5 (5.6)	0.029

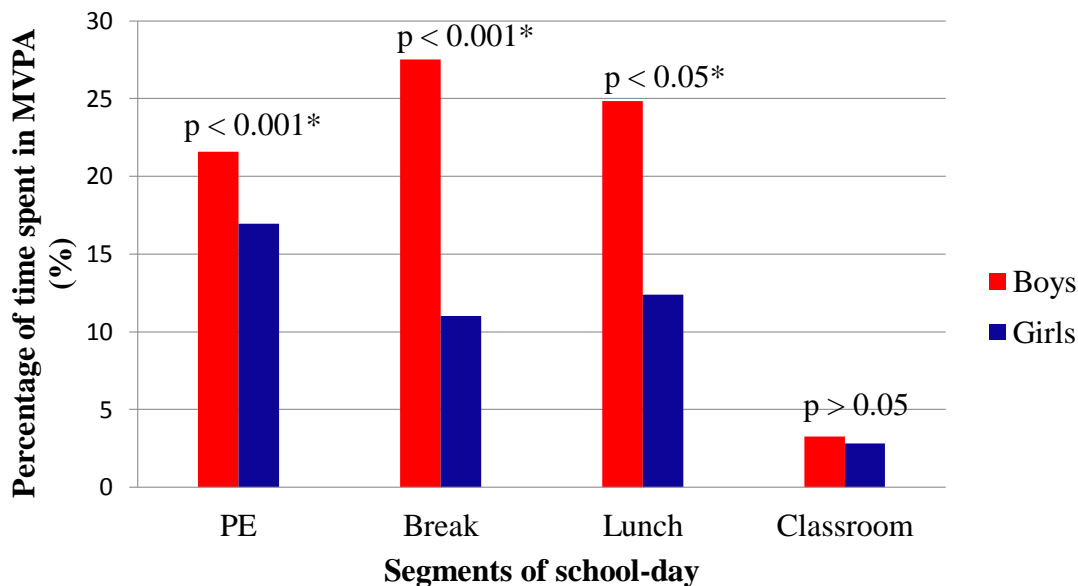


Figure 1. Proportion of time Irish boys and girls spent in MVPA during each segment of the school-day. (*) Statistical significant difference for boys’ vs. girls’ MVPA.

DISCUSSION:

The purpose of this study was to determine the amount of minutes 8- to 12-yr-old children spend in MVPA during the segmented school-day and identify whether gender differences exist in the time spent in MVPA in the school-day. The results of this study extend the current literature by providing an account of the time primary level children spent in MVPA during the segmented school-day using accelerometers where low daily PA levels were previously reported. The findings of the study will be discussed under the following headings: scheduled PE MVPA, break-/lunch-time MVPA and class time MVPA.

Scheduled PE MVPA

Boys and girls in the present study spent 21.6% and 17% in MVPA during PE. The Irish children spent a higher proportion of PE time in MVPA than 8- to 11-yr-old Canadian children (girls and boys spent 13% and 11.4% of time in MVPA) (Nettlefold et al., 2011). The varying PA levels among the Canadian and Irish children may have been due to different teaching

styles/curriculums. Nettlefold et al. (2011) suggested that PE lessons may have focused on the non-PA aspects of the curriculum when monitored. Although all schools in the present study had a hall available for PE lessons, the duration of scheduled weekly PE ranged from 30-60 minutes. The Department of Education and Skills (DES) recommends that every primary school pupil should have at least 60 minutes of PE each week. Following the DES PE guideline may enable more children to meet the daily PA guideline.

Although PE is a structured segment where children's PA is directed by the teacher, girls spent a significantly lower proportion of time in MVPA during PE than boys. This indicates that the boys performed the activities in PE at a higher intensity than the girls. Conversely, three studies did not report a significant difference between boys' and girls' minutes of MVPA (Nettlefold et al., 2011) and step count (Brusseau et al., 2011, Tudor-Locke et al., 2006) during PE. This finding suggests that the Irish PE lessons yielded significantly lower activity levels from girls than boys which contrasts with findings of PE lessons in other countries. It is well documented that girls are less active than boys (Waring et al., 2007) and understanding girls' PA trends within the school-day is important to effectively intervene. Girls in the present study spent the highest proportion of school-day MVPA during PE. Likewise, Brusseau et al. (2011) also found girls to be most active during PE than other school-day segments. These findings suggest that providing structured activities for girls during unstructured segments (break-/lunch-times) may lead to higher levels of PA and warrants investigation.

