Article

HEJ

Health Education Journal
2014, Vol. 73(2) 129–136

DOI: 10.1177/0017896912471032
hej.sagepub.com
SAGE

Non-overweight and overweight children's physical activity during school recess

Nicola D Ridgers[a], Pedro F Saint-Maurice[b], Gregory J Welk[b], Mohammad Siahpush[c] and Jennifer L Huberty[d]

[a]Centre for Physical Activity and Nutrition Research, Deakin University, Australia
[b]Department of Kinesiology, Iowa State University, USA
[c]Department of Health Promotion, Social and Behavioral Health, College of Public Health, University of Nebraska Medical Center, USA
[d]College of Education, University of Nebraska Omaha, USA

Abstract

Objective: Little research has investigated children's physical activity levels during school recess and the contribution of recess to school day physical activity levels by weight status. The aims of this study were to examine non-overweight and overweight children's physical activity levels during school recess, and examine the contribution of recess to school day physical activity.

Design: Cross-sectional.

Setting: Four elementary schools located in Nebraska, United States of America (USA).

Methods: Two hundred and seventeen children (99 boys, 118 girls; 47.9% overweight) wore a uni-axial accelerometer for five consecutive school days during autumn 2009. The proportion of time spent engaged in sedentary (SED), light (LPA), moderate (MPA) and vigorous (VPA) intensity physical activity during recess was determined using age-specific accelerometer thresholds.

Results: Overweight children engaged in more %MPA and less %VPA than non-overweight children, respectively. No differences were found between overweight and healthy weight children's moderate-to-vigorous physical activity (MVPA). Recess contributed 16.9% and 16.3% towards non-overweight and overweight children's school day %MVPA, respectively.

Conclusion: Examining %MVPA as an outcome variable may mask differences in recess physical activity levels between non-overweight and overweight children. Future research is needed to establish why healthy weight and overweight children engage in differing levels of %MPA and %VPA during recess.

Keywords

Accelerometers, play and playthings, playtime, schools, youth

Corresponding author:
Nicola D Ridgers, Centre for Physical Activity and Nutrition Research, Deakin University, 221 Burwood Highway, Burwood, Victoria 3125, Australia.
Email: nicky.ridgers@deakin.edu.au

Introduction

The high prevalence of overweight and obesity, both nationally[1] and internationally,[2] has become a major public health priority. The negative health consequences of pediatric obesity are well documented.[2–3] While the etiology of obesity is complex, behavioural factors such as increased sedentary recreation (e.g. TV viewing)[4] and a lack of physical activity engagement[5] clearly contribute to the problem.

To reverse or slow the progressing obesity epidemic it is necessary to intervene at all levels of the obesogenic environment.[2] Schools are one context that can be targeted to implement health policies and interventions.[6] However, the structure of the school day can also be a barrier to physical activity opportunities, as a large proportion of the day is spent in sedentary behaviours. One opportunity for engaging in physical activity during the school day is recess, which provides children with a regular opportunity to engage in unstructured play and physical activity with their peers.[7,8] However, regularly scheduled recess is not required by all states[9] and in recent years there has been a trend to reduce the frequency and duration of school recess, often due to curricular pressures.[7,10] This is of concern, as recess contributes to children's physical activity levels[11] and is important for children's social, cognitive, emotional, physical and social development.[12,13]

In order to inform physical activity programming and policy in schools in relation to attempting to combat childhood obesity, research identifying the activity levels of children during recess and the contribution of school recess to daily physical activity is warranted. A recent review identified six studies that have investigated the recess physical activity levels of non-overweight and overweight children; however, no association was found between weight status and physical activity levels.[14] These studies primarily focused on moderate-to-vigorous physical activity[15–16] or steps taken.[17–18] Identifying engagement in different physical activity intensities is important, as this may inform interventions design and delivery in this context. It should also be noted that only two studies have examined the contribution of recess to daily physical activity.[17,19] Such information is needed to contribute to the debate concerning the role of recess in school,[12] and support calls for enhanced recess provision within the school day.[19]

The aims of this study, therefore, were to: (a) investigate the physical activity levels of non-overweight and overweight children; and (b) determine the contribution of recess to school day physical activity levels by body mass index (BMI) group.

