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ORIGINAL RESEARCH

Physical Activity Levels During School Recess in a Nationally Representative Sample of 10- to 11-Year-Olds

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Purpose: School recess provides a valuable opportunity for children's daily moderate- to vigorous-intensity physical activity (MVPA). This study aimed to quantify MVPA during school recess in a representative sample of Scottish children and examine whether recess MVPA varied by gender, socioeconomic status, season, urban/rural residency, and recess length. ***Method:*** Five-day accelerometry MVPA data were analyzed from 773 children (53.9% girls, 46.1% boys, 10- to 11-y-olds) from 471 schools. Binary logistic regression explored associations between meeting/not meeting the recommendation to spend 40% of recess time in MVPA and the aforementioned risk factors. Descriptive recess data were also analyzed. ***Results:*** Participants spent an average of 3.2 minutes (SD 2.1) in MVPA during recess. Girls engaged in 2.5 minutes (SD 1.7) of MVPA compared with 4.0 minutes (SD 2.2) for boys. Only 6% of children met the recess MVPA recommendation. The odds of girls (odds ratio 0.09; 95% confidence interval, 0.04–0.25) meeting the recommendation was lower ($P < .001$) compared with boys. No statistically significant differences were observed in meeting the recommendation for the other risk factors. ***Conclusion:*** Levels of MVPA during school recess are very low in Scottish children, and interventions aimed at increasing MVPA during recess are needed.

Keywords: moderate- to vigorous-intensity physical activity, health, accelerometer, primary school children

Childhood physical activity (PA) is associated with positive physical, developmental, and psychological health (12,14) and helps prevent noncommunicable diseases (50), which means a lower risk of cardiovascular disease, hypertension, diabetes, and many cancers later in life. Low PA in children is one of the most important public health issues in the 21st century (23). The World Health Organization has recommended that school-age children engage in moderate to vigorous PA (MVPA) for an average of at least 60 minutes per day (51). However, many children globally do not meet the recommendation (13,50). School is a key environment where children accumulate MVPA (41) on around half of all days (allowing for weekends and school holidays). There are recommendations in the United States (25) and in the United Kingdom (6) that children and adolescents should achieve 30 minutes of MVPA daily during school hours. Weaver et al (48) found that most children (in grades 1–3) were not accumulating 30 minutes per day of MVPA during school hours. Grao-Cruces et al's (11) systematic review showed that less than a quarter of children reached the 30-minute MVPA recommendation during school hours.

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The PA Guidelines for Americans (7) suggest that, as part of the school strategy to increase MVPA, school-day segments (such as physical education and recess) are opportunities for providing MVPA (7). School recess is an essential school experience that has developmental (27) and behavioral (3) benefits. Recess also serves as a necessary break from the rigors of academic challenges (29). This is particularly important now as Kharel et al's (15) systematic review has shown that since the start of the COVID-19 pandemic, children and adolescents typically spend less time in MVPA and more time on screens (15). It is crucial to examine how active children are during recess and what factors are associated with MVPA at recess so that interventions aimed at improving recess MVPA can be optimized. In 2005, Ridgers and Stratton (35) suggested that children should engage in MVPA for at least 40% of recess time. This benchmark has been accepted by many researchers since (30). Despite this specific MVPA recommendation, few studies have examined children's compliance with MVPA during recess. The Sánchez and Gallego (41) systematic review found only 2 studies (1,22) of children's compliance with the recess MVPA recommendation. Furthermore, the sample sizes of these 2 studies were small (n = 135 and n = 379), and there was a lack of studies using accelerometers in large, nationally representative samples. In addition, a number of factors (such as gender, climate, and recess length) that may affect children's recess MVPA have been reported (32,36,43). To date, no large-scale, nationally representative accelerometry studies have explored the possible influence of these factors on children's activity levels. Therefore, this study aimed to (1) examine how much MVPA is accumulated during recess and the percentage of recess time spent in MVPA and (2) explore the risk factors for low recess MVPA, including gender, socioeconomic status (SES), season, urban/rural residency, and recess length, on recess MVPA in a representative sample of 10- to 11-year-olds in Scotland.

Methods

Participants and Study Design

The present study used data from the SPACES (Studying PA in Children's Environments across Scotland) study (19) conducted during the school year between May 2015 and May 2016. Both children (n = 1096) and their parents were required to sign consent forms before participating. (More details of the SPACES study can be found in Supplementary Material [available online].)

