Psychosocial, physical and anthropometric variables in chilean schoolchildren. A comparative study according to physical activity levels

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Summary

Introduction: Physical activity (PA) has multiple benefits for physical and mental health in different types of populations; however, there are no comprehensive evaluations in school population. On the other hand, levels of physical inactivity have generated an increase in childhood obesity worldwide and cardiovascular risk factors, affecting the overall development of children and their quality of life, in addition to a large number of psychosocial components. The purpose of the research was to compare according to levels of PA, psychosocial, anthropometric and physical variables in Chilean schoolchildren.
Method: 605 schoolchildren (272 women and 333 men) between 11 and 14 years of age participated. Self-esteem, body image, cardiorespiratory fitness, blood pressure and anthropometric parameters were evaluated.
Results: The girls presented higher body mass index (BMI) and percentage of body fat (BF), in addition they presented higher risk score of dissatisfaction with the corporal image ($p = 0.03$), in the self-esteem there were no differences ($p > 0.05$). PA was higher in children ($p < 0.001$), as were values in systolic blood pressure (SBP) and diastolic blood pressure (DBP) ($p < 0.05$). Children had a higher proportion of school children categorized with high PA ($p < 0.001$). School children with lower levels of PA have higher anthropometric parameters ($p < 0.001$), as well as a higher risk of body dissatisfaction ($p = 0.009$) and lower self-esteem ($p < 0.001$) and cardiorespiratory fitness ($p < 0.001$).
Conclusion: Schoolchildren with lower PA levels presented negative results in psychosocial variables such as body image and self-esteem, as well as a lower cardiorespiratory fitness and high anthropometric parameters.

Key words:
Obesity. Physical activity. Schoolchildren. Cardiorespiratory capacity.

Variables psicosociales, físicas y antropométrica en escolares chilenos. Un estudio comparativo según niveles de actividad física

Resumen

Introducción: La actividad física (AF) tiene múltiples beneficios para la salud física y mental en distintos tipos de poblaciones, sin embargo, no existen evaluaciones integrales en población escolar. Por otra parte los niveles de inactividad física han generado un incremento de la obesidad infantil en todo el mundo y de los factores de riesgo cardiovascular, afectando el desarrollo integral de los niños y su calidad de vida, además de un gran número de componentes psicosociales. El propósito de la investigación fue comparar según niveles de AF, variables psicosociales, antropométricas y físicas en escolares chilenos.
Método: Participaron 605 escolares (272 mujeres y 333 hombres) de entre 11 y 14 años de edad, se evaluó la autoestima, imagen corporal, capacidad cardiorrespiratoria, presión arterial y parámetros antropométricos.
Resultados: Las niñas presentaron mayor índice de masa corporal (IMC) y porcentaje de grasa corporal (GC), además presentaron mayor puntaje de riesgo de insatisfacción con la imagen corporal ($p=0,03$), en la autoestima no existieron diferencias ($p>0,05$). La AF fue superior en los niños ($p<0,001$), al igual que los valores en la presión arterial sistólica (PAS) y diastólica (PAD) ($P<0,05$). Los niños presentaron mayor proporción de escolares categorizados con AF alta ($p<0,001$). Los escolares con menores niveles de AF presentan parámetros antropométricos más elevados ($p<0,001$), así como también, presentan mayor riesgo de insatisfacción corporal ($p=0,009$), menor autoestima ($p<0,001$) y capacidad cardiorrespiratoria ($p<0,001$).
Conclusiones: Los escolares con menores niveles de AF presentan resultados negativos en variables psicosociales como la imagen corporal y autoestima, además de una menor capacidad cardiorrespiratoria y parámetros antropométricos elevados.

Palabras clave:
Obesidad. Actividad física. Escolares. Capacidad cardiorrespiratoria.

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Introduction

There are strong associations between physical activity (PA), obesity and cardiometabolic risk (CMR) factors in children[1,2] because the low levels of PA present today[3,4] have led to a rise in childhood obesity worldwide[5] and an increase in cardiovascular risk factors[6]. At the same time, they have also affected the overall development of children, their quality of life[7] and various psychosocial variables[8].

In general, the literature consistently shows a significant association between PA and different psychosocial variables and mental health, but the research designs are often weak and the effects either small or moderate[9], generating a vacuum in relation to PA levels and variables such as self-esteem and dissatisfaction with body image. These two psychosocial variables are of great importance to the development of schoolchildren, because body dissatisfaction is a good predictor of various mental health risks[9] and self-esteem is related to many positive aspects of mental health and academic achievement[8].

In physical health, blood pressure is an element used to assess the heart's response and high values are of predictive value for the later development of hypertension (HT)[10]. HT is often underdiagnosed in children[11] even though it is considered the most important cardiovascular risk factor in the world[12] and screening and detection in children and adolescents should be a priority.

Physical fitness is another important component of health because the cardiometabolic risk of those children and adolescents who have a higher level of cardiorespiratory fitness (CRF) is lower[13] and, therefore, their cardiovascular profiles are healthier[14]. Consequently, cardiorespiratory fitness is a key contributor to development in this stage of life[15] and assessment at early stages is paramount[16], since risk could be modified, chiefly by improving CRF[17] and also by increasing PA levels.

Most studies of the child population consist of isolated evaluations of physical, anthropometric and/or psychosocial variables relative to PA levels, there existing a vacuum in the literature where all these variables are compared within a school context to appreciate the real damage of low PA levels. For all these reasons, this research aimed to compare psychosocial, anthropometric and physical variables according to PA levels in Chilean schoolchildren.

