PLAY AREA AND PHYSICAL ACTIVITY IN RECESS IN PRIMARY SCHOOLS

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Abstract:

The aim of the present study was to describe the daily physical activity (PA) during recess of primary-school children and its relationship with the play area and their age. 738 children (8.5±1.7 years, range six to eleven years) participated in the study. The playground recess PA of each child was measured using accelerometry. An ANOVA was used to determine the differences in PA by play area (large >15 m^2/child and small area <8 m^2/child) in each age group. In general, the children in larger play areas were more active than the children in small play areas (effect size=.36). This difference was larger in nine-year (effect size =.81), ten-year (effect size =.60) and eleven-year old children (effect size =.55). It seems necessary to carry out strategies that provide a greater opportunity for PA in small playgrounds with a high density of children.

Key words: *childhood, exercise, health, sedentary lifestyle*

Introduction

Physical activity (PA) is associated with numerous health benefits. In children it is essential to prevent being overweight and obese. There is evidence that low levels of PA predispose children to increased body fat (Reilly, 2008). PA prevents chronic health problems and promotes a balanced physical, social and psychological development (Janssen & LeBlanc, 2010). However, a lot of young people have lower activity levels than recommended for good health (Verstraete, Cardon, De Clercq, & De Bourdeaudhuij, 2006). Worryingly, the international *Health Behavior in School-aged Children* study reports that less than two thirds of all young people participate in sufficient PA to meet these guidelines (27% of all girls and 40% of all boys) (World Health Organization, 2004). A comprehensive understanding of the determinants of PA among the youth is essential for the identification of appropriate points of intervention to promote active lifestyles and their associated health benefits (Davinson & Lawson, 2006). Physiological determinants of PA in children include race, sex, and age (Sallis, Prochaska, & Taylor, 2000). The school represents a suitable setting for intervention programmes aimed at promoting PA to benefit health (Ridgers, Stratton, & Fairclough, 2006) because children spend a large portion of their day in school (Van Sluijs, McMinn, & Griffin, 2007). They can be physically active before and after school, during physical education classes and recess time (Beets, Beighle, Erwin, & Huberty, 2009). Recess periods are an important school environmental factor for the promotion of health-related PA in primary-school children (Verstraete, et al., 2006). Several studies have attempted to evaluate PA in the playground during recess, these have concentrated on specific age groups (Beighle, Morgan, Le Masurier, & Pangrazi, 2006; Mota, Silva, Santos, Ribeiro, Oliveira, & Duarte, 2005; Sarkin, McKenzie, & Sallis, 1997), a cross-section at age studies (Escalante, Backx, Saavedra, García-Hermoso, & Dominguez, 2011), differences between sexes (Ridgers & Stratton, 2005; Ridgers, Toth, & Uvacsek, 2009), differences between ethnics (Blatchford, Baines, & Pellegrini, 2003), or interventions for accumulating more PA (Ridgers, Fairclough, & Stratton, 2010a; Stratton & Mullan, 2005). However, only a small number of studies have examined the impact of the characteristics of the school's environment on PA during recess. The play area seems to be a determinant for realizing adequate PA levels in the playground in children

between eight to eleven years old (Harten, Olds, & Dollman, 2008). In the same way, studies show that in smaller schools (≤100 students) the PA in recess time was significantly higher than in larger schools (≥500 students) (Zask, van Beurden, Barnett, Brooks, & Dietrich, 2001). However, another study did not find a relationship between play area size and PA, but this study measured the PA in different areas. The aim of the present study was to describe the daily PA during recess of primary-school children and its relationship with play area and age.

Methods

Subjects

Seven schools from Extremadura, Spain, were invited to take part in the study. The sample of schools was representative of the total population schools (rural and urban schools). Initially, the parents of 913 children (84% of those invited) gave written informed consent to participate. 175 subjects were not included in the analysis due to failure to complete the general questionnaires (139 children) or a problem with the accelerometers (36 children). The final sample therefore consisted of 738 children (8.5±1.7 years, range six to eleven years). The study was approved by the Bioethics and Biosafety Committee of the University Extremadura (Spain) and respected the principles of the Declaration of Helsinki.

Playground size and characteristics

All playground features were recorded by members of the research team, who visited the schools. The presence or absence of the following playground characteristics were recorded: indoor/outdoor playgrounds, basketball courts, handball/indoor football courts, volleyball courts and other equipment. The number of children enrolled in each school was provided by the schools during the researcher's visits. Google Earth Pro software was used to provide an estimate of the playground spatial area (m^2) at each of the schools using aerial pictures of the playgrounds and the polygon measurement tool. This methodology had been used before in other studies (Ridgers, Fairclough, & Stratton, 2010b). The average play area per child was calculated by dividing the number of children in the school by the playground size available for use during recess. The researchers measured all the playgrounds to determine the play area per child. The playgrounds were divided into large-area (>15 m^2/child) and small-area (<8 m^2/child) playgrounds. The researchers investigated the difference in volume of PA and the relationship with playground size.