Instruments

Measurements of MVPA During Recess

ActiGraph GT3X+ (Actigraph Inc). In the SPACES study (19), accelerometry data were collected using the ActiGraph GT3X+ (Actigraph Inc) worn on a belt around the waist. Children were asked to wear the device for 8 consecutive days (with a minimum of 10 h on a weekday/school day) during waking hours (19,38).

ActiLife software (version 6, Actigraph Inc). In the present study, accelerometry data were considered valid with a minimum of 4 hours per day over 3 school days (31). To ensure that the sample was broadly representative of the Scottish population, the sample was weighted to compensate for potential bias (5,19). Nonwear time periods (if 60 consecutive min of strings of 0 counts acceleration were recorded by the device) were removed from further analyses. ActiLife software (version 6, Actigraph Inc) was used to download, clean, and analyze data. Once downloaded, data files (.agd) were reintegrated from the original 10-second epoch to a 60-second epoch to establish the pupil's recess time. To define children's MVPA, the commonly used cut points (values ≥2296 counts/min) from Evenson et al (9) were used to define MVPA levels from the accelerometer count data.

Procedures

Definition and Identification (Extraction) of Recess Time

Recess time was defined as the timetabled 15- or 20-minute (typically between 10 and 11 AM) morning break that primary school children have during school days in Scotland. Time spent in MVPA was extracted for this morning recess only from each day of data. Each child's morning recess time was identified by using the primary schools' online handbooks for the 2015–2016 school year and extracted manually from the individual accelerometry data by matching the child to their school's recess time. Accelerometry counts from each day of each pupil were visually checked to verify that the counts increased at the expected start of the recess interval and whether the counts decreased at the expected end of recess for each day. MVPA values are reported as the percentage of the length of recess time (ie, time available) to control for varying durations of school and recess (using mean minutes and percentage per day in the statistical analysis).

Definition of the Explanatory Variables

The widely used Scottish Index of Multiple Deprivation (SIMD) (42), a composite area-based measure (not based on the individual child/family) of relative social, economic, environmental, and health circumstances, was used to define children's SES. SIMD rank scores were grouped into 5 quintiles where 1 represented the most deprived area and 5 represented the least deprived area (19). Season of data collection when each participant wore the accelerometer was a 4-level categorical variable (spring, summer, autumn, and winter) (20). Children's urban or rural residency was defined using their home address combined with a standard classification method used in Scotland that recognizes settlement size (population between 3000 and ≥125,000 was urban and <3000 was rural) (19).

Data Analysis

Continuous variables were presented as means and standard deviations (SD), and categorical variables were presented as numbers and percentages of the overall sample and for boys/girls separately. Binary logistic regression analyses were used to examine the association between the risk factors (independent explanatory variables) and meeting the 40% recess time MVPA (the dependent variable—based on the benchmark suggested by Ridgers and Stratton [35]). Models were run for each explanatory variable (with reference categories identified) separately. We did not produce a combined model with all risk factors included simultaneously because we found that only one of the factors was associated with meeting the recess MVPA guideline in initial analyses. *P* values for the overall trend, odds ratio, and confidence intervals (CIs) for each category of explanatory variables are presented. All models controlled for the number of schools involved. Significance was set at $P < .05$. Data were analyzed with SPSS Statistics (version 26) in July 2022.

Results

Characteristics of Participants

Of 2162 parents who had consented to be contacted for SPACES, 1096 (50.7%) children took part in data collection. Of those, 859 (78.4% of those who participated) children provided data, but only 774 (70.6% of those who participated; 417 girls and 357 boys aged 10–11 y) provided sufficient (defined as at least 4 weekdays and 1 weekend day) data for inclusion in the SPACES data set (19). One participant did not meet the minimum inclusion criterion enabled for the present analysis (3 school days with at least 4 h/d) and was removed from the present study data set. A small number of nonvalid recess periods (132 periods, representing 3.5% of the total recess periods) were removed because only 0 counts could be found during recess time in a valid school day. The final analytical sample comprised 773 children across a mean of 4.8 days of data per participant. Valid data from 3733 recess periods were included in the analyses. Table 1 presents the descriptive characteristics (mean [SD]) of the sample. Overall, 773 children (mean age 11.1 y, 53.9% girls, and 46.1% boys) attending 471 schools participated, with 306 schools having one participant each, 94 schools having 2, and 71 schools having ≥3 participants. Mean daily recess length was 16.1 minutes (SD 2.2).

