South African Journal for Research in Sport, Physical Education and Recreation, 2017, 39(3): 57 – 66.
Suid-Afrikaanse Tydskrif vir Navorsing in Sport, Liggaamlike Opvoedkunde en Ontspanning, 2017, 39(3): 57 – 66.
ISBN: 0379-9069

PHYSICAL ACTIVITY DURING RECESS IN ELEMENTARY SCHOOL: GENDER DIFFERENCES AND INFLUENCE OF WEIGHT STATUS

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ABSTRACT

The aim of this study was to determine the levels of physical activity during unstructured recess in the elementary school considering gender and weight status. There were 66 elementary school participants from southern Spain. Anthropometric parameters, such as body mass, body height and body mass index and physical activity were recorded. Overweight children and those with obesity showed lower levels of vigorous and very vigorous activity, a lower number of steps, and lower total physical activity compared to normal weight children. Girls showed lower energy expenditure, number of steps, very vigorous activity, total physical activity and greater sedentary time than boys. Pearson correlation analysis shows a significant correlation between body mass index and number of steps (r=-0.251, p=0.042). In the interaction between gender and weight status, the children who were overweight or obese exhibited high energy expenditure (p=0.002), fewer number of steps (p=0.024), high active energy expenditure (p=0.017), and low very vigorous activity (p=0.003). The physical activity levels in recess are regulated by gender and weight status. Boys were more active than girls during recess regardless of their weight status. Regardless of gender, the normal weight group was more active than overweight+obesity group during recess.

Keywords: Playground; Children; Overweight; Obesity; Physical exercise.

INTRODUCTION

The importance of physical activity (PA) for health is well known and research has noted both physical and psychological benefits when children participate in physical activities (Janssen & Leblanc, 2010; Ahn & Fedewa, 2011). To improve cardiorespiratory and muscular fitness, bone health and cardiovascular and metabolic health biomarkers in youths aged 5-17 years, the World Health Organisation (WHO, 2010) recommends accumulating at least 60 minutes of moderate to vigorous intensity PA daily. Physical activity longer than 60 minutes provides additional health benefits. Most of the daily PA should be aerobic.

Vigorous intensity activities, including those that strengthen muscle and bone, should be incorporated at least three times per week. However, children may not be engaged in enough

PA to benefit their health (Livingstone, 2001; Speiser *et al*., 2005; Van Stralen *et al*., 2014). In addition, the prevalence of overweight and obese children is a worldwide growing concern. The incidence of overweight and obese children has increased worldwide from 4.2% in 1990 to 6.7% in 2010 and is expected to reach 9.1% or about 60 million in 2020. This trend is due to the change in nutrition and PA patterns in complementary activities (De Onis *et al.*, 2010). The increase of obesity and other childhood diseases are related to physical inactivity (Livingstone, 2001; Speiser *et al.*, 2005).

European children spend an average of 65% of their time at school on sedentary activities and another 5% on moderate to vigorous intensity activities. Girls spend a significantly greater amount of school-time on sedentary activities (67% vs. 63%) and less time on moderate to vigorous intensity activities (MVPA) (4% vs. 5%) than boys. In addition, overweight children spend significantly less time on MVPA than normal weight children (4% vs. 45%) (Van Stralen *et al*., 2014). Laguna *et al*. (2011) reported that during the week MVPA was associated more with gender than with the body mass index (BMI) (overweight/obese vs. not-overweight), with boys being significantly more active than girls. Important differences were found only between not-overweight vs. overweight/obese boys.

In relation to age, Aznar *et al*. (2011) noted that young children were more active and less sedentary than older children during the week. During weekdays, more children achieved PA recommendations than on weekend days, although few children achieved the level of MVPA recommended for health, in particular adolescent girls were at risk. Overweight and obese children often are teased by schoolmates especially during physical education (PE) classes (DeSmet *et al*., 2014). This could influence the practice and enjoyment of sports, resulting in low levels of PA (Faith *et al*., 2002). As a result, PA levels are lower in overweight children (Janssen *et al*., 2005).

