Physical Activity During School Recess:
The Liverpool Sporting Playgrounds Project

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Recess offers primary-school-age children the opportunity to engage in physical activity, though few studies have detailed the physical activity levels of children in this environment. The physical activity levels of 270 children ages 6–11 years from 18 schools were monitored on 1 school day using heart rate telemetry. Data revealed that boys engaged in higher levels of moderate-to-vigorous and vigorous physical activity (MVPA) than did girls during recess (26 and 20 min, respectively). These results suggest that recess can make a worthwhile contribution to the recommended 60 min of MVPA per day.

The importance of a physically active lifestyle has been well documented (17). Studies that have investigated the relationship between physical activity (PA) and health, primarily in adult populations, indicate that higher levels of PA are associated with a reduced risk of coronary heart disease, osteoporosis, diabetes, stroke, some cancers, and obesity (11,18,24). Psychological benefits of a physically active lifestyle have also been documented, with PA being used as a treatment to improve psychological well-being (6). Although the relationship between activity and health is not as clear in children (17), it is hypothesized that a physically active lifestyle in childhood will reduce the health risks associated with inactivity and will benefit health in adult life (3,9).

In order to enhance quality of life and promote health, guidelines suggest that children should engage in 60 min of daily moderate-to-vigorous physical activity (MVPA; 2). There is growing concern, however, that children do not engage in enough PA to promote health. A study by Riddoch et al. (19) found that children were active for less than 1 hr a day, and 14- to 16-year-old children were less active than their 11- to 13-year-old counterparts. More recently, Armstrong and Welsman (1) and Sleap and Warburton (26) reported that considerable numbers of young children did not participate in enough sustained activity to promote cardiorespiratory fitness (25). A study by Sleap and Tolfrey (25), however, which included light, moderate, and vigorous PA thresholds, found that children exceeded daily PA recommendations. The authors concluded that the thresholds used and the interpretations of research findings could influence the way in which children’s PA levels are interpreted. Whereas methodological problems in PA research remain
unresolved, the majority of studies on PA in children have found that PA levels are low and need to be improved. Therefore, studies that aim to promote active lifestyles in children are needed (18).

PA is a multidimensional and complex behavior (18). A number of psychological, environmental, and social factors have been reported to influence PA behaviors in children; these include maturation, perceived barriers to activity, parental and peer behaviors, self-efficacy, and facilities available to the children (9). One recommended setting for PA promotion is the school (31). Because children spend a substantial proportion of their day at school, this context can play a critical role in the development of PA behaviors (9). Within the school environment, physical education classes and recess represent the two main opportunities for children to be active (21). With the time available for physical education decreasing as a result of increasing pressures on curricula time (23), however, school recess might prove to be the main opportunity for children to be physically active (30), particularly because the time spent in recess exceeds that spent in structured physical education classes (10). In the U.K., children experience up to 600 recess periods a year (based on 3 times a day, 5 days a week, 39 weeks a year; 27). Recess could, therefore, contribute considerably to the accumulation of the recommended 60 min of MVPA a day (2). Although no PA recommendations have been developed for recess, it has been suggested that children should engage in MVPA for 50% of the time available (29). This suggestion was extrapolated from physical education guidelines recommending that children should engage in MVPA for 50% of lesson time (31).

Although children best accumulate PA in free, unstructured environments (14), scant attention has been paid to school recess, which has been described as “probably the most enjoyable part” of the school day (5, p. 170). In studies that have focused on PA during recess, it is generally reported that boys are more active than girls (10,29,33). Unfortunately, these investigations have been on a small scale and involved low numbers of children in few schools. Therefore, much larger studies that measure PA objectively are required.

The purpose of this study was to quantify the PA levels of children during school recess and to assess gender and age differences on the dependent variables. A secondary aim of this study was to determine the extent to which recess could contribute to PA recommendations and to ascertain whether the children met the proposed 50% MVPA threshold during school recess (29).

Method

Participants and Setting

One hundred and forty-nine boys and 147 girls randomly selected from 18 schools in the northwest of England provided informed signed parental consent to participate in the study. The mean age of the children was 8.0 years (± 1.5 years), with 75 classed as early primary children (38 boys, 37 girls, mean age = 6.2 ± 0.7 years) and 221 classed as late primary children (111 boys, 110 girls, mean age = 8.6 ± 1.1 years). The mean body mass index (BMI) for the whole group was 17.53 (± 2.84) kg/m².

