The Contribution of Recess to Children’s School-Day Physical Activity

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Background: Recess is an important component of a Comprehensive School Physical Activity Program, providing approximately 1268 and 914 steps for boys and girls, respectively, within a 15-minute time period. The purpose of this study was to determine the contribution of unstructured recess on children’s school-day physical activity levels and to examine if recess and school-day physical activity levels varied by BMI, gender, and grade level. Methods: One-hundred sixty third- to fifth-grade students from 2 elementary schools wore pedometers during 4 recess periods. Results: Recess accounted for 17% to 44% of school-day step counts. There was a significant main effect for grade level, but not for BMI or gender, on the percentage of school-day steps accumulated during recess. Conclusions: A 15-minute recess makes a valuable contribution to children’s school-day physical activity, especially for the least active children. More research is warranted to determine environmental influences on children’s recess physical activity.

Keywords: youth, elementary

Physical inactivity is one determinant of obesity among children. Despite the recommendation to participate in 60 minutes or more of moderate-to-vigorous physical activity (MVPA) each day, 23% of children living in the United States, age 9 to 13 years, report no participation in free-time physical activity. Furthermore, only 38% of youth are engaged in organized physical activity. Given the magnitude of the current childhood obesity epidemic and low physical activity levels of youth, efforts to increase the physical activity levels of children are warranted.

Physical activity professionals and experts have suggested that “schools systematically and effectively provide and promote physical activity,” because with the exception of the home, youth spend more time in school than in any other location. The National Association for Sport and Physical Education (NASPE) provided a position statement in which Comprehensive School Physical Activity Programs (CSPAP) are recommended for all P-12 schools. Within CSPAPs, quality physical education, school-based physical activity opportunities, school employee wellness and involvement, and family and community involvement are promoted. Recess is one potential school-based physical activity opportunity for youth, especially in the elementary school setting.

There are mixed findings on recess physical activity. Research suggests that 20% to 50% of recess time spent is being physically active. Although one study found girls to be more physically active than boys during recess, as in other settings, it is generally accepted that boys are more active than girls during recess and other free-play environments. In addition, during free play, higher-skilled children are more active than lower-skilled children regardless of gender. Thus, a free-play environment during recess may not offer equal opportunity for physical activity for all children. However, utilizing an organized or structured recess environment may enhance the opportunities for all children to be physically active as this strategy has been shown to increase physical activity levels. Furthermore, researchers have reported that physical activity levels between genders are similar when using an organized or structured activity.

Few studies have examined the contribution of recess to children’s physical activity levels. When examining sixth-grade students’ physical activity in segments of the school day, Tudor-Locke and colleagues found that lunchtime physical activity (ie, outdoor or gymnasium break time after lunch) and scheduled recess (15 minutes) accounted for 15% to 16% and 8% to 9% of the youth’s daily physical activity, respectively. A descriptive study on recess showed that boys spent 78% of their 15-minute recess time engaged in physical activity, while for girls that figure was 63%. No current studies address the contribution of recess to school-day physical activity.

In an era where physical activity opportunities (eg, recess and physical education programs) at school are being reduced due to an increased emphasis on academic achievement and time devoted to core subjects, data supporting the contribution of recess to children’s school-day physical activity levels are needed. Information detailing
Methods

All third- to fifth-grade students from 2 public elementary schools in a midsize city in the southeastern United States were invited to participate in this study. The elementary schools were selected to participate because of willingness to collaborate, and they were similar in population. School A’s enrollment consisted of 26.1% free and reduced lunch, 91% Caucasian, 4% African American, and 5% other. School B’s enrollment was comprised of 26.1% free and reduced lunch, 78% Caucasian, 8% African American, and 14% other. Five of the twenty third- to fifth-grade teachers chose not to allow their students to participate for academic reasons. Thus, of the total 501 eligible third- to fifth-grade students, 376 informed consent forms were sent home and 260 students agreed to participate. Due to missing data as a result of absences and students not wearing their pedometer during school and recess, 100 students were removed from the data analysis. In addition, 2 participants were excluded from the analysis because their recess step counts were less than 50 steps and thus, likely did not reflect the number of steps required to walk outside of the building for recess. A total of 160 children (50% girls) were included in the final data analysis. Specifically, School A had 118 participants (49% girls; Mean ± SD: Height: 1.38 ± 0.07 m; body mass: 35.1 ± 9.6 kg; BMI = 18.3 ± 4.1 kg·m⁻²) and School B had 42 participants (52% girls; Height: 1.38 ± 0.07 m; body mass: 33.8 ± 7.4 kg; BMI = 17.6 ± 2.4 kg·m⁻²). The University’s Institutional Review Board approved all procedures.