Break- and lunch-time MVPA

Boys and girls participating in the present study engaged in MVPA for 27.5% (4.5 minutes) and 11% (2 minutes) of break-time and 24.9% (7.7 minutes) and 12.4% (3.8 minutes) of lunch-time. In the UK, Ridgers et al. (2005) suggest that an achievable goal for primary school-aged children is to spend at least 40% of break-/lunch-times in MVPA. The participants in the present study did not attain an average of 40% of time in MVPA during either segment. British boys and girls aged 10-14 years spent a higher proportion of time in MVPA at break- (47%, 30.5%) and lunch-time (45.3%, 26.1%) than participants in the present study (Bailey et al., 2012) which may have been due to the time allotted for this segment (45-65 minutes for the British lunch-time, 30 minutes for the Irish lunch-time). Research suggests that children are more active in longer breaks due to providing sufficient time for children to organise and play complete games/activities (Ridgers et al., 2007). Overall, Irish children spent a low proportion of break-/lunch-time in MVPA which suggests that these segments present an opportunity to increase children's MVPA. Girls in particular would benefit from an intervention during break-/lunch-times as they were significantly less active than boys and spent a lower proportion of time in MVPA during these segments than PE time.

Class time MVPA

As expected of a usual seated segment, boys and girls in the present study spent a low proportion of class time in MVPA (3.3% and 2.8%). Primary school children's minutes of MVPA during class time has only been analysed in two other studies (Bailey et al., 2012, Nettlefold et al., 2011). Children in these studies spent about four times the proportion of class time in MVPA than the Irish participants: British boys and girls spent 11.2% and 10.2% of class time in MVPA (Bailey et al., 2012) and Canadian boys and girls spent 14.1% and 12% of class time in MVPA (Nettlefold et al., 2011). It is unclear why the Canadian and British children were more active in the class setting than the Irish children. However, the British children spent more time in the class (5-6 hours) than the Irish children (4-5 hours) which may have allowed for more class activity. Furthermore, different curriculums/teaching styles may promote more activity in the class however as these studies do not state these aspects it is only speculative. Children worldwide spend a large proportion of the school-day in class time. The findings of the present study suggest that children only accumulate a small proportion of MVPA during this segment. Therefore, the class time would provide an opportunity to increase children's daily PA with programmes like

Take 10! (Stewart et al., 2004) and Bizzy Breaks! (Murtagh et al., 2013). Furthermore, both boys and girls spent the least proportion of time in MVPA during this segment which indicates that activating the curriculum and/class time activity breaks for lesson transitions may assist both genders in increasing their daily minutes of MVPA.

Study strengths and limitations

Two strengths of this study include: 1) accelerometers were used to measure children's PA, allowing a direct comparison to existing and future school-day accelerometer studies and 2) the sample consisted of an equal amount of boy (n=58) and girl (n=58) participants which facilitated a gender balanced analysis of PA.

Study limitations include that the majority of participants were in sixth class grade level at the time of monitoring therefore caution needs to be taken when generalising the results against the 3rd-6th class national population as activity levels generally decrease with increasing age (Waring et al., 2007). Research also states that the measurement of children's PA over four to five days is ideal to achieve a 0.80 reliability of children's PA data (Troost et al., 2000) however, it must be noted that data for four days was not available for 43 participants (36.8% of participants).

CONCLUSION:

The findings indicate that Irish children spent a low proportion of PE, class and break-/lunch-times in MVPA. Girls spent significantly less time than boys in MVPA in the whole school-day and all segments of the school-day except for class time. This is the first study to examine primary level children's PA exclusively using accelerometers during the segmented school-day where low daily PA levels were previously reported. The study identifies the potential of class, break- and lunch-times to increase primary level children's PA at school.

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