Physical education and recess are great opportunities to complete the daily PA goal without showing any evidence of compromising academic performance (Strong *et al*., 2005). The recommendations for the elementary school are more than 30 minutes of MVPA per day through PE and recess and especially recommended is at least 20 minutes of recess per day (Carlson *et al*., 2013). Gender differences in PA levels during recess are well documented (Ridgers *et al*., 2005; Beighle *et al*., 2006; Nettlefold *et al*., 2011). In Spain, PE classes in elementary schools are structured in two 45-minute sessions per week with different forms of PA. This does not reach the minimum international PA standards recommended to maintain and improve health. Therefore, recess could help children to reach PA goals. Physical activity patterns and levels of children during recess and its contribution to the recommendations for PA in Spanish children are not well known (Ridgers *et al*., 2005; Erwin *et al*., 2012).

PURPOSE OF RESEARCH

Given the above context, the following question was posed: Is it possible that during recess physical activity can be influenced by the gender and the weight status of the children? The following hypothesis has relevance: the children who are overweight and are obese will perform less PA during recess. Therefore, the aim of this study was to determine PA levels during unstructured recess in elementary schools, taking into account the gender and weight status.

METHODOLOGY

Participants

This study included 66 children, with a mean age of 9.52±1.28 years and age range of 8-12 years, were randomly selected from a total sample of 365 children from a primary school in southern Spain. Twenty-three (23) were girls and 43 were boys, while 33 were normal weight and 33 were overweight or obese. A verbal description of the nature and purpose of the study was given to the children's parents and school supervisors. Parents gave their approval for the study to proceed. Students with intellectual or physical disabilities were not selected for the study. The study was conducted; not only in adherence to the standards of the Declaration of Helsinki (2013 version), but also in compliance with the European Community's guidelines for Good Clinical Practice (111/3976/88 of July 1990) and the Spanish legal framework for clinical research on humans (Real Decreto 561/1993 on clinical trials). The study was approved by the Ethics Committee of the University of Jaen (Spain).

Materials and testing

Height (in centimetres) was measured using a Seca 222 stadiometer (Hamburg, Germany) and weight (in kilograms) using a Seca 899 weighing scale (Hamburg, Germany). Body Mass Index (BMI) was calculated by dividing weight (in kilograms) by the height squared (in metres). The 85th and 95th percentiles of the study by Sobradillo *et al*. (2004) were considered in classifying children as overweight or obese, respectively, and 10-84th percentiles for normal weight in relation to BMI. There were two groups: Group 1 included children who were of normal weight and the Group 2 consisted of children who were overweight or obese.

The Multi-Sense Wear Armband (SWA) (BodyMedia Inc., Pittsburgh, PA, USA) is a wireless body monitor that is worn over the triceps on the right arm. The monitor uses a series of non-invasive biometric sensors that continuously measure different physical parameters: skin temperature, galvanic skin response, heat flux, 2-d accelerometer infer energy expenditure, PA duration/intensity, step count and sleep duration. Data from the monitor were downloaded using Professional Research Software V.6.1 developed by BodyMedia.

Energy expenditure was calculated at 1-minute intervals, including data from all sensors, in addition to gender, age, body weight and height. The SWA provided valid and reliable estimates of energy expenditure at rest and generated similar mean estimates of energy expenditure as indirect calorimetry on the ergometer (Fruin & Rankin, 2004). Physical activity levels were established as follows: Total PA (expressed as a measure of overall PA and time engaged), Sedentary time (SDt), Moderate PA (MPA), Vigorous PA (VPA) and Very vigorous PA (VVPA). All levels were based under these limits: <3; 3–5.9; 6–8.9; and nine Metabolic Equivalent of Tasks (METs) per minute, respectively (Freedson *et al*., 2005).

Procedure

Data were collected during the spring months. After obtaining the appropriate school permission and parental approval, anthropometric data were recorded during the first testing session to classify children as normal weight and overweight or obese. Subsequently, children were instructed to wear a SWA device for 30 minutes during recess from Monday to Friday to continually assess PA. The activity monitor was worn on the back of the upper right arm at the

level of the triceps from 5 minutes before until the end of recess. Children were not given information about the purpose of this study or the function of the device. PA from five recesses was recorded. The first day of recording was not included in the analysis to minimise reactivity. The average time spent doing PA was recorded.