Instrument

Participants wore a pedometer (Walk4Life, LS 2500, Plainfield, IL) for 4 consecutive school days. The Walk4Life pedometer was selected because it is considered an accurate and appropriate motion sensor for research with children.¹⁸

Procedures

Before the study, participants were oriented to the pedometers by the researchers and given the opportunity to handle the pedometer, open it, and practice putting it on and taking it off their waistband. On the first day of the study, at the beginning of the school day, each participant was given a pedometer to be used for the duration of the study. Students were instructed to wear the pedometer for the entire school day and record their data on a data sheet when prompted by their teacher or a researcher. Lastly, participants were instructed to participate in normal activities and to avoid tampering with the pedometer during the day.

Data were collected during 4 school days within a 1-week period. Each day, upon arriving at school, students fastened their pedometer to their waistband and obtained a data recording sheet for that day. Before leaving for recess students were prompted by a teacher or researcher to record their step count. After recess, students were again prompted to record their step count. The prerecess step count was subtracted from the postrecess step count to calculate the number of steps accumulated during recess. At the conclusion of the school day, students recorded their final step count and placed their pedometer into a collection container. These data collection procedures have previously been used with elementary students and supported by other research studies.¹⁷,¹⁹ After school each day, pedometers were reset by the researchers in preparation for the next day. Recess was held outside, during the midmorning of each day, and was approximately 15 minutes in length. The data were collected in early fall, and the weather was conducive to outside physical activity. Each child was scheduled to have physical education 1 day during data collection. Physical education times were equal (55 minutes) between schools.

Contextual information describing the children’s recess environment revealed that the playground area at both schools was very similar. Both had large open areas including grassy fields, play structures, blacktopped basketball courts, hopscotch areas, fun hoops, and several trees for shade. A variety of playground balls (kickballs, basketballs) and jump ropes were available for the students to use during recess.

Data Analysis

Pedometer step counts were only included in the data analysis for participants who had worn the pedometer at school and during recess (on the same day) for at least 2 days. School-day, recess, and nonrecess step counts were averaged across the days for each participant. Multiple 2 × 3 (gender × grade level) analyses of variance were used to examine the effect of gender and grade level on step counts during the school day, at recess, and during nonrecess school time (ie, school-day step count – recess step count). Tukey post hoc analyses were conducted to identify where significant differences existed. In addition, power and effect size [eta squared (η²); small effect size: .01; medium effect size: .06; large effect size: .14] estimates are provided for primary outcome analyses. Furthermore, the percentage of recess step counts relative to school-day step counts was calculated as: [(recess step counts / school-day step counts) × 100]. Comparisons were made of the percent of school-day step counts accumulated during recess by grade level using a median test. Post hoc pairwise comparisons were made with Chi-squared tests. Mann-Whitney U tests were used to compare the mean ranks of the percent of school-day activity may provide adequate support to preserve and/or increase time devoted to recess for children at school. Therefore, the purpose of this study was to determine the contribution of unstructured recess on children’s school-day physical activity levels. A secondary purpose was to examine if recess and school-day physical activity levels varied by gender, grade level, and BMI.
step counts accumulated during recess by gender for each grade and to determine if differences existed between the percent of school-day step counts accumulated at recess by school-day physical activity level.

