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Physical activity behavior, aerobic fitness and quality of life in school-age children

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Abstract

The aim of this article is to assess the differences in sedentary and physical activity behavior, physical fitness and quality of life in school-age children according to their adiposity state (BMI-SD) and gender. 352 children participated in the study (11.99 ± 1.5 years). Children were assigned to a normal weight group (NW) ($n=175$) or to an overweight/obese group (OW/OB) ($n=177$). The percentage of OW/OB was significantly superior ($p<0.05$) in boys (55.4%) than in girls. Boys reported spending 2:19h/week ($sd= 2:33$; $p<0.01$) watching TV and 3:21h/week (4:28; $p<0.001$) more than girls practicing moderate-high intensity physical activity. In contrast, in weight groups differences appeared only at high intensity activities to which NW children devoted 52minuts/week (2:33; $p<0.01$) longer than OW/OB children. NW and OW/OB groups presented significant ($p<0.05$) differences in all the physical fitness tests, except for the medicine ball toss one. Children's involvement in at least three hours a week of physical activity were associated to a lower prevalence of overweight or obesity, and to higher physical fitness in children.

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BMI-SD: Body Mass Index Standard deviation; OW/OB: Overweight and Obese; NW: Normal Weight, MH: Moderate to High; PA: Physical Activity; QoL: Quality of Life

1. Introduction

Childhood obesity has mainly been attributed to factors related to lifestyle (Ballabriga & Carrascosa, 2001), specifically to the lack of physical activity and to unhealthy eating (ACSM, 1999; Fullana,

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Momparler, Quiles, & Redondo, 2009). This excess of weight is associated with an overload of the musculoskeletal system, an increase in the prevalence of cardiovascular risk factors, psychological and social problems. Obesity can also lead to having a poor body image and a sense of inferiority and rejection (Serra & Aranceta, 2002).

This has important health, social and economic consequences. It is important to know how obesity affects children of school age. In that sense, the aim of the study is to assess the differences in sedentary conduct and physical activity behavior, and in physical fitness and quality of life in school-age children according to their adiposity state (BMI-SD) and gender.

2. Method

This is a cross-sectional study that took place in several schools in Lleida, Catalonia. Eligible participants were children aged between 8 and 13 years old that attended these schools. Before proceeding with the measures, informed parental and children consent and authorization from their schools was obtained. All procedures were conducted in accordance with the Declaration of Helsinki and its subsequent revisions.

Waist circumference, waist-to-height ratio and body mass index (BMI) measures were collected as anthropometric parameters. Children were grouped as overweight/obese (OW/OB) or normal weight (NW) based on their BMI-SD according to the LMS method (Pan & Cole, 2007). Sedentary and physical activity behaviors were assessed with a modified version of the 7-day recall physical activity questionnaire, which had previously been validated for children (Sallis, Buono, Roby, Micalè, & Nelson, 1993). Following Ainslie, Reilly & Westerterp (2003) recommendations, the activities were classified according to their metabolic cost as sedentary, light, moderate and high-intensity. The physical fitness test comprised aerobic resistance (6 minutes walking test) (Morinder, Mattsson, Sollander, Marcus & Larsson, 2009), medicine ball toss (Legido, Segovia, & Ballesteros, 1995), standing broad jumps and sit-ups (EUROFIT, 1989). The children's health related quality of life (QoL) was assessed by means of the Spanish version of the EQ-5D-Y (Gusi, Badía, Herdman, & Olivares, 2009).

2.1. Data analysis

All statistical analyses were conducted with SPSS version 15.0 (SPSS Inc., Chicago, IL, 2007). Data are reported as mean \pm standard deviations (SD). Student t-test was used to compare independent samples (NW versus OW/OB and girls versus boys). Statistical significance was set at $p < 0.05$.

3. Results

The main anthropometric results are presented in table 1. More than half (55.4%) of the boys were OW/OB. For girls, this percentage was also high (44.6%) but significantly lower ($p < 0.05$) than in boys. Nevertheless, between genders, no differences in any other anthropometric parameter were observed.