Statistical analysis

Descriptive statistics are represented as means (M), standard deviations (SD) and percentages. Tests of normal distribution and homogeneity (Kolmogorov-Smirnov and Levene's, respectively) were conducted on all data before the comparative analysis. A multivariate analysis of variance (MANOVA) assessed the group factors of weight status (normal weight group and overweight+obesity group) and gender (boys and girls). A Pearson correlation analysis was performed between all variables. All statistical analyses were conducted by using SPSS for Windows, V19.0 (SPSS Inc.; USA) at a significance level of 0.05.

RESULTS

Table 1 (to follow) shows age, BMI and metabolic variables according to weight status. Overweight children and children with obesity showed significantly lower VPA and VVPA; lower number of steps, lower PA time and higher energy expenditure than normal weight children ($p<0.01$). Table 2 that follows, shows age, BMI and metabolic variables according to gender. Girls showed significant lower energy expenditure, lower number of steps, lower VVPA and lower PA time than boys and longer sedentary time than boys ($p<0.01$).

Pearson correlation analysis showed a significant correlation between BMI and the number of steps ($r=-0.251$; $p=0.042$), age and energy expenditure ($r=0.475$; $p<0.01$), and age and VPA ($r=0.266$; $p=0.031$). In the interaction between gender and weight status it is observed that boys who are overweight or obese exhibited high energy expenditure ($p=0.002$), a fewer number of steps ($p=0.024$), higher active energy expenditure ($p=0.017$) and lower VVPA ($p=0.003$). Scatter plots between the number of steps and VPA in normal-weight and overweight children with obesity are shown in Figure 1 (to follow).

DISCUSSION

This study aimed to contribute to the base current literature by examining PA levels of Spanish children (boys vs. girls and normal weight vs. overweight/obese children) during recess. The main finding of this study were that when boys and girls are compared, regardless of their weight status, boys were more active than girls during recess. Moreover, when children in the normal weight group were compared with children in the overweight+obesity group, regardless of their gender, the normal weight group were more active than the overweight+obesity group during recess.

In this study, physical activities engaged in during recess contributed about 23.34±4.94 minutes for boys and 17.65±4.94 minutes for girls toward the daily PA recommendations. These data indicate that PA occupies 77.8% and 58.83% of total time of recess, respectively. Beighle *et al*. (2006) generated similar percentages (78% vs. 63%), showing significant differences in PA participation during recess between boys and girls.

Table 1. **AGE, BMI AND METABOLIC VARIABLES FOR WEIGHT STATUS**

Variables	**Normal-weight** Mean±SD n=33	**Overw.-Obesity** Mean±SD n=33	**p-value**	**95% Confidence Interval**	
Boys, n(%) Girls, n(%)	22(66.7) 11(33.3)	21(63.6) 12(36.4)	0.796*	–	–
Age (years)	9.42±1.22	9.61±1.34	0.568	-0.815	0.451
BMI (kg/m^2)	16.96±1.71	24.67±2.61	<0.001	-8.802	-6.625
Energy Exp. (kcal)	75.03±32.40	101.97±34.73)	0.002	-43.458	-10.421
Mets	4.60±1.45	3.99±0.90	0.044	0.016	1.208
SDt (min)	7.03±5.37	9.64±6.46	0.075	-5.482	0.270
MPA (min)	16.79±5.37	16.30±6.07	0.733	-2.337	3.306
VPA (min)	4.97±4.41	3.24±3.39	0.079	-0.208	3.663
VVPA (min)	1.15±3.34	0.36±1.27	0.211	-0.457	2.032
VPA+VVPA (min)	6.12±4.82	3.60±3.58	0.019	0.424	4.607
No. of steps	1749.55±493.00	1466.45±443.72	0.017	52.274	513.908
Act. energy exp. (Kcal)	67.79±34.43	86.55±40.85	0.048	-37.340	-0.176
PA duration (min)	22.87±5.21	19.84±6.35	0.038	0.172	5.889