Methods

Subjects

Two hundred and fifty-seven children (118 boys, 139 girls) aged 7–12 years (mean = 9.5 ± 1.2 yr) from four elementary schools located in Nebraska were recruited into this study. The participants comprised of Caucasian (39.1%), Hispanic (29.2%), African-American (28.9%), and Asian (1.6%) children. A small percentage of children (1.2%) classed their ethnicity as 'other'. The percentage of children who received free or reduced school meals was 79.4%.

The children were a sub-sample from a larger study called Ready for Recess, which is a recess intervention aimed at determining the effectiveness of staff training and playground environmental modifications on children's physical activity levels during recess.[20] Baseline data collected prior to the start of the intervention (autumn 2009) were used for analysis in this study. All procedures and measures were approved by the institutional review board at the University of Nebraska at Omaha. Children in grades 3–6 (16 classes in total) were provided with consent forms to give to their parents to sign and then return to their teachers. Children who returned written parental consent to their teacher before the data collection period began were eligible to participate in the study.

Instruments

Demographic data. The school nurse and/or school secretary reported demographic data that included race, gender, birth dates, and free or reduced lunch status for all children in grades 3–6.

Anthropometry. The school nurse or health aid at each school measured the children's stature and body mass using standardized procedures. Graduate assistants entered information into an excel file which automatically calculated BMI according to stature, body mass, birth date, and date when measurement occurred. Age- and gender-specific BMI percentiles were calculated using the Centers for Disease Control and Prevention criteria,[21] and children were classified as non-overweight (BMI < 85th percentile), overweight (BMI > 85th–< 95th percentile) or obese (BMI > 95th percentile). In this sample, 52.1% were non-overweight, 24.4% were overweight, and 23.5% were obese. To balance the groups for data analysis in this study, the overweight and obese group were merged to form one group termed overweight (BMI > 85th percentile).

Physical activity. Physical activity was objectively assessed using a hip-mounted GT1M ActiGraph accelerometer (ActiGraph, Pensacola, FL). The ActiGraph is a common tool in the assessment of children's volume and intensity of physical activity.[22] The epoch length was set at five seconds to capture the intermittent and sporadic nature of children's physical activity.

Accelerometers were initialized and downloaded using ActiGraph software (version 4.2.0, ActiGraph, Pensacola, FL). Data were initially screened for spurious data points and compliance with the protocol using a data reduction program (KineSoft 2.0.94, Kinesoft Software, New Brunswick, Canada). To be retained for analysis, children were required to have worn the monitor on a minimum of three complete school days (typically 8:15am to 4:15pm). Days where children arrived late and/or left school early were coded as missing days. Forty children (19 boys, 21 girls; 50% overweight) did not meet the minimum inclusion criteria and were removed from the data set. The final sample consisted of 217 children (99 boys, 118 girls; 47.9% overweight).

Since children only wore the monitor at school, it was assumed that children complied with the protocol unless information logged by the research team indicated otherwise. Screening of data to check for non-wear time was not conducted but individual data files were checked for anomalies or aberrant data in the files. Age-specific cut-off points derived from the Freedson et al.[23] energy expenditure prediction equation were used to determine the time spent in light (LPA), moderate (MPA) and vigorous physical activity (VPA). Minutes with fewer than 200 counts were coded as sedentary to avoid misclassifying the amount of light activity in the day.[24] For comparison with previous studies, moderate-to-vigorous (MVPA) was calculated by summing MPA and VPA.

To control for varying times of school recess periods and to aid comparisons to previous studies, physical activity variables are reported as percent of time (%sedentary, %LPA, %MPA, %VPA, %MVPA). The mean percentage per day per intensity category was calculated and used in the statistical analyses. The mean daily recess length was 19.7 ± 6.5 min.