As a secondary analysis, the sample was divided into the most active (ie, > 50th percentile for school-day steps: > 3555 steps) versus the least active (< 50th percentile for school-day steps: < 3556 steps) participants to evaluate segmented (ie, recess, nonrecess time, school-day) school-day activity patterns by physical activity level classification to determine when participants were most/least active. Independent samples t tests were used to compare step count variables by activity level classification. Pearson product moment correlations were used to evaluate the relationship between BMI and school-based step count measures. Furthermore, a comparison of recess step counts by BMI classification (ie, healthy weight vs. overweight/obese) relative to age and sex was made using an independent sample t test. The level of significance was set at P < .05 to evaluate the main and interaction effects of the ANOVA tests and a Bonferroni adjustment was made to set P < .012 (.05 / 4 comparisons) for post hoc analyses to control for the inflation of Type I error associated with conducting multiple t tests. SPSS version 16.0 was used to perform all analyses.

**Results**

Descriptive statistics for physical activity outcome measures are presented by gender and grade level in Table 1. In terms of recess step counts there was a main effect for grade level \((F(2,154) = 12.23, P < .001, \eta^2 = .133, \text{power} = .995)\) such that fourth graders accumulated more steps than third and fifth graders \((P \leq .001)\). There was not a main effect of gender \((P = .753, \eta^2 = .001, \text{power} = .061)\) on recess step counts indicating no difference overall between boys and girls. Regarding nonrecess step counts, there were main effects for grade level \((F(2,154) = 19.93, P < .001, \eta^2 = .188, \text{power} = 1.0)\) and gender \((F(1,154) = 17.073, P < .001, \eta^2 = .081, \text{power} = .984)\). Specifically third and fifth graders accumulated more steps than fourth graders \((P < .001)\) and fourth-grade boys accumulated more steps than fourth-grade girls \((P = .001)\). In terms of school-day step counts, there were main effects for grade level \((F(2,154) = 4.807, P = .009, \eta^2 = .054, \text{power} = .791)\) and gender \((F(1,154) = 12.856, P < .001, \eta^2 = .073, \text{power} = .946)\). Specifically third graders accumulated more steps than fourth graders \((P = .008)\), and fourth-grade boys accumulated more steps than fourth-grade girls \((P = .006)\).

Figure 1 displays the contribution of recess step counts relative to school-day step counts by grade level and gender. On average, unstructured recess accounted for 17 to 44% of school-day step counts. There was a significant main effect for grade level on the percentage of school-day steps accumulated during recess \((\chi^2(2, N = 160) = 30.017, P < .001)\), indicating that fourth-grade students obtained a greater percentage of school-day steps during recess than third- and fifth-grade students. In terms of gender, fifth-grade girls obtained a greater percentage of school-day steps during recess than fifth-grade boys \((z = –3.011, P = .002)\).

The least active (according to school-day step counts) participants obtained a significantly greater percentage of school-das steps during recess compared with the most active participants \((z = –2.242, P = .025; \text{Figure 2})\). However, in terms of absolute physical activity levels, the most active participants during the school day accumulated a greater number of steps during recess \((1341 \pm 701 \text{ vs. } 915 \pm 420 \text{ steps, } P < .001)\), nonrecess school time \((3330 \pm 1084 \text{ vs. } 1837 \pm 575 \text{ steps, } P < .001)\), and during the entire school day \((4671 \pm 1028 \text{ vs. } 2752 \pm 573 \text{ steps, } P < .001)\) compared with the least active participants.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Gender</th>
<th>School day step count</th>
<th>Recess step count</th>
<th>Nonrecess step count</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Girls (n = 38)</td>
<td>3554 ± 1115*</td>
<td>937 ± 502</td>
<td>2616 ± 972</td>
</tr>
<tr>
<td></td>
<td>Boys (n = 38)</td>
<td>4360 ± 1526</td>
<td>1148 ± 479</td>
<td>3212 ± 1326</td>
</tr>
<tr>
<td></td>
<td>All (n = 76)</td>
<td>3957 ± 1388*</td>
<td>1043 ± 499*</td>
<td>2914 ± 1193*</td>
</tr>
<tr>
<td>4</td>
<td>Girls (n = 27)</td>
<td>2919 ± 907*</td>
<td>1310 ± 722</td>
<td>1609 ± 510*</td>
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<tr>
<td></td>
<td>Boys (n = 28)</td>
<td>3705 ± 1118</td>
<td>1512 ± 779</td>
<td>2193 ± 661</td>
</tr>
<tr>
<td></td>
<td>All (n = 55)</td>
<td>3319 ± 1086*</td>
<td>1413 ± 752*</td>
<td>1906 ± 656*</td>
</tr>
<tr>
<td>5</td>
<td>Girls (n = 15)</td>
<td>3520 ± 1008</td>
<td>968 ± 326</td>
<td>2552 ± 947</td>
</tr>
<tr>
<td></td>
<td>Boys (n = 14)</td>
<td>4125 ± 1184</td>
<td>646 ± 230</td>
<td>3479 ± 1264</td>
</tr>
<tr>
<td></td>
<td>All (n = 29)</td>
<td>3812 ± 1120</td>
<td>813 ± 323*</td>
<td>2999 ± 1189*</td>
</tr>
</tbody>
</table>