SD=Standard Deviation BMI=Body Mass Index PA=Physical Activity Exp=Expenditure
SDt=Sedentary time Overw.=Overweight Act.=Activity
MPA=Moderate PA VPA=Vigorous PA VVPA=Very Vigorous PA. * Chi Square (χ^2)

Table 2. **AGE, BMI AND METABOLIC VARIABLES ACCORDING GENDER**

Variables	**Girls** Mean±SD n=23	**Boys** Mean±SD n=43	**p-Value**	**95% Confidence Interval**	
Age (yrs)	9.52±1.23	9.51±1.31	0.976	-0.656	0.676
Normal weight, n(%)	11(47.8)	22(51.2)	0.796*	–	–
BMI (Kg/m^2)	20.59±4.31	20.93±4.58	0.772	-2.658	1.982
Energy Exp. (kcal)	68.83±20.40	99.02±38.21	0.001	-47.326	-13.068
Mets	3.42±0;61	4.77±1.23	<0.001	-1.982	-0.802
SDt (min)	12.17±6.02	6.28±4.83	<0.001	3.173	8.616
MPA (min)	16.09±5.73	16.79±5.73	0.636	-3.662	2.255
VPA (min)	1.57±1.44	5.47±4.27	<0.001	-5.739	-2.061
VVPA (min)	0.00±0.00	1.16±3.08	0.076	-2.453	0.127
VPA+VVPA (min)	1.56±1.44	6.62±4.45	<0.001	-6.974	-3.152
No. of steps	1276.78±403.0	1785.16±435.7	<0.001	-727.582	-289.178
Act. energy exp. (Kcal	51.43±23.10	90.93±38.43	<0.001	-57.019	-21.971
PA duration (min)	17.65±6.02	23.34±4.94	<0.001	-8.454	-2.939

SD=Standard Deviation BMI=Body Mass Index PA=Physical Activity Exp=Expenditure
SDt=Sedentary time Act.=Activity MPA=Moderate PA VPA=Vigorous
PAVVPA=Very Vigorous PA. * Chi Square (χ^2)

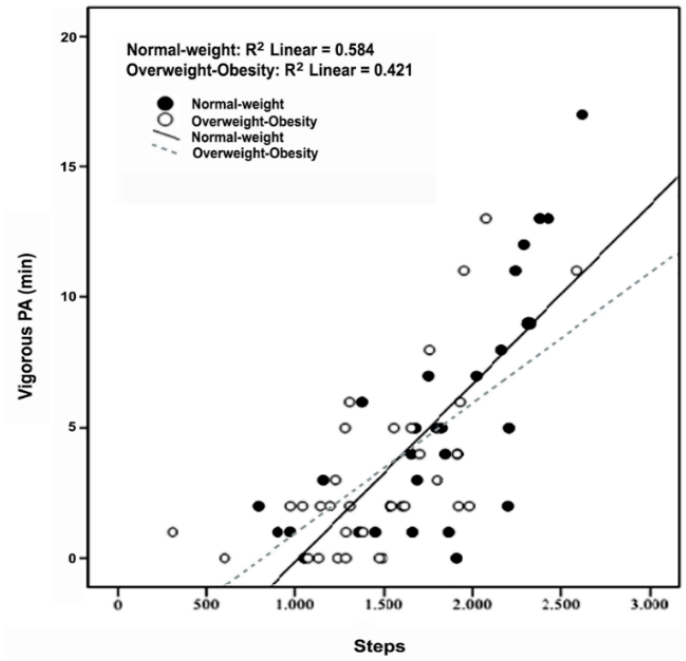

Figure 1. **SCATTER PLOTS BETWEEN NUMBER OF STEPS AND VPA IN NORMAL-WEIGHT AND OVERWEIGHT-OBESITY CHILDREN**

Martinez-Gomez *et al*. (2014) noted that recess contributes significantly to the MVPA in boys but not in girls. Taking into account the total sample, recess represents 34.15% of the daily PA recommendations. This value is in accordance with the interval value of involvement in daily PA at recess, between 5% and 40% (Ridgers *et al*., 2006). On average, children exceeded 50% in daily PA at recess with the boys complying with the recommendations (Carlson *et al*., 2013). Overweight and obese children, however, are significantly below the recommended values (≥20 minutes per day).