Procedure

Each school was visited for one school week (Monday to Friday) in September 2009 (autumn). Each morning children were provided with a specific numbered accelerometer to wear whilst at school. Children wore the same monitor each day. A familiarization session was provided on the first morning to explain to children about the correct wearing of the monitors, and to explain the study protocol. Children were encouraged to wear the accelerometers during the entire school day and to follow their normal daily school routine. Graduate students removed the accelerometers at the end of the school day. Records of attendance were kept each day to identify the children who wore the monitors for the full school day, and identify those who did not comply with the monitoring protocol for at least one of the following reasons: absenteeism, arrived at school late, left school early, or decided to not wear the monitor on a given day. One teacher from each grade (grades 3–6) was provided with a log and a stopwatch to record what time the recess periods occurred and length of the recess periods during the school day. At the end of each week, the teachers returned the logs to the investigators.

Data analysis

Descriptive statistics (mean ± *SD*) were initially calculated for all variables. Differences between children with complete and incomplete data were compared. To examine BMI group and sex differences in the different physical activity intensities, data were initially analysed using a 2 (sex) × 2 (BMI group) analysis of variance. Post-hoc analyses were used to identify where significant differences lay in the event of a significant interaction.

The relative contribution of recess to school day physical activity was calculated as a proportion using ([time in activity intensity/total time in activity intensity during the school day] × 100), and averaged over valid days. Differences in the contribution of recess to school day physical activity by BMI group and sex were assessed using analyses of variance. Significant *p*-values were established at $p \leq .05$. All data were analysed using Statistical Package for the Social Sciences (SPSS) version 17.

Results

Table 1 reports the descriptive characteristics of this sample. No significant differences were found between included and excluded children on the descriptive data ($p > 0.05$).

BMI group main effects were revealed for %LPA, %MPA and %VPA. Overweight children engaged in significantly more %LPA and %MPA and significantly less %VPA than their non-overweight peers. Sex main effects were found for all physical activity variables (Table 1). Boys engaged in significantly more %MPA, %VPA and %MVPA than girls, while girls engaged in significantly more sedentary time and %LPA than boys. A significant gender × BMI group interaction was found for %VPA. Post-hoc analyses revealed that non-overweight boys were significantly more active than overweight boys ($p < 0.01$), non-overweight girls ($p < 0.001$) and overweight girls ($p < 0.001$). No other significant interactions were found.

Figure 1 shows the contribution of recess to non-overweight and overweight boys' and girls' school day physical activity. Recess contributed significantly more %VPA to non-overweight boys' school day physical activity compared to non-overweight girls and overweight boys and girls. No differences were found between groups for %LPA, %MPA or %MVPA. Overall, recess contributed 16.9% and 16.3% towards non-overweight and overweight children's school day %MVPA, respectively.

Discussion

This is the first study to explore non-overweight and overweight children's engagement in different physical activity intensities, and determine the contribution of recess to school day physical activity levels. Small but significant differences in %LPA, %MPA and %VPA engagement during school

Table 1. Anthropometric characteristics and physical activity levels of non-overweight and overweight boys and girls during school recess (mean ± *SD*).