Assessments

All participants were assessed for height and weight. Playground recess PA was measured using accelerometry. This method is commonly used in a pediatric population (Rowlands, 2001). The accelerometer used was a Caltrac® (Hemokinetics, Madison, WI, USA) which was programmed to function as a PA monitor (Sallis, Buono, Roby, Carlson, & Nelson, 1990). The Caltrac is an accelerometer that contains a piezoelectric bender element which assesses the movement in the vertical plane. The Caltrac adds and integrates the absolute values of acceleration versus curves and derives this as a numerical value (motion counts). This uni-axial accelerometer has been shown to be highly correlated with the tri-axial accelerometer (Eisenmann, Strath, Shadrick, Rigsby, Hirsch, & Jacobson, 2004). This methodology is similar to that used in other studies (Escalante, et al., 2011; Kimm, et al., 2000; Sallis, et al., 1990; Sarkin, et al., 1997).

Table 1. General characteristics of schools

Characteristic	Total (N=7)	Large-area (>15 m^2/child) (n=3)	Small-area (<8 m^2/child (n=4)
Children	738	365	373
Playground (%)	100	100	100
Surface			
Cement (%)	71	100	50
Cement and land (%)	29	0	50
Courts			
Multi-sport (%)	100	100	100
Other equipment			
Tree (%)	14	0	25
Slide or swing (%)	14	0	25

Procedures

After the initial contact with the schools and the acceptance to participate in the study by the head teachers and school, an informed consent form was given to the parents/guardians. Those who signed the consent form were included in the study. The children were measured (height and weight) at the start of the day. Approximately ten minutes before recess, two researchers entered the classroom and distributed accelerometers to the participants who were seated at their desks. Each accelerometer was fixed to the waistband of the child's skirt or trousers before recess and the screen of the accelerometer was covered using black tape to prevent observation of the accelerometer measurement. Teachers and researchers monitored the recess ensuring that PA was not different from the usual activities in order to prevent the manipulation of the accelerometer measurement. Upon returning to the classroom after recess time, the students placed their accelerometers in a plastic collection container. The recess in all schools was of thirty minutes duration, was performed outdoors on sunny days and all age groups participated simultaneously, forty children were assessed during each recess period.

Statistical analysis

The normality of the distributions was assessed by means of the Kolmogorov-Smirnov test and Levene test. A one-way analysis of variance (ANOVA) was used to test the hypotheses about the equality of the means between groups for recess physical activity. Multivariate analysis of variance (MANOVA) was used to analyse the main and interaction effects of age and play area. A p-value <.05 was considered to be statistically significant. Confidence intervals and effect sizes (ES) of the differences were calculated (Cohen, 1988). The Statistical Package for Social Sciences (SPSS for Windows, version 15.0®) was used for all analyses.

Results

Recess PA characteristics of children according to age and play area are shown in Table 2. In general, the children with large-area playgrounds were more active in recess than those with small-area playgrounds (p<.001; ES=.36). These differences were greater in nine–year (p<.001; ES=.81), ten–year (p=.001; ES=.60) and eleven–year olds (p=.005; ES=.55). There were no interactions between sex or age and daily physical activity or physical activity at recess.

Discussion and conclusions

In order to promote PA in children, it is important to know where, how and when PA is performed. Schools have been recognized as a potential public health tool (Story, Kaphingst, & French, 2006) because the schools create an extended window of opportunity to promote PA for all children, regardless of their life circumstances (Naylor & McKay, 2009). The present study evaluates the differences in recess time physical activity levels in primary school-aged children and the relationship with age and play area (m^2 per child). To our knowledge, this is the first cross-sectional study in schoolchildren (covers six years, children six to eleven years old) that describes the PA during recess of primary--school children and its relationship with the play area.

School playgrounds provide important settings and opportunities for children to engage in PA and should be a part of each school day. There are a lot of studies and information about the fact that moderate or vigorous PA activity is needed to inform future activity promotion efforts (Ridgers, et al., 2010b). However, most of these studies do not take into account the school environmental characteristics (area type and size). These characteristics are determinate factors in recess PA (Harten, et al., 2008; Ridgers, et al., 2010b; Sallis, Conway, Prochaska, McKenzie, Marshall, & Brown, 2001; Verstraete, et al., 2006; Willenberg, et al., 2009). In general, the results showed that the children in large-area playgrounds achieved more recess PA than the children in small-area playgrounds (ES=.36, 95% CI, 0.21 to 0.50). It was shown that a larger play area is associated with higher activity levels in pre-schoolers (Cardon, Van Cauwenberghe, Labarque, Haerens, & De Bourdeaudhuij, 2008)

Table 2. Physical activity characteristics of children according to age and play area. Data are mean ± standard deviation