In the current study, overweight and obese children exhibited high energy expenditure, high active energy expenditure, low number of steps and low VVPA. Obese children displayed a significantly higher pulmonary ventilatory and heart rate responses to exercise than children with normal weight, therefore, physical activities, such as walking and running are energetically more expensive for obese children than for normal weight children (Maffels *et al*., 1993). In this regard, obese adolescents are less physically active than normal-weight adolescents, but energy expenditure is not significantly different between groups (Ekelund *et al*., 2002).

Within the strain of thought, Collings *et al*. (2013) established a relationship between VPA and low adiposity, however, sedentary and moderate PA time was not associated with adiposity. Therefore, promoting of VPA should give priority to addressing childhood obesity. Likewise and according to the current study, Ridgers *et al*. (2013) showed that overweight children are engaged in more MPA and less VPA than non-overweight children.

In relation to the interaction between gender and weight status, it appears from the findings of the current study that overweight and obese boys exhibited high energy expenditure, fewer steps, high active energy expenditure, and low vigorous+very vigorous PA. These findings concur with Stratton *et al*. (2007), who noted that overweight boys were significantly less active than their normal weight counterparts. This difference was not found among girls. However, Erwin *et al*. (2012) found neither gender nor weight influenced the PA levels at recess.

In a recent study, Vale *et al*. (2015) noted a significant correlation between minutes of total PA and steps per day ($r=0.760$; $p<0.001$). In this study; there is a significant correlation between number of steps and VPA in all children regardless of their weight status. Therefore; the number of steps could be a predictor of VPA at recess. Erwin *et al*. (2012) showed greater number of steps than the current study, which constitute 44% of number of steps throughout the school day. Also; they did not find significant differences in the number of steps in relation to gender. However, Beighle *et al*. (2006) noted that boys had a greater number of steps during a 15-minute recess than girls, 1268±341 vs. 914±261, respectively.

LIMITATIONS AND RECOMMENDATIONS

Some limitations need to be considered in the current study. Whilst a small sample size was the main limitation, another was the lack of information on the social and physical environments within which these recess periods occur. These data may have an influenced on the PA patterns of students. However, the use of accelerometers to objectively measure PA strengthens the internal validity of our findings, as does systematic and objective registration throughout the school week of PA at all recesses. Future studies should try to recruit children randomly selected from different schools in order to generalise the results. Notwithstanding these limitations, intervention studies are needed to identify the effects of the implementation of new practices of PA during recess. The current study provides some insight into this topic.

School represents an environment for sedentary time; so it would be important for teachers to incorporate more PA activities in their daily classrooms (O'Dwyer *et al*., 2014). At the same time, providing game equipment during morning recess was effective in increasing children's MPA from 41% to 45% (Verstraete *et al*., 2006). Schools should promote interventions which would increase PA for children during recess by organising and allowing children, particularly those who are overweight or obese, to participate in different physical activities. These findings suggest that hiring staff or seeking volunteers to support PA during recess together with the improvement of sports equipment could lead to increased PA of the children. Howe *et al*. (2012) showed that a structured recess is feasible to implement and can significantly increase moderate to VPA.

CONCLUSION

In conclusion, this study contributes to the current literature by examining PA levels of Spanish children during recess. This study confirms the findings of previous studies, which show that recess provides a valuable opportunity for school children to be physically active. The PA levels in recess are conditioned by gender and weight status. Girls and children with overweight and obesity showed lower PA levels in recess than boys and normal weight children, respectively. Therefore, specific active school models are needed to promote PA in elementary schools in a more effective way.

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(*Subject editor: Dr Sue Basset*)