	Boys		Girls		Analysis of variance (*p*-values)		
	Non-overweight (*n* = 55)	Overweight (*n* = 44)	Non-overweight (*n* = 58)	Overweight (*n* = 60)	Gender effect	BMI group effect	Gender × BMI group
Age (yrs)	9.4 ± 1.2	9.6 ± 1.2	9.6 ± 1.2	9.7 ± 1.1	NS	NS	NS
Stature (inches)	54.8 ± 3.3	56.8 ± 4.3	54.1 ± 3.7	56.5 ± 3.8	NS	<0.001	NS
Body mass (lbs)	72.2 ± 13.4	111.5 ± 30.6	72.1 ± 13.8	109.9 ± 24.0	NS	<0.001	NS
Body mass Index	16.8 ± 1.6	24.0 ± 3.7	17.2 ± 1.6	24.2 ± 3.8	NS	<0.001	NS
Physical activity							
%Sedentary	35.5 ± 18.2	34.3 ± 14.4	48.2 ± 14.8	46.4 ± 14.4	<0.001	NS	NS
%LPA	15.0 ± 4.5	17.6 ± 4.9	17.1 ± 4.4	18.4 ± 4.7	0.03	<0.01	NS
%MPA	28.4 ± 9.2	33.9 ± 11.6	23.2 ± 8.3	24.9 ± 8.5	<0.001	<0.01	NS
%VPA	21.0 ± 11.2	14.2 ± 8.7	11.6 ±7.2	10.3 ± 7.2	<0.001	<0.001	0.02
%MVPA	49.5 ± 18.1	48.1 ± 16.0	34.8 ± 13.5	35.3 ± 13.8	<0.001	NS	NS

Abbreviations: %LPA = light physical activity; %MPA = moderate physical activity; %VPA = vigorous physical activity; %MVPA = moderate-to-vigorous physical activity; NS = not significant.

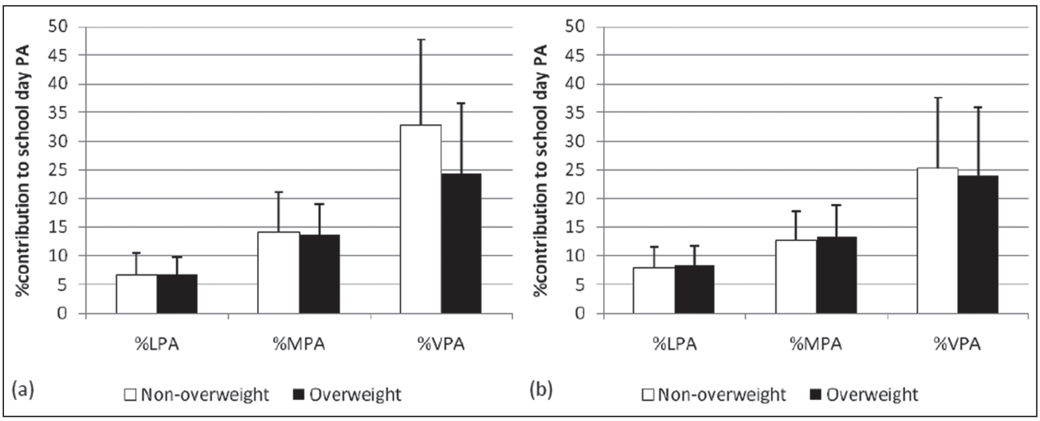

Figure 1. Contribution of recess to school day physical activity for (a) boys and (b) girls by weight status.

recess were observed. Whilst no studies have examined engagement in %LPA or %MPA separately, making comparisons to the current literature difficult, previous research has reported that overweight children engage in less %VPA during school recess.[15,25] This is consistent with the findings from this study. Whilst the reasons for these findings are not widely known, previous research examining the context of school recess reported no significant differences between non-overweight and overweight children's social play behaviours.[16] It is possible that, while social play behaviours are similar between non-overweight and overweight children, overweight children may not be able to engage at higher intensities due to fitness[15] or differences in fundamental movement skills.[26] Different intervention strategies may be required for non-overweight and overweight children during school recess to increase their physical activity levels, and a range of options should be provided for children to engage in physical activity levels of different intensities.