Prevalence of Meeting 40% of Recess Time in MVPA Recommendation

Only 6% (1% of girls and 11% of boys) of children spent at least 40% of their recess time in MVPA. Table 1 shows that mean MVPA during recess was 3.2 minutes (SD 2.1), equating to 20% of recess time, on average, for the entire sample (mean minutes of recess MVPA [3.2 min] divided by mean recess time [16.1 min] × 100). Girls engaged in 2.5 minutes (SD 1.7) compared with 4.0 minutes (SD 2.2) for boys. This equated to 16% and 25% of recess time in MVPA for girls and boys, respectively.

Table 1 Participant Characteristics (n [%] Unweighted) Split by Gender and for the Overall Sample

	Girls (n = 417)	Boys (n = 356)	All (N = 773)
Gender			
Girls	—	—	417 (53.9%)
Boys	—	—	356 (46.1%)
SES—Using SIMD quintile			
1, most deprived	35 (8.4)	29 (8.1)	64 (8.3)
2	55 (13.2)	43 (12.1)	98 (12.7)
3	96 (23.0)	73 (20.5)	169 (21.9)
4	110 (26.4)	97 (27.2)	207 (26.8)
5, least deprived	121 (29)	114 (32)	235 (30.4)
Season of data collection[a]			
Winter	89 (21.3)	74 (20.8)	163 (21.1)
Spring	46 (11)	47 (13.2)	93 (12)
Summer	74 (17.7)	61 (17.1)	135 (17.5)
Autumn	207 (49.6)	175 (49.2)	382 (49.4)
Urbanicity			
Urban	313 (75.1)	254 (71.3)	567 (73.4)
Rural	104 (24.9)	102 (28.7)	206 (26.6)
MVPA minutes per school recess[b]	2.5 (SD 1.67)	4.0 (SD 2.17)	3.2 (SD 2.05)
Proportion of MVPA during recess, % (recess MVPA/mean recess length in minutes)	15.7% (2.5/16.1 min)	24.8% (4.0/16.1 min)	19.9% (3.2/16.1 min)
Recess time contributed to school hours MVPA,[c] %	8.6% (2.5/29.0 min)	13.8% (4.0/29.0 min)	11% (3.2/29.0 min)

Abbreviations: MVPA, moderate to vigorous physical activity; SIMD, Scottish Index of Multiple Deprivation; SES, socioeconomic status. Note: Categorical variables are presented as numbers with percentages in parenthesis. The continuous variable of MVPA is presented as mean with standard deviation in parenthesis.
[a]Winter is from late December to mid-March, Spring is from mid-March to mid-June, Summer is from mid-June to late September, and Autumn is from late September to late December. [b]For MVPA, the total sample (weighted) is 770 (415 girls and 355 boys). [c]An average of 29 minutes was found during school hours in the previous study (50) in the same sample.

Risk Factors for Not Meeting 40% of Recess Time in MVPA Recommendation

Tables 2 and 3 present the weighted number, percentages/results of the logistic regression, and the odds ratios (95% CI) for meeting the 40% MVPA recommendation during recess. Odds of meeting the recommendation were significantly lower in girls (odds ratio 0.09; 95% CI, 0.04–0.25; $P < .001$) than in boys. SES was not related to meeting the recommendation. There was no statistically significant relationship for the overall SIMD (42) factor ($P = .29$) nor differences between quintiles and the reference category (least deprived) of SIMD with all CIs overlapping 1.0. The overall trend for seasonal influence was also not significant ($P = .25$). No differences in compliance were found between urban or rural residency and when the length of recess time (15 min vs 20 min) was compared (both factors $P = .91$).

Discussion

This study revealed that most children spent very little time (an average of 20% of recess time) in MVPA at morning recess. In Scotland, schools have lunch periods wherein children can/may be active as well. However, lunchtime is an unpredictable combination of time spent queuing for, and eating, lunch and recess time for play, so we only counted the nationally mandated morning recess for practical considerations. None of the risk factors for low recess MVPA (SES, season, urban/rural residency, and recess length), other than gender, influenced the odds of meeting the recommendation.

