

Original Article

Effect of unstructured 15-minute active recess on children's daily physical activity

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Abstract:

School recess represents one of the few opportunities during the school day where children can typically engage in freely chosen leisure activities with their peers. An effective way to promote high levels of physical activity and increase the time spent in moderate-to-vigorous physical activity during the recess is in the availability of the sports equipment; however, it is not known if this is effective also in shorter (e.g. < 15-minute) recess periods. Therefore, we aimed to determine the contribution of 15-minute free-play recess, with available sport equipment, in 91 children (6-8 years) to daily physical activity. Physical activity was monitored by an accelerometer to determine the amount of overall, low, moderate, vigorous and moderate-to-vigorous physical activity. Children were randomised in control (CG; N=32) and experimental (EG; N=59) groups. CG followed usual recess while EG had available various but familiar sports equipment. During the recess EG were less inactive, and spend more time in overall, low, moderate, vigorous and moderate-to-vigorous physical activity ($p < 0.001$) than CG and spend 57.2 (18.0) % of recess time in moderate-to-vigorous physical activity. This was reflected also at daily levels, where EG reached higher overall (7.5 %; $p=0.048$), low (14.2 %; $p=0.010$), vigorous (22.3 %; $p=0.034$) and moderate-to-vigorous physical activity (15.6 %; $p=0.024$) than CG. Further, 92 % of EG achieved > 60 minutes of moderate-to-vigorous physical activity while only 69 % of CG. We confirmed a positive transfer of recess and daily moderate physical activity levels in a pooled sample and EG ($p<0.001$) with ~20 % of shared variance. A 15-minute school recess is a valuable contribution to the daily amounts of the children's physical activity. Even more, active recess periods could contribute also to the most recent (2020) WHO physical activity guidelines in limiting sedentary behaviour. Teachers supervising children during school recess should be encouraged to incorporate a range of different sports equipment to encourage children to play freely and to increase the intensity of physical activities during the school recesses.

Key Words: MVPA, Accelerometer, Physical Inactivity, School

Introduction

The physical, mental, and social health benefits of physical activity in children are well documented (Andersen et al., 2004; Janssen & LeBlanc, 2010). Despite the benefits of physical activity, a lot of children do not meet the minimal recommendations of moderate to vigorous intensity of physical activity (MVPA) neither in European countries (Verloigne et al., 2012; Wood et al., 2014) nor in Slovenia (Volmut et al., 2013). Specifically, only 4.6 % girls and 16.8 % boys aged 10-12 years are engaged in > 60 minutes of MVPA (Verloigne et al., 2012). In Slovenia the percentage is higher, as 21-67 % of children, from five to nine years, reach the recommendation, depending on sex and age (Volmut et al., 2013).

US Department of Health and Human Services Human Services (Altman, 1991) recommends that children achieve at least half of their daily physical activity recommendations during school hours. Therefore, schools play a central role in providing opportunities for children to engage in physical activity, especially for children who spend a large part of their average week day in school (IOM 2013; Pate and O'Neill 2008). During the week, school-age children spend up to 32 hours a week at school, from 73 % (Carson et al., 2014) to 92 % (Burns et al., 2015) of this time they spend physically inactive or sitting. A growing trend toward reallocating time in school to accentuate the more academic subjects has put this important facet of a child's school day at risk (Murray & Ramstetter, 2013). Schools can provide opportunities to engage in physical activity during the recess, during Physical education lesson and maybe during other physically active curricular activities and after the school time (extracurricular activities) (Jago & Baranowski, 2004; Wechsler et al., 2000). Therefore, Physical education lessons and the recesses represent two-main contexts in which all children have the opportunity to be physically active (Rooney & McKee, 2018; Sarkin et al., 1997). However, a recent systematic review reported that children spend only 32.6% of Physical education lesson time in MVPA (Brusseau et al., 2016; Hollis et al., 2016), and similar amount was found in Slovenia, too (Pušnik, Tim, Volmut, Tadeja, Šimunič, 2014). School breaks are more common on the timetable during the day and represent an opportunity

for children to be physically active. Therefore, it is important to consider how best to design school breaks to increase children's physical activity.

In most elementary schools in Slovenia the actual time of physical activity during Physical education is often shorter than 45 minutes, e.g. 36 minutes with only 11 minutes of MVPA (Pušnik, Volmut and Šimunič 2014), and is in Slovenia scheduled only three times per week as well as in majority of other countries (Clennin et al., 2018). On the other hand, the recess is scheduled more frequently throughout the school day time (Verstraete et al., 2006) and may contribute importantly to the recommended 60 minutes of MVPA daily (Ridgers, Stratton and Fairclough, 2006; Rooney and McKee, 2018). It also represents an opportunity during the school time when all children can be physically active (Slingerland & Borghouts, 2011), especially on the days when they do not have scheduled Physical education.