It should be noted, however, that no differences were found between non-overweight and overweight children's %MVPA, which supports previous research conducted in elementary school age children.[15–16,18] Previous research has suggested that overweight children are less active during their discretionary time,[18] yet the results of the current study suggest that these differences occur at higher intensities. Overall, these findings suggest that assessing %MVPA may mask differences in recess physical activity levels between BMI groups, and may explain the lack of association found in a recent correlates review.[14]

In this study, recess contributed 16.9% and 16.3% towards non-overweight and overweight children's school day %MVPA, respectively. This is lower than the contribution of recess to the number of steps taken by non-overweight (29.6%) and overweight (31.1%) children during the school day reported by Erwin and colleagues.[19] Interestingly, recess contributed between a quarter to a third of children's school day VPA, despite accounting for 4% of the whole school day. This highlights the importance of recess as an opportunity for children to engage in physical activity which may benefit health outcomes such as weight status.[27] Furthermore, this finding lends further support to recommendations that recess should occur on a daily basis,[8,28] as it contributed a significant proportion to their school day physical activity

School recess contributed significantly more to non-overweight boys' school day VPA than overweight boys and girls in general. This latter finding is difficult to explain, as it suggests that girls and overweight boys engage in more VPA in other parts of the school day. It is possible that non-overweight boys compensate for their engagement in VPA during recess by reducing their VPA in other parts of the day,[29] though further research is needed to determine where these reductions may occur. Overall, however, these results lend support to the concerns reported by Ramstetter et al.,[12] who highlighted that reducing or removing recess from the school day may be counterproductive. Indeed, reductions in recess duration and frequency may have a negative impact on both non-overweight and overweight children's physical activity engagement.

Limitations

Few studies have investigated the physical activity levels of different intensities of non-overweight and overweight children in contexts where there are opportunities for physical activity and limited opportunities for engaging in screen-based sedentary leisure activities. This is a strength of this current study. Some limitations, however, warrant attention. First, all children with a BMI greater than the 85th percentile were grouped together in this study to add power to the analyses. Future studies should determine whether differences occur between normal weight, overweight and obese children's physical activity levels during recess. Second, no habitual physical activity data were collected. It was not possible, therefore, to determine the extent to which recess contributes to non-overweight and overweight children's daily activity levels, and whether activity compensation occurs during the day. Third, it is not known what behaviours non-overweight and overweight children engaged in during recess. Further research is needed to identify the activities they choose to engage in during this time, which will help to inform future intervention strategies.

Conclusion

Overweight children engage in more %MPA and less %VPA than non-overweight children during school recess. Moreover, recess contributed between a quarter and a third to children's school-day VPA engagement. Interventions that aim to increase both non-overweight and overweight children's physical activity levels during school recess are warranted.

Acknowledgements

The authors thank A Jergenson, SJ Wolfe, D Sylofski and E Fuhrmeister for collecting the data.

Funding

Preparation of this manuscript was funded by the Robert Wood Johnson Foundation through its national program Active Living Research (ALR). N Ridgers was supported by the LJMU Promising Researcher Fellowship Scheme.

References

1. Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of high body mass index in US children and adolescents, 2007 2008. *JAMA*, 2010: 303: 242–9.
2. Lobstein T, Baur L, Uauy R. IASO International Obesity Taskforce. Obesity in children and young people: A crisis in public health. *Obes Rev*, 2004: 5(Suppl 1): 4–104.
3. Guo SS, Wu W, Chumlea WC, Roche AF. Predicting overweight and obesity in adulthood from body mass index values in childhood and adolescence. *Am J Clin Nutr*, 2002: 76: 653–8.
4. Salmon J, Campbell KJ, Crawford DA. Television viewing habits associated with obesity risk factors: A survey of Melbourne schoolchildren. *MJA*, 2006: 184: 64–7.
5. Byrd-Williams C, Kelly LA, Davis JN, Spruijz-Metz D, Goran MI. Influence of gender, BMI and Hispanic ethnicity on physical activity in children. *Int J Pediatr Obes*, 2007: 2: 159–66.
6. van Sluijs EMF, McMinn AM, Griffin S. Effectiveness of interventions to promote physical activity in children and adolescents: Systematic review of controlled trials. *BMJ*, 2007: 335: 703–7.
7. Ridgers ND, Carter LM, Stratton G, McKenzie TL. Examining children's physical activity and play behaviors during school playtime over time. *Health Educ Res*, 2011: 26: 586–95.
8. National Association for Sport and Physical Education. *Recess for Elementary School Students* [Position paper]. Reston, VA: National Association for Sport and Physical Education, 2006.
9. Lee SM, Burgeson CR, Fulton JE, Spain CG. Physical education and physical activity: Results from the school health policies and programs study 2006. *J Sch Health*, 2007: 77: 435–63.
10. Pellegrini A, Bohn C. The role of recess in children's cognitive performance and school adjustment. *Educ Res*, 2005: 34: 13–19.
11. Ridgers ND, Stratton G, Fairclough SJ. Physical activity levels of children during school playtime. *Sports Med*, 2006: 36: 359–71.
12. Ramstetter CL, Murrary R, Garber AS. The crucial role of recess in schools. *J Sch Health*, 2010: 80: 517–26.
13. Ginsburg KR. The importance of play in promoting health child development and maintaining strong parent-child bonds. *Pediatrics*, 2007: 119: 182–91.
14. Ridgers ND, Salmon J, Parrish AM, Stanley RM, Okely AD. Physical activity during school recess: A systematic review. *Am J Prev Med*, 2012, 43: 320–8.
15. Stratton G, Ridgers ND, Fairclough SJ, Richardson DJ. Physical activity levels of normal-weight and overweight girls and boys during primary school recess. *Obesity (Silver Spring)*, 2007: 15: 1513–19.