All the children participating in the project followed their normal daily school routine. The recesses monitored were morning, lunch, and afternoon. The mean daily recess time available for the children to engage in PA on the playground was
84 (± 12.3) min. Recess time was measured from the time the school bell rang to start recess to the time it rang to conclude recess. The total time for morning, lunchtime, and afternoon recesses was 19 (± 4.5), 60 (± 7.7), and 15 (± 2) min, respectively. All the schools were located in the same geographical area, and none of the schools had new playground markings at the time of the current study. This study was carried out as part of the Liverpool Sporting Playgrounds Project (LSPP); the full details have been reported elsewhere (30).

**Instrumentation**

The Polar Team System (Polar Electro Oy, Kempele, Finland) heart rate monitor was used to measure the children’s physiological response to recess. Heart rate was recorded every 5 s. The children’s resting heart rate (RHR) was determined by averaging the 5 lowest recorded heart rate values during the period of data collection (8). This definition was used because it is the most common in the literature, and it takes into account the effect that age and fitness can have on children’s RHR (12). Heart rate reserve (HRR) values of 50 (HRR\text{50}) and 75 (HRR\text{75}) per cent were used as threshold values to represent MVPA and VPA (vigorous physical activity), respectively. HRR\text{50} equates to a brisk walk (1), and HRR\text{75} equates to a measure of VPA because it is thought that this intensity increases cardiorespiratory fitness in children (15,28). Maximum heart rate was set at 200 bpm (28).

Heart rate telemetry has been validated for use with children (24) and it has good test–retest reliability when used in the playground context (32). Of the initial 296 children in the study, complete data sets for 135 boys (32 early primary and 103 late primary) and 135 girls (32 early primary and 103 late primary) were used in subsequent analyses. Twenty-six children’s heart rate data were lost through electronic interference. HRR was subsequently used to calculate HRR\text{50} (MVPA) and HRR\text{75} (VPA) thresholds for each child. The percentage of absolute time per day each child spent at or above HRR\text{50} and HRR\text{75} was calculated and used in subsequent analyses.

**Procedure**

Eighteen children from each school had their heart rates monitored on 1 school day between July and November 2003. Measurements of stature and body mass were recorded using the Seca scales (Seca Ltd, Birmingham, UK) and the Leicester Height Measure (Seca Ltd, Birmingham, UK) before fitting the monitors. Heart rate monitors were fitted to the children at the beginning of the school day. During this time children were instructed to seek the researchers for refitting if the monitors became detached. Children were then asked to follow their normal daily routine. Children wore the monitors during morning and lunch recess, and children from 10 schools wore the monitors during an afternoon recess. Monitors were removed at the end of the school day.

**Data Analysis**

Heart rate data were downloaded using the Polar Team System Interface and analyzed using the Polar Precision Performance™ 3.0 Software (Polar Electro Oy, Kempele, Finland). All data were analyzed using the Statistical Package for the Social Sciences (SPSS®) version 11. The dependent variables were the percentage
of time and absolute time (min) spent in MVPA and VPA during recess over the whole school day. The independent variables used to group the data were gender and age. Descriptive data for age, stature, body mass, BMI, RHR, HRR\textsubscript{50}, HRR\textsubscript{75}, and mean heart rates during each recess period for gender and age group were also determined. Independent \( t \) tests were used to examine gender and age group differences on these data. Initial exploratory analyses were conducted on the data to establish whether any differences existed between the percentage MVPA and VPA accumulated across two (morning and lunch) or three (morning, lunchtime and afternoon) recess periods, as well as the time of data collection. The main analysis consisted of a \( 2 \times 2 \) (Gender \times Age group) analysis of covariance in order to analyze gender and age differences on the dependent variables (with play duration and BMI as the covariates). The alpha level was set at \( p < .05 \).

**Results**

**Descriptives**

The mean (± SD) values for the children’s anthropometric and physiological characteristics are shown in Tables 1 and 2.

**Exploratory Analyses**

**Recess Periods.** One-way analyses of variances (ANOVAs) revealed no significant differences between the children’s percentage of MVPA, \( F (1, 268) = 0.2; p > .05 \), and VPA, \( F (1, 268) = 0.1; p > .05 \), whether they engaged in two recess periods or three. The MVPA and VPA data from the differing number of recess periods were subsequently collapsed into total recess time, and number of recess periods was not used as a factor in the ensuing analyses.