On the other hand, as it could be expected all the adiposity parameters, were significantly ($p < 0.001$) higher in OW/OB children compared to their NW peers.

Table 1. Anthropometric parameters

	Boys (n=184)	Girls (n=168)	Normal Weight (n=175)	Overweight/Obese (n=177)
	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Age (years)	12.02±1.45	11.90±1.50	12.10±1.33	11.82±1.58
Weight (kg)	50.28±13.06	48.62±12.13	41.80±7.60	57.08±12.03 ^{δδδ}
Height (cm)	1.53±0.11	1.51±0.09	1.51±0.09	1.53±0.11
BMI (kg/m²)	21.35±4.15	21.10±4.10	18.12±1.63	24.31±3.47 ^{δδδ}
BMI SD (units)	1.11±1.07	0.93±1.03	0.16±0.56	1.88±0.64 ^{δδδ}
Waist circumference (cm)	76.84±11.70	75.44±11.13	68±5.53	84.25±9.92 ^{δδδ}
Waist-to-Height ratio (cm/m)	50.39±7.48	49.93±6.80	44.98±2.73	55.30±6.43 ^{δδδ}

BMI: body mass index; ^{δδδ}p<0.001 Significantly different in respect to Normal weight

As shown in table 2, boys devoted more time than girls to watching TV (2:19 ± 2:33 h/week; p<0.01) and in physical activities as moderate and high (MH) intensity activities (3:21 ± 4:28 h/week; p<0.001). However, girls spend more time into light intensity activities (3:29 ± 7:21h/week; p<0.001) than boys. In contrast, among adiposity groups, differences were observed only at high intensity activities, where NW children spent 52 minutes/week (2:33; p<0.01) longer than OW/OB children. There was a modest but significant correlation (p<0.01) between BMI-SD and TV-time (r=0.168) and high (r=-0.245) or MH (r=-0.133) intensity activities.

Table 2. Sedentary and physical activity behaviors

	Boys (n=184)	Girls (n=168)	Normal Weight (n=175)	Overweight/Obese (n=177)
	Mean±SD	Mean±SD	Mean±SD	Mean±SD
TV time (h/w)	15.83±9.01	13.51±7.90**	14.26±7.69	15.19±9.35
Computer time (h/w)	9.28±9.18	9.06±8.19	9.66±8.74	8.70±8.68
Sedentary intensity (h/w)	123.20±12.68	125.54±11.91	123.97±11.83	124.67±12.88
Light intensity (h/w)	8.62±7.35	12.10±8.06***	9.88±7.29	10.68±8.43
Moderate intensity (h/w)	8.10±6.98	5.60±5.40***	7.16±6.28	6.66±6.51
High intensity (h/w)	2.93±2.76	2.08±2.63*	2.96±2.99	2.09±2.36 ^{δδ}
Moderate-High intensity (h/w)	11.03±7.70	7.68±6.22***	10.12±7.35	8.75±7.04

h/w: hours per week ; *** p<0.001; ** p<0.01; * p<0.05 Significantly different in respect to boys.

^{δδ} p<0.01 Significantly different in respect to Normal Weight children.

Boys and girls presented similar results in the physical fitness tests (table 3), apart from the sit-ups, where boys did 1.69 (2.49; p<0.05) extra sit-ups compared to the girls. OW/OB children achieved lower results than their NW peers in all physical condition tests where weight was a determinant of performance. In contrast, no differences were observed in the medicine ball toss test.

Table 3. Physical fitness test

	Boys (n=184)	Girls (n=168)	Non-Obese (n=175)	Overweight/Obese (n=177)
	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Medicine ball toss (cm)	3.59±1.22	3.56±1.26	3.55±1.29	3.60±1.18
Sit-ups (n°)	22.42±6.01	20.73±6.42**	22.57±5.66	20.74±6.66 ^{δ δ δ}
Standing broad jump (cm)	1.36±0.40	1.35±0.37	1.40±0.42	1.32±0.34 ^δ
Aerobic resistance (meters)	478±127	467±118	511±108	437±125 ^{δ δ δ}