	Overall (N=738)	6 years (n=121)	7 years (n=122)	8 years (n=124)	9 years (n=119)	10 years (n=125)	11 years (n=127)
Playground physical activity (counts)							
Large-area (n=365)	27.71 ± 11.03	23.68 ± 9.86	28.21 ± 9.59	28.93 ± 12.03	29.56 ± 12.10	28.97 ± 11.49	26.30 ± 9.44
Small-area (n=373)	23.77 ± 11.12	26.82 ± 12.30	24.04 ± 10.68	29.20 ± 11.32	20.41 ± 9.83	22.80 ± 8.43	20.42 ± 11.35
p-value	**<.001**	.123	**.022**	.900	**<.001**	**.001**	**.005**
Effect size	.36	-.29	.41	-.02	.81	.60	.55
Inferior interval confidence	0.21	-0.65	0.06	-0.38	0.42	0.24	0.17
Superior interval confidence	0.50	0.08	0.77	0.34	1.20	0.97	0.94

and in schoolchildren, but only in boys (Harten, et al., 2008). Therefore, the area available for a game (Davison & Lawson, 2006; Ridgers, et al., 2010b) and the density in the playground (m^2/child) (Zask, et al., 2001) are key determinants of recess PA. However, it is not clear how much further improvements in school environments could boost students' PA (Sallis, et al., 2001).

On the other hand, the recess PA according to age showed that the children in large-area playgrounds (m^2 per child) achieved more PA than the children in small-area playgrounds in seven-, nine, ten- and eleven-year olds. The minor differences were in seven-year-olds with a small effect size (ES=.41, 95% CI, 0.06 to 0.77) and the major differences in nine-year-olds with a large effect size (ES=.81, 95% CI, 0.42 to 1.20). These differences at age seven may be due to the activities in this age group being largely anaerobic or fantasy games that do not require a large area generally (Strong, et al., 2005). In this way the differences were less marked, or not there (6-year-olds). In this sense, it has been suggested that young children participate more in moderate and vigorous PA than older schoolchildren (Pate, Baranowski, Dowda, & Trost, 1996). This could indicate that this practice is independent of the playing area available. On the other hand, older children (9-14 years old) incorporate individual or group activities and many organized sports (Strong, et al., 2005). Often football dominates more than half of the playground perhaps due to cultural and environmental factors (Nilsson, et al., 2009). So, the rest of children are placed around the perimeter of the game playground and they participate in sedentary activities (Armitage, 2001). This could explain the smaller differences in PA at the younger age. The researchers observed the use of a large-area playground for participating in team activities such as football, basketball or handball. These games required more space for their practice and involved more children aged between 9-11 years. This confirms that the density of the playing area may be important in PA level. In small-area playgrounds children often participate in activities that are less intense (i.e. talking, walking, using a skipping rope, eating snacks) or ball sports where children take turns to have their share of the play area, which seems more pronounced at older ages (9-11 years old). The types and contexts of activities are variable and change with age during childhood and adolescence (Strong, et al., 2005).

The present study has some limitations. First, the use of accelerometers could influence the PA in the playground. However, the teachers of the children denied that the behaviour of the children differed from normal. On the other side, the large number of subjects (738) and school recess time could compensate for these variations analysed. Secondly, the study has not taken into account how the equipment and material available in the playground affect the PA performed by the subjects. Thirdly, the time during which the accelerometry data was collected, during the spring and summer months in a hot climate, may have had a seasonal effect on the data.

In general, the children in large play areas (m^2 per child) were more active than the children in small play areas. This difference was great between ages 9-11 years. This seems to suggest the need to carry out strategies that provide greater opportunities for PA in small area playgrounds. In this sense the study could propose separated recess time courses with different hours to create more available space per child. Alternatively, specific areas could be assigned for different games (football, basketball, etc.) allowing more children to have space assets for other activities.

Practical implications

The recess could be an opportunity for children to be more active. So, the children in large play areas were more active than the children in small play areas. Finally, strategies that provide greater opportunities for PA in a small area playground are necessary.

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IGRALIŠTE I TJELESNA AKTIVNOST ZA VRIJEME ŠKOLSKOG ODMORA U OSNOVNIM ŠKOLAMA

Cilj je ovog istraživanja bio opisati dnevnu tjelesnu aktivnost osnovnoškolske djece za vrijeme školskog odmora i utvrditi njezinu povezanost s veličinom igrališta i dobi djece. U istraživanju je sudjelovalo 738 djece (8,5±1,7 godina, raspon godina 6–11 godina). Tjelesna aktivnost svakog djeteta na školskom igralištu za vrijeme školskog odmora mjerena je akcelerometrom. Za utvrđivanje razlika između razine tjelesne aktivnosti prema veličini površine igrališta u svakoj dobnoj grupi (veliko igralište >15m^2/dijete i malo igralište >8m2/dijete) korištena je ANOVA. Općenito, djeca koja su provodila školski odmor na velikom igralištu bila su tjelesno aktivnija od djece koja su provodila školski odmor na malom igralištu. Razlika je bila veća u devetogodišnje (veličina efekta=0,81), desetogodišnje (veličina efekta=0,60) i jedanaestogodišnje djece (veličina efekta=0,55). Istraživanje pokazuje da je potrebno provesti strateške promjene koje bi omogućile povećanje tjelesne aktivnosti na manjim igralištima na kojima se odmara veći broj djece.

Ključne riječi: *djetinjstvo, tjelovježba, zdravlje, sedentarni stil života*