Long and uninterrupted physical inactivity is largely prevalent also in children (Mitchell, 2019) and many important risk factors for chronic diseases of adults are initiated in childhood. Approximately 40 % of children aged 5-8 years old have increased risk factors for heart disease, such as obesity, hypertension and high total cholesterol, or for diabetes (Mavrovouniotis, 2012). Furthermore, physical inactivity in children is an important risk factor for physical activity-related injuries (Bloemers et al., 2012). Physical inactivity during the school time is threatening, especially when we do not interrupt it for several times in a day. For that purpose, all recesses during the school time are very important in order to further prevent the negative effects of prolonged physical inactivity on children's health and to increase out of school physical activity habits (Drummy et al., 2016). During the school recess children have the opportunity to participate in free play activities, semi-structured or structured activities in indoor or outdoor school settings. School recess represents one of the few opportunities during the school day where children can typically engage in freely chosen leisure activities with their peers that are largely independent of adult control (Anthony D Pellegrini, 2006). Ridgers and Stratton (Ridgers & Stratton, 2005) and Stratton and Mullan (2005) suggested that children should be physically active for 40-50 % of school recess time in order to achieve physical activity recommendations. Extensive research showed that children spent from 10.8-65 % of their recess periods engaged in MVPA (Baquet et al., 2018; Brusseau et al., 2013; Erwin et al., 2012; Gao et al., 2017; V. P. Lopes et al., 2006; Ridgers et al., 2018; Ridgers & Stratton, 2005; Saint-Maurice et al., 2018). Some studies have analysed children's free-play physical activity levels during recess and revealed that children spent less than 50 % of their recess time engaged in MVPA during free-play recess periods (Larson et al., 2014; Stratton, 2000). Physical activity during free-play recess is frequently decided by children themselves according to their interest and motivation. Children, who do not enjoy taking part in a physical activity, rather do sedentary activities (e. g. screen time, drawing, colouring etc.). In addition, a free-play environment during recess may not offer equal opportunity for physical activity to all children (Erwin et al., 2012).

A simple way to further increase time spent in MVPA during the recess is in the availability of the sports equipment (Jago & Baranowski, 2004; Wechsler et al., 2000), as the availability of type and amount of sports equipment can promote high levels of physical activity and increase the MVPA for 48-61 %. (Verstraete et al., 2006). Zask and colleagues (2001) reported that the ratio of balls per children had an influence on vigorous physical activity (VPA). In other studies, they also received a positive association between the presence of sport equipment between major recess and the MVPA (Baquet et al., 2018; Ridgers et al., 2012).

Recess periods in abovementioned studies were 60 minutes (Brusseau et al., 2013; Ridgers et al., 2005), rarely shorter, e.g. 16 minutes, (Verstraete et al. 2006), and the duration had a strong lever to contribute to the overall daily physical activity. However, in Slovenia mostly 5-15 minutes recesses are available, and the question remain if < 15-minute recess could contribute to the daily physical activity levels. Further, children spend most of the school time supervised and there is a need to encourage free-play during the recess for their creative, emotional and social development (Burdette & Whitaker, 2005; Ramstetter et al., 2010). A further understanding of the effects of unstructured (free-play) and semi-structured recess is needed, as it is important to know that unstructured and semi-structured recess may have an enjoyment effect. We also know that enjoyment influences behaviour and has an indirect effect on physical activity (Dishman et al., 2005).

Therefore, the aim of the study was to determine the contribution of free-play and semi-structured 15-minute active recess to children's physical activity level during recess and daily levels using an accelerometer.

Material & methods

Participants

The study was conducted in coastal elementary school in the western part of Slovenia. The sample included 91 children (47 boys) of the first three years of elementary school, aged 6 to 8 years. There were 28 children from the first grade, 40 children from the second and 23 children from the third grade. Children were divided in the control (CG; N=32) and the experimental (EG; N=59) group. The parents of children who agreed to participate signed written consent. All ethical dilemmas were solved within the institutional ethical body of the Institute for kinesiology research, Science and Research Centre Koper, University of Primorska.