Our evidence of lower compliance with the recess recommendation in girls than boys was consistent with older accelerometry studies from Bailey et al (1) and Nettlefold et al (22), though we found lower compliance in the present analysis. The former (1) found that 28% of girls and 60% of boys, aged 10–14 years, met the recess MVPA recommendation, and the latter (22) reported that 16% of girls and 34% of boys, aged 8–11 years, were compliant with recess recommendations. Differences in compliance between studies may relate to the time period of measurement, the age range of the samples, or a different length of recess time. Our findings concerning activity levels are similar to those found in the UK-based study by Ridgers and Stratton (35) (4.3% of girls and 14.9% of boys, 5- to 10-y-olds, met the 40% value) and are consistent with other studies (ie, ~20% of recess spent engaged in MVPA) (17,39,44). The reasons for gender differences in recess MVPA may be attributable to the social context (1,41), the structure of the playground environment, and differences in the behaviors that boys and girls typically engage in during recess. Pawlowski et al (25) indicated that girls tend not to be interested in competitive sport-based activities, and they like socializing with friends during recess (25). Saint-Maurice et al (40) reported that boys prefer to engage more in team sports activities, and this may be due to gender stereotype/socialization (10,18). The absence of an association between SES and meeting the recess MVPA recommendation in our results is consistent with Tercedor et al (47). Taylor et al (46) found that school environments provide the opportunity for the influence of SES during school hours to be minimized as all children are exposed to similar environmental context regardless of individual circumstances (46). However, some studies either

Table 2 Weighed Number (n) and Percentages (% in Parenthesis) Meeting the Recess MVPA Recommendation for Each Potential Risk Factor

	No	Yes	Total bases weighted	Total unweighted
Gender				
Girls	410 (98.8%)	5 (1.2%)	415	417
Boys	315 (88.7%)	40 (11.3%)	355	356
Total	725 (94.2%)	45 (5.8%)	770	773
SES—Using SIMD quintile				
1, most deprived	159 (96.4%)	6 (3.6%)	165	64
2	121 (89%)	15 (11%)	136	98
3	136 (95.1%)	7 (4.9%)	143	169
4	155 (93.4%)	11 (6.6%)	166	207
5, least deprived	154 (95.7%)	7 (4.3%)	161	235
Total	725	46	771	773
Season				
Winter	160 (93.6%)	11 (6.4%)	171	163
Spring	86 (91.5%)	8 (8.5%)	94	93
Summer	135 (94.4%)	8 (5.6%)	143	135
Autumn	344 (95%)	18 (5%)	362	382
Total	725	45	770	773
Urbanicity				
Urban	582 (94.5%)	34 (5.5%)	616	567
Rural	143 (92.9%)	11 (7.1%)	154	206
Total	725	45	770	773
Length of recess				
15 min	581 (94.6%)	33 (5.4%)	614	609
20 min	140 (92.1%)	12 (7.9%)	152	161
25 min	1 (100%)	0	1	1
30 min	3 (100%)	0	3	2
Total	725	45	770	773

Abbreviations: MVPA, moderate to vigorous physical activity; SIMD, Scottish Index of Multiple Deprivation; SES, socioeconomic status. Note: Total weighted number of participants used in the calculation of proportions is represented by total bases weighted. The total number of participants measured is represented by total unweighted.

reported that children with higher SES spend more time in MVPA (21) or that children from lower income families in America are least likely to have recess (4). In Scotland, recess is mandatory, and all primary school children receive one 15- or 20-minute morning recess period per day. Moreover, schools have similar capacity (fixed equipment) and funding (in fact additional funding per pupil for schools in lower SES areas) to engage all children in MVPA broadly equally during recess. As no comparable studies currently exist exploring links between urban or rural residency and MVPA during recess, no direct comparisons are possible. As our results showed no significant difference between urban and rural residency influencing the recess MVPA, this might demonstrate the similar school environments across Scotland. Our finding of no seasonal influence on recess MVPA is contrary to some studies that reported that children are more active in spring compared with autumn or winter (40) or in cooler compared with warmer months (34). The seasonal variability between the studies may be due to differences in sample size, the number of recesses included, and geographical locations. There is some evidence that the impact of short-term changes in the weather (eg, rain or temperature during recess) might have more of an impact than seasons (16).

