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Short Communication

Preschool children's physical activity intensity during school time: Influence of school schedule

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ABSTRACT

Chile's Physical Activity Report Card graded the overall index on PA behavior with an F The Ministry of Sports is implementing since 2014 "Jardín Activo" (JA program) which recommends 3 weekly teacher-led PE lessons for preschool children, on half or full day attendance. We determined the effectiveness of the JA program (contribution to MVPA during school time) and assessed if effectiveness varied according to schedule. 596 five y olds, (50% boys) were selected from 66 schools; 52.9% attended half day and 47.1% full day. Children wore accelerometers during school time a day with and one without PE lesson (JA day/non JA day). We compared PA intensity between both these days by gender, using descriptive statistics and *t*-tests and determined the differential effect on PA intensity, between non JA and JA days by school schedule, using mixed models analyses We compared β of sedentary and of MVPA by schedule with *t*-tests. Significant differences were found in PA intensity between both days within each gender. Minutes being sedentary were significantly less during JA days (14 and 15 min in boys and girls respectively); MVPA significantly higher in JA days (11 and 10 min respectively). % time children were sedentary and % they engaged in MVPA differed by schedule. Sedentary minutes were significantly higher (β − 16.2 vs − 13.2) in half day, while the increase in MVPA was significantly higher (β 12.5 vs 9.7) in full day. The JA program is effective, especially when children attend school full time.

1. Introduction

There is ample evidence regarding the importance of engaging in sufficient physical activity (PA) for the healthy development of children (Timmons et al., 2012). However, many children do not accumulate the recommended 60 min/day of moderate-to-vigorous PA (MVPA) for 5–17 y old children (World Health Organization, 2010) and 180 min/day of total physical activity for 1–4 y old children (Tremblay et al., 2012; Hnatiuk et al., 2014).

In spite the school environment being an important venue for promotion of daily PA, several studies have shown that preschool children are very sedentary during school time. A recent review conducted by Barbosa and de Oliveira of 7 studies measuring PA of preschool children during school time, showed the proportion of MVPA was only 3.3% of school time in 4–5 y old children (Barbosa and Oliveira, 2016)

Chilean children engage in little total PA and excessive levels of sedentary behavior. According to the 2016 Report Card on Physical Activity and Youth, which graded several indicators on PA and sedentary behavior, Chilean children ranked among the lowest 30% globally and assigned an overall grade of F (fail) (Aguilar-Farias et al., 2016). While data on Chilean preschool children are sparse, a study of 6–9 y old children in a low-income district of Santiago, found that only 25% and 14% of children met the guideline for PA on weekdays and weekend days, respectively (Moreno et al., 2015).

Given the need for increased PA among children, the Ministry of Sports initiated a nationwide program in 2014 to increase PA and sports participation among low-income schoolchildren between the ages of 3 and 14 y. This program includes an intervention component targeting 3–5 y olds attending preschool children in both public elementary schools and kindergartens for half or full day: "Active Preschools" or Jardín Activo (JA program). This program provides funding for certified physical education (PE) teachers to lead recommended three structured PE lessons (JA lessons) per week of 45 or 60 min each, for at least 7 months of the school year.

To achieve JA's general objective of increasing PA, the Ministry of Sports instructs teachers through an on- line session of 1 h, to

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strengthen basic motor skills, using active play while addressing gender differences. In 2015, there were a total of 533 JA programs nationwide; of these 311 targeted preschool children in 92 schools (around 7500 participants) (Government of Chile, Minister of Sports, 2015)

The aim of this study is to determine a) the effectiveness of the JA program in terms of its contribution to MVPA during school time, and b) if effectiveness of the JA program varies according to school schedule.

2. Methodology

2.1. Participants

The study sample consists of preschool children in elementary schools. Because the 92 schools could house more than one JA program, we selected only one per school, as the same PE teacher taught all JA lessons. Sixty six schools from 28 districts located in 8 Regions (Chile has 15 Regions and 334 districts) met inclusion criteria of: a) agreeing to participate b) being logistically feasible for ten-week data collection and c) represent the urban/rural distribution of low income Chileans. The study was conducted from October 1, 2015 to December 10, 2015.

The Ethics Committee for Human Studies of the Institute of Nutrition and Food Technology (INTA), University of Chile approved this study. In addition, a signed informed consent form was obtained from a parent/guardian of every child.

In each school, the study PE teacher selected 4–5 preschool children upon arrival from the classroom list by alphabetical order (at least half of each gender), during one week, which normally included 3 JA days. The children were equipped with an Actigraph GT3X accelerometers (Actigraph LLC, Pensacola, Florida, USA) placed on the right hip with an elastic belt which was removed when the school day ended, so each participant wore the device for the entire duration of school.