Instrumentation

Physical activity was assessed with ActiGraph GT1M accelerometer (ActiGraph, Pensacola, Florida). Each child was being measured for one day. The accelerometer was placed around the child's waist with an

elastic belt in the morning, when they came to school. The children wore the accelerometers on the right hip all the time except during night sleep or taking a shower or a bath. In the beginning we demonstrated how to fasten and unfasten the accelerometer. The next day, before the school, the accelerometers were taken away. We carefully recorded the time of the active recess. The accelerometer recorded physical activity for every 15-second interval. For valid daily analyses, we considered the data collected from 8:00 am to 8.00 pm (12 hours). All continuous 20 minutes of “zeros” were eliminated from the record. Only children with at least 80 % of valid time (9.6 hours) were taken in the analysis (Cain et al., 2013). The physical activity cut-off points for school children were determined as follows: being 0 – 1488, 1489 – 2336, 2337 – 3520 and > 3520 cpm for physical inactivity, light (LPA), moderate (MPA) and VPA intensity of physical activity (Pate et al., 2006).

Procedure

All recess evaluations were conducted outdoor in April and May. The main recess at this elementary school on a typical school day initially lasts 25 minutes, after the second school lesson at 9.55 am. During the study the recess was divided into two periods, the first 10 minutes were taken for breakfast, and the remaining 15 minutes were free for play or semi-structured physical activity, being the focus of this study.

The recess of the EG, which was intended for semi-structured physical activity, was on average 14.2 (2.5) minutes and was spent in the outdoor school playground. Various sport equipment was available to children (two football balls, four softballs, ten tennis balls, seven jumping ropes, five medium and six big flat hoops, five standard hoops, five pairs of badminton rackets and twelve plastic hockey sticks). Children were supervised and free to play with this equipment. All sports equipment and manipulation with it was already familiar to children. Recess supervisors included a physical education teacher and an elementary school teacher. They showed all sports equipment to the children and encourage them to be physically active. Children could only play with sports equipment during the recess, which was intended for physical activities. The task of the researcher was to prepare sports equipment before the start of the school recess.

The children who were included in the CG had an ordinary school recess. During the 15-minute part of the recess these children were free to play in the classroom or outdoors. The children were supervised for safety purposes, but were not given instruction on what activities to engage in.

Data collection and analysis / Statistical analysis

The accelerometer data are presented as mean and (standard deviation) for overall and minutes spent in all intensity phenotypes of physical activity. The data passed the normality tests (histogram, Q-Q plot, Shapiro-Wilk). However, Leven tests indicated heterogeneity of variances (due to large differences in mean and standard deviation values) in majority of physical activity phenotypes when analysed during active breaks. Therefore, we took t-test for unequal variances for comparing groups. After excluding possible sex-, age- and interactions sex*group- and age*group-effects using multivariate General Linear Model (GLM) we pooled the data for between group comparison using t-test. A correlation analysis of within recess and daily physical activity data was performed with Pearson correlation coefficient and Bonferroni correction of p-value (initially set to 0.05). The data was analysed using Microsoft Excel (Microsoft Co., USA) and the SPSS statistic packet (24.0, SPSS, IBM Inc., USA). When we found significant differences an effect size was calculated as Cohen’s d value.

Results

Recess physical activity analysis

We could not confirm any sex-, age- or interactions sex*group- and age*group-effects in physical activity phenotypes ($p > 0.05$); therefore, we pooled data for further analysis. Table 1 presents between group analysis of the data obtained within 14.2 (2.5) minutes recess. There was a significant group effect ($p < 0.001$) for each physical activity phenotype during the recess, with large effect sizes (from 1.0 to 9.3). It is noticeable that the amount of overall physical activity of the CG during the recess was very low, even lower than their overall daily physical activity being 750.4 (169.1) cpm ($p = 0.034$; Table 2). During the recess the EG reached > 50 % of recess time in MVPA, 57.2 (18.0) %, whereas CG only 7.04 (1.24) % ($p < 0.001$).

Table 1: Comparison of physical activity during school recess between experimental and control group.