**Seasonal Differences.** One-way ANOVA’s revealed no significant differences between the children’s total percentage of MVPA, \( F (1, 268) = 2.4; p > .05 \), and VPA, \( F (1, 268) = 1.1; p > .05 \) across the period of testing. The MVPA and

<table>
<thead>
<tr>
<th>Whole group</th>
<th>Boys</th>
<th>Girls</th>
<th>Early primary</th>
<th>Late primary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>8.0 ± 1.5</td>
<td>7.9 ± 1.5</td>
<td>8.0 ± 1.4</td>
<td>6.2 ± 0.7²</td>
</tr>
<tr>
<td>Body mass (kg)</td>
<td>30.9 ± 8.1</td>
<td>31.4 ± 7.9</td>
<td>30.5 ± 8.3</td>
<td>25.3 ± 5.3²</td>
</tr>
<tr>
<td>Stature (m)</td>
<td>1.32 ± 0.91</td>
<td>1.33 ± 0.09</td>
<td>1.31 ± 0.09</td>
<td>1.23 ± 0.07²</td>
</tr>
<tr>
<td>BMI (kgm\textsuperscript{-2})</td>
<td>17.5 ± 2.8</td>
<td>17.6 ± 2.8</td>
<td>17.4 ± 2.9</td>
<td>16.6 ± 2.5²</td>
</tr>
</tbody>
</table>

²Significant \( t \) test interage group results: early primary < late primary, \( p < .01 \).
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Main Analyses

**MVPA.** Boys and girls engaged in MVPA for 31 (± 17) and 24 (± 17) percent of recess time, respectively. ANCOVA revealed a significant main effect for gender, $F(1, 235) = 8.1; p < .01$, but not age ($p > .05$). The gender-by-age group-interaction effect was not significant, $F(1, 235) = 1.2; p > .05$. The results indicate that boys engaged in almost 26 min of MVPA during school recess compared with 20 min for girls (see Figure 1).

**VPA.** Boys and girls engaged in VPA for 11 (± 11) and 8 (± 10) percent of recess time, respectively (Table 3). The ANCOVA revealed a significant main effect for gender, $F(1, 235) = 8.8; p < .01$, but no main effect for age on VPA was found. The gender-by-age group-interaction effect for VPA was not significant, $F(1, 235) = 2.1; p > .05$. The results indicate that boys engaged in 9 min of VPA during school recess compared with 7 min for girls; the absence of an interaction suggests that this difference was constant over time.

Discussion

This study investigated the PA levels of children during school recess. This has taken recent work by Stratton et al. (27,28) forward by using a larger sample of children and assessing PA against recently proposed guidelines (29). Data revealed that the boys engaged in significantly more MVPA and VPA than girls, which supports the results of previous studies (10,21,22,27,29,33). The results contrasted with the findings of Mota and Stratton (13) and Santos et al. (20), however, who found that girls engaged in significantly more MVPA during recess. The latter studies were
Figure 1 — Early and late primary boys’ and girls’ MVPA during school recess using raw scores (mean ± SD). The 50% threshold value is marked on the graph (29).

*Significant intergender difference: boys > girls, p < .01.

Table 3 Percentage of Time Spent in MVPA and VPA During Recess (Raw Scores: Mean ± SD)

<table>
<thead>
<tr>
<th></th>
<th>Whole group</th>
<th>Boys</th>
<th>Girls</th>
<th>Early primary</th>
<th>Late primary</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVPA</td>
<td>28 ± 17</td>
<td>31 ± 17*</td>
<td>24 ± 17*</td>
<td>30 ± 26</td>
<td>27 ± 17</td>
</tr>
<tr>
<td>VPA</td>
<td>9 ± 9</td>
<td>11 ± 10*</td>
<td>8 ± 8*</td>
<td>15 ± 19</td>
<td>9 ± 8</td>
</tr>
</tbody>
</table>

*Significant intergender difference: boys > girls, p < .01.

conducted with Portuguese children, suggesting that cultural reasons might underlie this finding, although this possibility was not reported by these studies.

Although the reasons behind the gender differences in the levels of PA are not widely established (22), it might be that they are affected by the children’s attitudes and beliefs about recess. Blatchford and his colleagues (4) investigated the effects of social influences on the children’s behavior on the playground, and they found that although boys tended to play more ball games, girls engaged in more conversation and sedentary play, which led to lower levels of PA. Evans (7)
reported similar findings when looking at children’s attitudes towards recess, with boys seeing recess as an opportunity to engage in active games, whereas girls saw it as an opportunity to socialize with friends. In the present study, boys might have engaged in higher levels of PA because they saw it as an opportunity to play competitive games, which dominate the school playground (16). In such circumstances, the girls tend to situate themselves around the perimeter of this area, engaging in more sedentary behaviors because the space for physical activity is limited (16). This, in turn, could explain in part girls’ lower PA levels.