Results from the present study showed no association between the length of the recess and compliance with the recommendation. This result is different from those found by Suga et al (45) and Ridgers et al (37): Their studies reported that a longer duration of recess was associated with increased PA in the playground. Stanley et al indicated that length of recess time was found to positively facilitate interventions in school recess time PA (43). When checking the pupils' individual accelerometer data in the present study, their MVPA typically did not appear until around 5–8 minutes into recess time, suggesting that higher MVPA levels may be more possible in a longer recess length.

Recess is a valuable opportunity for all children to increase their PA (33). Erwin et al (8) argued that the potential of recess for MVPA accumulation is undervalued especially for inactive children (8). Schools should, therefore, carefully consider the time available for breaks and work to ensure that pupils in schools have adequate breaks in the day for them to play and socialize with peers (2). Pfledderer et al (28) suggested altering or adding playground markings and utilizing zonal design along with the markings indicating the types of activities that might be performed in that area to suit the needs of boys and girls. Parrish et al (24) suggested

Table 3 OR (95% CI) for Meeting the 40% Recommendation of MVPA During Recess

	Meeting 40% of recess time in MVPA
Gender	
Boys	1.00 reference
Girls	**0.09 (0.04–0.25)**
P value	<.001
SES—Using SIMD quintile	
5, least deprived	1.00
4	1.55 (0.70–3.44)
3	1.09 (0.44–2.71)
2	2.39 (0.97–5.86)
1, most deprived	2.11 (0.70–6.42)
P value	.294
Season of data collection	
Winter	1.00
Spring	0.75 (0.28–2.04)
Summer	0.93 (0.41–2.10)
Autumn	0.51 (0.25–1.05)
P value	.245
Urbanicity	
Urban	1.00
Rural	1.04 (0.51–2.13)
P value	.91
Length of recess time	
15 min	1.00
20 min	1.29 (0.65–2.58)
P value	.915

Abbreviations: CI, confidence interval; MVPA, moderate to vigorous physical activity; OR, odds ratio; SIMD, Scottish Index of Multiple Deprivation; SES, socioeconomic status. Note: All models control for school number; bolded category is significant at $P = .003$.

that longer term plans, which incorporate changes to interventions over time, may assist in maintaining children's interest and, so, promote sustained increases in PA during recess. Schools need to create strategies that are not only gender equal (18) and feasible but that also cater specifically for different pupils' needs.

Our study had a number of strengths, notably the large representative sample with accelerometry measures of MVPA. Few other international studies have been based on large, nationally representative samples with accelerometry measures of MVPA, which are considered more valid and reliable tools to assess MVPA than self- or proxy reports (32). Few studies have examined the proportion of children meeting the benchmark of 40% recess time in MVPA (35).

There were some limitations in this analysis. Despite the very large sample size relative to the previous studies, the low MVPA may have limited our ability to assess potential risk factors for not meeting the recommendation. Second, as this is a secondary data analysis, accelerometer data were extracted to fit this study's purpose. Actual recess time was not measured, and whether the recess periods reported aligned with movement/activity could not be verified. To analyze the data, we reintegrated from the original 10-second epoch to a 60-second epoch, and if MVPA is being accumulated in very short and sporadic bursts, the epoch of 60 seconds is likely to reduce the apparent time spent in MVPA. Third, the potential risk factors for not meeting the recess MVPA recommendation were limited to those factors available in the original SPACES data set (19); other potentially important factors, such as teachers or peer influence and the context of the playground, were not available. It would be difficult to control for school in the analysis due to the small number of children (only 1–2 children) recruited from each school, which aimed to minimize school-level effects and achieve a nationally representative sample. Fourth, the focus of the present study was purely on the morning recess period because this is a time of the school day when free play is prioritized over waiting and eating lunch. Hence, MVPA during lunchtime was not examined and could be considered in future research. Finally, the results of this study were restricted to children aged 10–11 years old and are not necessarily generalizable to younger children or older youths.

Conclusions

Recess can make a worthwhile contribution to school children's daily MVPA. However, levels of MVPA during school recess are low in Scottish children aged 10–11 years old. Despite small gender differences in reaching MVPA recess goals, recess-based interventions are recommended for both boys and girls for the benefit of public health.

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