	Experimental group	Control group	P (effect size)
N	59	32	
Overall amount of PA (cpm)	2769 ± 726	626 ± 350	< 0.001 (5.3)
Physical inactivity (min)	3.96 ± 2.49	13.2 ± 2.20	< 0.001 (4.2)
Low physical activity (min)	1.86 ± 0.83	1.02 ± 0.83	< 0.001 (1.0)
Moderate physical activity (min)	3.10 ± 1.39	0.78 ± 0.78	< 0.001 (3.0)
Vigorous physical activity (min)	4.59 ± 2.28	0.31 ± 0.46	< 0.001 (9.3)
Moderate to vigorous physical activity (min)	7.69 ± 3.96	1.09 ± 1.10	< 0.001 (6.0)

Daily physical activity analysis

At the daily levels, we could not confirm any sex-, age- or interactions sex*group- and age*group-effects in physical activity phenotypes ($p > 0.05$) using multivariate analysis. After pooling the data for statistical analysis, as was also done with the data obtained within the recess, we found between group changes ($p =$

0.039). Therefore, in Table 2 we presented between group analysis of the daily physical activity data and found 7.5 % ($p = 0.048$) higher overall physical activity, 14.2 % ($p = 0.010$) higher LPA, 22.3 % ($p = 0.034$) higher VPA and 15.6 % ($p = 0.024$) higher MVPA in EG than in CG. In average children achieved > 60 minutes of MVPA; however, 31 % and 8 % from the CG and EG, respectively, did not.

Table 2: Comparison of daily physical activity between experimental and control group.

	Experimental group	Control group	P (effect size)
N	59	32	
Overall amount of PA (cpm)	826 ± 185	750 ± 169	0.048 (0.45)
Physical inactivity (min)	573 ± 38.5	586 ± 35.5	0.113
Low physical activity (min)	50.6 ± 10.9	44.3 ± 10.5	0.010 (0.60)
Moderate physical activity (min)	43.3 ± 12.2	38.5 ± 11.6	0.073
Vigorous physical activity (min)	42.7 ± 17.0	34.9 ± 16.1	0.034 (0.48)
Moderate to vigorous physical activity (min)	86.0 ± 25.9	73.3 ± 23.8	0.024 (0.53)

Table 3 presents correlation analysis of physical activity within recess and daily physical activity for pooled participants and separately for EG and CG. We could observe that MPA within the recess correlates to daily amount of MPA in EG ($r = 0.486$; $p < 0.001$) as well as in pooled participants ($r = 0.443$; $p < 0.001$). This is reflected also in MVPA; however, only in pooled participants ($r = 0.341$; $p = 0.001$).

Table 3: A Pearson correlation analysis between physical activity within recess and daily physical activity.

	Pooled	Experimental group	Control group
N	91	59	32
Overall amount of PA (cpm)	0.303	0.235	0.422
Physical inactivity (min)	0.169	0.112	-0.100
Low physical activity (min)	0.281	0.028	0.500
Moderate physical activity (min)	0.443 (<0.001)	0.486 (<0.001)	0.312
Vigorous physical activity (min)	0.297	0.209	0.391
Moderate to vigorous physical activity (min)	0.341 (0.001)	0.246	0.422

In brackets significant correlation after Bonferroni correction of p-value to 0.003.

Discussion

The main finding of this study is that the children of the EG in a short, < 15-minute recess, intended for relaxation and entertainment, spent as much as 57.2 % of recess time in MVPA which contributed that 92 % of them achieved minimal daily recommendations for MVPA, whereas only 69 % of CG children achieved recommendations. Even more, EG children were 27.3 % of the recess time in physical inactivity while CG children spent as much as 91 % of the recess time in physical inactivity. Similar findings are also reported by Verstraete et al. (2006), where 10-year-old Belgian children had various sport equipment available during 16-minute morning recess and spent 56 % of time in MVPA.

Stratton and Mullan (2005) suggested that schoolchildren should be 50% of the recess time physically active in order to achieve the indicative daily recommendations for physical activity. Percent of MVPA of our study (57.2 %) and the study by Verstraete et al. (2006) (56 %) are slightly higher than those reported in other studies. In the Stratton's (2000) intervention study it is stated that 5-7-year-old British children spend 35-41 % of the recess time in MVPA. It seems that recess MVPA depends also on the duration of recess, as Guinhouya et al. (2005) reported that during two daily 15-minute recesses children spent 16.3-20 % in MVPA but in two 20-minute daily recesses MVPA increased to 23-26.5 %. The main recess, which extends over a longer period of time, allows children to handle sports equipment for longer, which may result in a longer and higher physical activity (Verstraete et al., 2006). However, the question remains if this trend is linear. Therefore, further research is needed to find ideal time of active recess to optimally increase the amount and intensity of physical activity in children.