Current PA guidelines recommend that all children engage in MVPA for 60 min a day (2). In this study, the results indicate that recess accounts for about a third of daily recommendations for PA in primary school children. The findings that boys and girls engaged in MVPA for 31% and 24% of recess time, respectively, is lower than the PA levels reported by Stratton (28), who found that the children engaged in MVPA for 35% of recess time before a playground-markings intervention took place. The PA levels in this study are higher than in another study reported by Stratton (27), in which boys engaged in MVPA for 15% and 29% of recess time, and girls engaged in 15% and 23% of recess time during the summer and the winter, respectively. These differences might be attributed to more effective sampling and larger sample sizes in this study. Results from this investigation also contrast with the findings of Santos et al. (20), in which girls were found to engage in MVPA for 38% of recess time compared with 31% in boys. Although the results reported vary across the studies, no studies met the recommendation of spending 50% of recess time in MVPA as proposed by Stratton and Mullan (29).

In this investigation boys engaged in 26 min of MVPA during recess time, just 4 min short of the minimum PA recommendation of 30 min of MVPA a day for children (2). The girls were two-thirds (20 min) of the way toward meeting this minimum recommendation. In the study, a total of 56 boys (20.7%) and 37 girls (13.7%) engaged in 30 min or more of MVPA during recess. This suggests that recess represents a significant context for PA promotion in some children. Methods for promoting PA behaviors during recess should be paramount, particularly in the light of growing concerns that the numbers of overweight and obese children are increasing across Europe (11).

There are no published targets for PA during recess. Data from this study, however, suggests that a threshold of 40% of PA during recess might be a more achievable health-promotion target for schools because it corresponds to just over 30 min of MVPA per day. In the present study, 43 boys (15.9%) and 30 girls (11.1%) engaged in MVPA for over 40% of the playtime available. Some primary-age schoolchildren might therefore meet the minimum daily recommendation through recess alone, potentially benefiting health both in childhood and in later life. Future studies are needed, however, to determine, first, whether this threshold is a suitable marker for children’s activity within the playground context and, second, whether it represents a useful threshold for achieving minimum daily PA recommendations in a school context.

The current study attempted to investigate the PA levels of primary school children using heart rate telemetry; its use to quantify PA, however, has a number of limitations. The recorded heart rate can be affected by factors including emotional state, level of fitness, and the type of muscle contractions used (19,27). The recording interval used can also present a problem, with longer recording intervals being less sensitive to children’s intermittent PA patterns compared with shorter intervals,
though this study attempted to counter this by monitoring heart rate every 5 s. Heart rate monitoring is also a reactive method because the children know that they are being monitored and might alter their playground behavior accordingly (19). Nevertheless, heart rate is a widely used method for the assessment of PA, and it is valid and socially acceptable to use with pediatric populations. Furthermore, heart rate monitoring enables the assessment of the frequency, intensity, and duration of activity in a nonrestrictive manner.

A further limitation to this study was that children’s PA was monitored on 1 school day. Though there are no reported data on children’s day-to-day variation in PA during recess, this study attempted to overcome this limitation by using a relatively large sample size. Studies that have investigated children’s daily habitual activity using heart rate have monitored children for 4 consecutive days (25) to gather data that was representative of daily PA. Because recess represents a more stable context in the school day of a child, further investigation is needed to determine the stability and pattern of PA behavior in this setting.

**Conclusion**

The aims of this study were to determine the PA levels of girls and boys during recess and to analyze data by gender and age. A further aim was to establish the extent to which school recess contributed to daily PA accumulation. The results of the study indicated that boy’s PA was higher than girls’, and that larger numbers of boys than girls met the proposed marker of 40% of playtime spent in MVPA. Because recess offers children their main opportunity to be physically active during the school day (21), schools can play a significant role in promoting the activity levels of children by adopting measures to achieve this threshold. Educators and health promoters need to identify strategies that focus on the promotion of PA through recess, so that the short-term and longer-term effects on the children’s PA patterns can be identified.

**Acknowledgments**

We would like to thank Sport England and the Liverpool Department for Lifelong Learning for funding the project, as well as Gary White of Liverpool Sport Action Zone. We would also like to thank John Curley, Adam Hale, and Ruth McLoughlin for their assistance in the collection of data.

**References**

4. Blatchford, P., E. Baines, and A.D. Pellegrini. The social context of school playground