*Indicates significant difference between girls vs. boys within a given grade for each dependent variable \((P < .012)\).

a,b Indicates significant difference between similar letters within each dependent variable \((P < .01)\).
Figure 1 — Percent of school day step counts accumulated during recess by grade level and gender. Bars represent group mean values. Error bars represent the standard deviation. * Indicates significant difference between all participants in fourth grade vs. third and fifth grade ($P < .001$). a Indicates a significant difference between like letters ($P = .002$).

Figure 2 — Percent of school day steps accumulated during recess by school day activity level classification. Least active: participants ($n = 80$) accumulated < 3556 school day steps; Most active: participants ($n = 80$) accumulated > 3555 school day steps. Error bars represent standard deviation. * Indicates significant difference between group mean values ($P = .025$).
There was no difference in the recess (1114 ± 610 vs. 1130 ± 527 steps, \(P = .891\)), nonrecess (2629 ± 1161 vs. 2505 ± 1153 steps, \(P = .593\)), or school-day physical activity levels (3743 ± 1292 vs. 3635 ± 1257 steps, \(P = .953\)) of healthy weight \((n = 105)\) versus overweight/obese participants \((n = 33)\). Likewise, there was no relationship between school based step count variables and BMI \((r \leq -.06, P \geq .478)\).

**Discussion**

The purpose of this study was to determine the contribution of unstructured recess on children’s school-day physical activity levels and to examine if recess and school-day physical activity levels varied by gender, grade level, and BMI. In this study, youth accumulated 17 to 44% (=1000 steps) of their school-day physical activity during a 15-minute unstructured recess. This is fairly significant given that recess time only accounts for about 4% of the total time in school (one 15 minute recess out of a 410 minute school day). Regardless of physical activity level (least active vs. most active), approximately one-third of students’ school-day physical activity was accumulated during recess (Figure 2). Recess was most influential with fourth-grade girls, as it contributed approximately 44% of their school-day physical activity (Figure 1).

In terms of gender, there were no differences in activity level during recess between boys versus girls. On average, boys in grades third and fourth were more active during recess than girls. Boys in grades third and fourth had significantly more school-day physical activity than girls in grades third and fourth, and fifth-grade boys, on average, accumulated more school-day physical activity than girls (nonsignificant). The literature suggests that boys are more physically active than girls.\(^3\) Our study replicated this finding for school-day physical activity, but not for recess physical activity. Recess step counts in boys and girls from the current study were similar to recess step counts of another investigation. Beighle and colleagues\(^20\) reported that boys accumulated significantly more steps than girls (boys: 1268 ± 341 steps; girls: 914 ± 261 steps) during a 15-minute recess. In the current study, boys and girls accumulated 1188 ± 643 steps and 1069 ± 582 steps \((P = .221)\) in a 15-minute recess, respectively. Although there was not a significant difference in recess step counts between boys and girls in the current study, there was a modest trend for boys to accumulate a greater step count (Table 1).

With respect to grade level, recess made the greatest relative contribution to school-day physical activity for fourth-grade students, accounting for approximately 40 to 44% of it (Figure 2). This is because the fourth graders had a greater recess step count, but lower school-day step count, on average, compared with third and fifth graders (Table 1). There are a number of possible explanations for the increased recess physical activity for fourth graders. Perhaps the fourth-grade teachers were more socially influential with regard to student activity during recess, or their recess may have been offered at a time of the day which was more conducive to physical activity (e.g., early morning, immediately before lunch, late afternoon). All students in the study used the same playgrounds (at each respective school), so the physical environment is not suspected to have played a role in the differences by grade level.