Some previous studies report that children can achieve up to 50 % of their daily MVPA during all school recesses (Verstraete et al., 2006). However, it must be emphasized that this recommendation is very difficult to achieve for children attending Slovenian schools, as schools usually have one or maybe mostly two main recesses, lasting up to 30 minutes per day in total. One recess or part of the recess, depending on school policy, is intended for school meals, and the other recess or half of the recess is for the children's relaxation and entertainment. Most foreign primary schools usually take three main school recesses, namely the morning and afternoon and the lunch recess, which gives a greater opportunity to follow the daily recommendations for physical activity. It may be advisable to include another longer recess in the daily school schedule, intended only for the children's physical activities, or to slightly extend the existing main recess (V. P. Lopes et al., 2006). In their study Mota et al. (2005) found that physical activity during the school recess can contribute 6-9 % of daily MVPA. This is in line with our EG, where children achieved 9.4 (3.9) % of daily MVPA during recess period, whereas CG only 1.5 (1.3) %. This underlines school's active role in the achievement of minimal

recommendations. Nevertheless, we are satisfied with the results of the study, since the children spent more than 50 % of the recess time in MVPA, and MPA (but not VPA) from recess time correlates also to daily MPA, especially in EG, explaining 19.6 % of daily MVPA variance. This could be explained by appropriately selected and pre-familiarised sports aids, favourable weather during the study, outdoor environment with playgrounds, that promoted children's participation in MVPA during recess. A suitable outdoor school environment with suitable outdoor playgrounds, sports fields and accessible sports aids enables children to be more physically active both during and after school (Brink et al., 2010; Fernandes & Sturm, 2010; Sallis et al., 2001).

In addition, we were interested in the effects of age and gender on the amount and time spent in each intensity of physical activity during recess. We did not find age- and sex- main effects, neither age*group and sex*group interaction effects in recess period nor in daily period. Most published studies investigating the effects of an intervention program on children's activity during school recess report that boys are more active than girls, regardless of age, and the method used to monitor physical activity (Luis Lopes et al., 2006; McKenzie et al., 2010; Ridgers et al., 2007) and that boys achieve longer MVPA periods than girls during the recess (McKenzie et al., 2010), which is not consistent with our results. Interestingly, Mota et al. (2005) and Lopes et al. (2009) found the opposite. Lopes et al. (2009) found that the intervention program during the main recess increased the level of mean intensity only in girls and decreased in boys, but the overall level of physical activity increased in both boys and girls. The authors add that the total amount of physical activity for boys increased during the intervention program at the expense of the increased VPA. Mota and colleagues (2005) found no differences between boys and girls in the time spent in the MVPA; however, girls spent more time in MVPA during recess than boys.

We found that recess differences (with large effect sizes) in physical activity were reflected also on a daily level of physical activity (with moderate effect sizes); however, only in overall physical activity, LPA, VPA and MVPA. It is interesting to see that short, < 15 minute, physically active recess could contribute in such an amount on daily physical activity. From this we can conclude that even a very short intervention, which lasts only 14.2 (2.5) minutes but physically very active, significantly contributes to daily physical activity. Although active school recess increases physical activity levels it seems that is not sufficient to enhance 6-minute walking distance in 7-9-year olds after 12-week intervention programmes (Casolo et al., 2019); however, it remains to be seen effects on fitness using more precise assessment methods.

In order to achieve higher levels of physical activity among children through intervention programs during school recess, future studies should examine more closely the factors that influence the physical activity of children of different ages. At the same time, they should study and understand how children respond to different types of interventions, as this will enable researchers to design interventions that best contribute to increasing physical activity during school recess involving physical activity.

Limitations

Our pilot study also has certain limitations. The first is that we measured the physical activity of each child only once during the intervention program during the main recess, so we do not know if the effect of the intervention program would be the same over a longer period. Due to the geographical limitation of the sample, the results of the study cannot be generalized to the entire population of Slovenian primary school children, so that in the future it would be useful to carry out an intervention program in more schools, other regions of Slovenia and under different weather conditions.

Conclusions

In conclusion, a fifteen-minute school recess is a valuable contribution to the daily amounts and intensity of the children's physical activities. Specifically, children spent as much as 57.2 % of recess time in MVPA which contributed that 92 % of them achieved minimal daily recommendations for MVPA, being 23 % more than children from the control group. Even more importantly, children spent only 27.3 % of recess time in physical inactivity, when compared to 91 % of physical inactivity time in the control group. This is gaining on the importance as the most recent WHO physical activity guidelines (Bull et al., 2020) are limiting sedentary behaviour for the first time in the history of their guidelines. Teachers supervising children during school recess should be encouraged to incorporate a range of different sports equipment to encourage children to play freely and to increase the intensity of physical activities during the school recesses. With a little planning, teachers can learn a variety of games that the children can play on the outside or inside surfaces of the school. More research is warranted to determine school environmental and sports equipment and influences on children's recess physical activity.

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