Accelerometers were programmed to record at a 15-s epoch length, which has been used in most studies including preschool children (Migueles et al., 2017). Cut-points to define PA intensity were determined by counts per minutes (cpm): sedentary (0–204), light (205–976), moderate (977–1527) and vigorous (≥ 1528) (Butte et al., 2014; Verbestel et al., 2015; Cerin et al., 2016). PA was monitored twice on the same children, a day with and one without a JA lesson (JA and non JA day). The data was processed with ActiLife 6 Software from Actigragh.

2.2. Statistical analyses

Initially, 766 children had accelerometer data on both days. We defined ≤ and > 15 min as the acceptable difference between school times between JA and non JA days. With this criteria and implausible measurements, we eliminated 114 children (86 and 28 respectively). The final sample included 596 children; of these, 27% attended schools located in rural districts. This is representative of the urban/rural distribution among Chileans classified as “poor”, which in 2015 was 25.4% (Government of Chile, Minister of Social Development, 2015)

The analyses included: a) the comparison of PA intensity during non JA and JA days by gender and b) the differential effect on PA intensity between non JA and JA days by school schedule, adjusting by gender and JA lesson scheduled length.

We used descriptive statistics to compare minutes accumulated in the different PA categories between children included and not included and also minutes in these categories during non JA and JA days, within each gender and also by school schedule, using *t*-tests for dependent samples. We also compared minutes of sedentary and MVPA between boys and girls, separately on non JA and JA days, using *t*-tests for independent samples.

We used mixed models analyzing the results of repeated measures calculated in fixed points in time (non JA and JA days), adjusted by gender and scheduled JA lesson length, separately for children attending school for half and full day, in order to assess differences (in minutes) in each of the PA categories between non JA and JA days, by schedule. We compared β (from mixed models) for sedentary and MVPA between both days by schedule, using *t*-tests.

3. Results

PA intensity of children included (n = 596) versus excluded (n = 170) were similar. For example, on average, minutes being sedentary were 201.7 in children included and 202.8 in children excluded in non JA days, while in JA days, they were 187 and 183.3 in respectively. Results for MVPA showed 30.4 and 30.5 min in non JA days and 41.4 and 41.9 min in JA days respectively (not shown).

The mean age of the children was 5.2 y (SD = 0.3); 50% boys. Of the total sample, 52.9% attended school for half day (a mean of 4.2 h/day) and 47.1% full day (a mean of 6.9 h/day).

Most scheduled JA lessons lasted 60 min; in half day only 5 lessons lasted 45 min, while in full day schedule, 27 lessons or 9.7%. Although not recommended by the program, 20 lessons in half day (6.6%) and 53 (19%) in full day, had a duration of 90 min and were taught twice a week.

Table 1 compares minutes accumulated in different PA categories by gender in non JA and JA days. In boys, there were significant differences in all categories between both days, except light PA. In girls, all differences were significant. Minutes being sedentary were significantly less during JA days (14 min and 15 min in boys and girls, respectively), while MVPA was significantly higher in JA days (11 and 10 min in boys and girls, respectively). Both in non JA and JA days, boys were significantly less sedentary (about 12 min less in both days) and engaged in significantly more MVPA (about 10 more min)

Table 2 shows the effect of school schedule on PA intensity by comparing minutes in the different PA categories in non JA and JA days. Because there was no significant interaction with scheduled JA lesson length, we present the results of the mixed model analyses by school schedule, adjusted by gender. Although all differences were significant in favor of JA days, these were greater for sedentary and MVPA for both school schedules, however the decline in sedentary minutes was significantly higher during half day (β − 16.2 compared to − 13.2), while the increase in MVPA was significantly greater during full day attendance (β 12.5 compared to 9.7)

4. Discussion

Although we show minutes in the different PA intensities during school time, we present the most important results in terms of MVPA, as recommended by WHO (2010) for children 5–17 (World Health Organization, 2010).

Both on half day and full day schedules, MVPA is significantly greater on JA days however the effect is greater when children attend

Table 1
Comparison of physical activity intensity between non JA and JA days by gender among Chilean preschool children.

	Boys (n = 299)		Girls (n = 297)	
PA categories	Non JA days (mean and SD)	JA days (mean and SD)	Non JA days (mean and SD)	JA days (mean and SD)
Sedentary	195.6 (63.7)	181.4 (60.8)[1]	207.7 (64.2)[2]	192.2 (63.6)[1,2]
Light	106.6 (42.7)	109.2 (40.3)	98.2 (39.4)	103.0 (35.4)[1]
Moderate	27.9 (14.7)	35.2 (13.7)[1]	21.5 (11.8)	27.9 (13.2)[1]
Vigorous	7.2 (6.6)	11.6 (7.8)[1]	4.6 (4.5)	8.2 (6.6)[1]
MVPA	35.1 (19.7)	46.8 (19.3)[1]	26.1 (15.1)[2]	36.2 (18.4)[1,2]

1 = statistical differences between non JA and JA days (p < 0.001).
2 = statistical differences between boys and girls (p < 0.001).