Recess periods evaluated in this study were unstructured, consisting of free play for the children. Some research suggests that offering semistructured activities not only tends to result in equal levels of activity between boys and girls,\(^12\) but it increases their overall physical activity level as well.\(^15\) On the other hand, it could be argued that recess is a time for children to develop essential brain functions, make social interactions, and be happy\(^21\) and that adults should not dictate the activities in which children engage during this time period. In general, current findings were inconsistent with most of the literature that finds boys are more active than girls during unstructured play.\(^12,20\) The current study found no differences in recess physical activity levels by gender. The large standard deviations for boys and girls at both schools indicate a wide range of variability in activity levels during recess, suggesting that the current recess environments were conducive for activity for some, but not for others. For example, the fourth-grade girls averaged 1310 ± 722 steps whereas the fifth-grade boys averaged only 646 ± 230 steps during recess. Harten and colleagues’ work\(^14\) suggests this may be due to skill level. Still others might imply this difference is because some children enjoy being physically active during free play while others typically engage in more sedentary activity during structured time. Because physical activity choices are varied and personal in nature, a recess environment that offers both structured physical activity opportunities and free-play opportunities is advocated.

Research has shown that playground physical structures and equipment lead to more physical activity during recess.\(^15,22,23\) Although teachers and supervisors may not have jurisdiction over the number and volume of playground structures (i.e., jungle gyms, swings), the amount of playground equipment (i.e., jump ropes, bouncy balls, badminton rackets) is more easily managed. Children’s moderate to vigorous physical activity and practice trials increase as a result of providing ample equipment.\(^23,24\) Therefore, the recommendation is that teachers and administrators provide adequate equipment for children during recess to improve physical activity levels.

Another approach to increasing physical activity levels during recess includes markings, drawings, and/or paintings on the playground areas/structures. Stratton\(^25\) demonstrated that fluorescent drawings on the playground surface improved children’s physical activity levels. Additional studies using bright paintings on the playground demonstrated increased energy expenditure and duration of children’s play during recess.\(^26,27\) Even more promising, these markings have also been found to have long-term effects on activity.\(^28\)
Conclusions

In just 15 minutes per day, recess makes a valuable contribution to children’s school-day physical activity (17% to 44%). Individuals who supervise children at recess should be encouraged to incorporate both free play and semistructured recess options as well as provide a variety of equipment to promote higher levels of physical activity engagement during recess time. In addition, the lack of differences in recess physical activity between genders at these schools suggests that something is occurring to encourage or influence the girls to move during recess time. More research is warranted to determine characteristics of recess environments that result in fairly equal amounts of physical activity engagement by gender. In an era in which recess and physical education are being cut from the school day due to budgeting and academic performance standards, it is imperative to emphasize the importance of its place in schools for children to accumulate physical activity, engage socially with other children, and potentially impact learning.

Limitations

The primary limitation in the current study involved a small sample size, partially as a result of missing data. In addition, 5 teachers declined their students’ participation, which resulted in fewer participants. Of the 260 students who returned consent forms, 160 were involved in data analysis for the study. This is a function of conducting studies in the natural school environment, and it is difficult to say whether the information is generalizable to those students who moved or transferred schools or who wore pedometers that malfunctioned. However, the study was sufficiently powered (power > .80) for most analyses to find statistical differences where they existed (see results section).

An additional limitation included the lack of descriptive information on the social and physical environments of the recess periods. These particulars may have influenced the students’ physical activity patterns. Studies including the effect of teacher and peers during recess are warranted. Furthermore, these data represent a cross-sectional evaluation of grade level. Future research should use a longitudinal design to evaluate the effect of age on recess and school-day physical activity.

Acknowledgments

This study was funded by donations from Steve and Elaine Harris of the Woodlands, Texas, and the George and Betty Blanda Endowed Professorship in Education at the University of Kentucky granted to Dr. Melody Noland.

References


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