16. Ridgers ND, Stratton G, McKenzie TL. Reliability and validity of the system for observing children's activity and relationships during play (SOCARP). *J Phys Act Health*, 2010: 7: 17–25.
17. Brusseau TA, Kulinna PH, Tudor-Locke C, Ferry M, van der Mars H, Darst PW. Pedometer-determined segmented physical activity patterns of fourth- and fifth-grade children. *J Phys Act Health*, 2011: 8: 279–86.
18. Stellino MB, Sinclair CD, Partridge JA, King Am. Differences in children's recess physical activity: recess activity of the week intervention. *J Sch Health*, 2010: 80: 436–44.
19. Erwin H, Abel M, Beighle A, Noland MP, Worley B, Riggs R. The contribution of recess to children's school-day physical activity. *J Phys Act Health*, 2012: 9: 442–8.
20. Huberty JL, Siahpush M, Beighle A, Fuhrmeister E, Silva P, Welk G. Ready for Recess: A piot study to increase physical activity in elementary school children. *J Sch Health*, 2011: 81: 251–7.
21. National Centre for Health Statistics. *CDC Growth Charts*. Washington, DC: NCHS, 2006.
22. Corder K, Ekelund U, Steele RM, Wareham NJ, Brage S. Assessment of physical activity in youth. *J Appl Physiol*, 2008: 105: 977–87.
23. Freedson P, Pober D, Janz KF. Calibration of accelerometer output for children. *Med Sci Sports Exerc*, 2005: 11(Suppl): S523–30.
24. van Sluijs EMF, Page A, Ommundsen Y, Griffin SJ. Behavioural and social correlates of sedentary time in young people. *Br J Sports Med*, 2010: 44: 747–55.
25. Ridgers ND, Fairclough SJ, Stratton G. 12-month effects of a playground intervention on children's morning and lunchtime recess physical activity levels. *J Phys Act Health*, 2010: 7: 167–75.
26. Okely AD, Booth ML, Chey T. Relationships between body composition and fundamental movement skills among children and adolescents. *Res Q Exerc Sport*, 2004: 75: 238–47.
27. Ruiz JR, Rizzo NS, Hurtig-Wennlöf A, Ortega FB, Wärnberg J, Sjöström M. Relations of total physical activity and intensity to fitness and fatness in children: The European youth heart study. *Am J Clin Nutr*, 2006: 84: 299–303.
28. Robert Wood Johnson Foundation. *Recess Rules*. San Francisco, CA: Robert Wood Johnson Foundation, 2007.
29. Dale D, Corbin CB, Dale KS. Restricting opportunities to be active during school time: Do children compensate by increasing physical activity levels after school? *Res Q Exerc Sport*, 2000: 71: 240–8.