** p<0.01 Significantly different in respect to boys

^{δ δ δ} p<0.001; ^δ p<0.05 Significantly different in respect to Non-obese

Apart from the data where all participants were pooled together, several differences within gender groups were observed between OW/OB and NW children. The prevalence of obesity was higher among boys, where 55.4% (n=102) of them were OW/OB, while the proportion of NW was 44.5% (n=82). Surprisingly, OW/OB boys showed similar results to NW ones in sedentary conduct, physical activity behavior, the medicine ball toss, sit-ups, standing broad jumps and QoL tests. Both groups only differed on the aerobic resistance test results, where NW children obtained better scores compared to their OW/OB peers (531.49±103.45 meters vs. 438.18±128.71 meters; p<0.001, respectively).

In contrast, more differences were observed between NW and OW/OB girls. The percentage of OW/OB girls was high (44.6%; n=75), but slightly lower than in boys. The rest, 55.4% (n=93) were NW. Compared to NW girls, OW/OB girls devoted more weekly time to light intensity physical activities (10.87±6.96 h/week vs. 13.62±9.06 h/week; p<0.028) and less weekly time to high intensity activities (2.70±3.06 h/week vs. 1.31±1.68 h/week; p<0.001). They obtained lower results in the sit-ups (22.12±5.50 vs. 19.11±7.05 number; p<0.003) and the aerobic resistance test (494.29±110 meters vs. 435.72±119.66 meters; p<0.002).

No differences in QoL scores were observed between groups determined by gender or by adiposity, the mean of the total score for the whole group being 80.45±17.22 over 100.

For the whole group, correlation analysis between adiposity parameters and TV-time showed a significant positive correlation and a significant negative correlation with physical activity behavior (time devoted to high or MH physical activities). Adiposity parameters also showed a significant negative correlation with the physical fitness test, except in the medicine ball toss test.

4. Discussion

The main finding of the study is the discrepancy found in sedentary conducts and physical activities when comparisons were made between gender and weight groups or subgroups of gender and weight. Differences were found when comparing boys and girls. Unexpectedly, differences between weight groups were almost inexistent and the only difference was nearly 1 hour/week extra of high intensity activities in the NW group in relation to the OW/OB group. However, surprisingly, when children were subdivided into NW vs. OW/OB boys, no differences were found. However, we still observed them when comparing NW vs. OW/OB girls. The present discrepancies are probably reflecting the results existing in the literature about the influence, or not, of sedentary and physical behavior in the degree of obesity in children. On the one hand, OW/OB children seem to be less active than NW children (Page et al., 2005). On the other hand, no difference between them was found (Ebenegger et al., 2010; Ortega, 2007). In preschool children, this controversy has already been mentioned (Metallinos-Katsaras, Freedson, Fulton & Sherry, 2007; Trost, Sirard, Dowda, Pfeiffer, & Pate, 2003). Due to design

limitations, it is not possible to conclude a cause-effect relationship. However, it could be suggested that some of these discrepancies could account for the differences existing between NW vs. OW/OB boys and NW vs. OW/OB girls, as observed in the present study.

In relation to their physical fitness, several differences were also found when all the groups were compared. Probably, it is difficult to explain these differences bearing only in mind weight and gender. According to Klein Fröhlich & Emrich (2013), other characteristics should be taken into account (socio-economic status, living situation, leisure behavior, school performance). However, the biggest difference between the groups seems to be their aerobic resistance.

Despite the existing controversy, data could indicate that it is necessary that OW/OB children change their lifestyle into a more active one, increasing at least one hour longer of high physical activity intensity a week. It could be a good tool to reduce obesity and help their physical fitness, reducing the possibility of several health diseases in their youth and adult life (Delgado, Gutiérrez, Castillo, 1999).

Children's behavior was self-reported by children and this could be in itself a limitation, as non objective measures could be not recorded. However, the tests were specific for children and it was a self-administered version. In addition, the data was collected with their teachers' help and with experimented and formed collaborators.

5. Conclusion

Practicing at least three hours a week of physical activity is associated to a lower prevalence of overweight or obesity and to higher physical fitness in school ages.

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