Material and method

Participants

Participation in the study was voluntary and purposive sampling was applied. The first population included (n = 687) was a finite population from 19 academic year groups (approximately 35 students from each year group), all in the registration stage. After applying the inclusion/exclusion criteria, a total of (n = 82) were excluded for different reasons, but mainly because it was impossible to carry out the evaluations on some academic year groups for administrative reasons. In the end, 605 children (272 female and 333 male) from schools in the Chilean region of Araucanía took part.

The inclusion criteria included informed parental consent and the consent of the participant, enrolment in the schools and being between 11 and 14 years old. Due to the voluntary nature of the study, those children who did not meet the requirements were excluded from the research.

The exclusion criteria were: musculoskeletal conditions or any other known medical condition which could affect the performance and health of the participants during the physical evaluation stage; children with physical, sensory or intellectual disabilities were also excluded.

The research respected the agreements of the 2013 Helsinki Declaration and was approved by the bioethics committee of the University of Jaén, Spain. The programme and tests were verbally explained to all the participants before the start of the study.

Instruments

Anthropometric parameters

PBody mass (kg) was measured using a TANITA UM-028 Scale Plus (Tokyo, Japan) with the children barefoot and in underwear. Height (m) was measured with a Seca® 214 measuring rod (Hamburg, Germany), graduated in mm. Body mass index (BMI), understood as body weight divided by height in metres squared (kg/m^2), was used to estimate the degree of obesity, determining the body weight status of the participants using the following rating criteria according to percentile; BMI between p 85 and < p 95: Overweight, BMI > p 95[18]: Obese. Waist circumference (WC) was measured using a Seca® 201 tape measure (Hamburg, Germany) at the level of the umbilicus. The waist-height ratio (WHR) is calculated by dividing WC by height and was used as a means of estimating fat accumulation in the central area of the body, values >0.5 indicating cardiometabolic risk[19].

Cardiorespiratory fitness

Cardiorespiratory fitness (CRF) was measured using the 20m shuttle run test[20] (20mSRT). The participants had to run between two lines 20 m apart, while maintaining the rhythm of the beeps from a pre-recorded CD[20].

Blood pressure

Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured twice after 15 minutes of rest, using widely recognised rating standards for studies involving children and adolescents[12]. An Omron® HEM 7114 digital electronic monitor (Illinois, USA) was used for both measurements.

Physical Activity Levels

Levels of physical activity were measured using the PAQ-C questionnaire for children. The questionnaire has 10 questions and question No. 10 was excluded from the analysis because it asks about illness in the last week[21]. The minimum total score from all responses was 9 points and the maximum was 45; a higher score indicates a higher level of PA.

Self-esteem

Self-esteem was measured using the TAE-Alumno test[22]: a self-report self-esteem test for schoolchildren in years 3 to 8 of primary education in relation to a standard set for academic year and age. 1 point is given for each affirmative answer and 0 points for each negative answer. The raw score is converted into a T-score according to age and each child is classified into one of the following categories. Normal self-esteem: 40 points or higher. Low self-esteem: between 30 and 39 points. Very low self-esteem: 29 points or fewer. The internal consistency of the questionnaire with the current sample was Cronbach's alpha = 0.81.

Body image

The Body Shape Questionnaire designed by Cooper, Taylor, Cooper and Fairburn in 1987 was used to identify dissatisfaction with body image[23]. The questionnaire consists of 34 items which are answered using a six-point Likert scale, where: one = never, two = rarely, three = sometimes, four = often, five = very often and six = always. The maximum possible score is 204 points and the minimum is 34. The scores obtained are classified as follows: a) below 81, no dissatisfaction with body image; b) 81-110, slight dissatisfaction; c) 111-140, moderate dissatisfaction, and d) over 140, extreme dissatisfaction.

Procedures

The previously trained research assistants (evaluators) visited the schools selected during the 2017 Chilean school year and conducted evaluations of children who had parental consent and wished to take part. The evaluations took place in a favourable space provided by the school with optimum temperature and reliable privacy. The evaluations were conducted in the morning during physical education classes.

Statistical analysis

Statistical analysis was performed using STATA v13.0 software. The nominal qualitative variables were expressed as proportions and differences were calculated using the chi-squared test. The continuous variables showed nonparametric distributions and, consequently, were expressed as medians and 5th and 95th percentiles. Differences between groups were determined using the Mann-Whitney U and Kruskal Wallis tests. Spearman's rank correlation coefficient was used to establish the relationship between variables of cardiometabolic risk, physical activity and perceived physical exertion. P-values <0.05 were considered statistically significant.

Results

Table 1 shows a comparison by sex. The girls gave greater BMI and BF (%) values and also scored higher in terms of risk of dissatisfaction with body image than the boys (p=0.03). No differences were noted in self-esteem (p>0,05). PA was higher in the boys (p<0.001), as were the SBP and DBP values (p<0.05).

The proportion of children with higher PA scores was greater in the boys (p <0.001). No differences were observed in weight, CMR, body dissatisfaction and self-esteem (p>0.05) (Table 2).

Table 3 shows that the children with higher PA levels gave lower BMI, WC, WHR and BF values (p<0.001), exhibited a lower risk of dissatisfaction with body image (p=0.009), obtained higher self-esteem scores (p<0.001) and achieved better 20mSRT results (p<0.001).

Figure 1 reveals that those children categorised as having low PA levels were more dissatisfied with their body image (p = 0.009) and had lower self-esteem (p <0.001).

Discussion

This research aimed to compare psychosocial, anthropometric and physical variables according to PA levels in Chilean schoolchildren. The main finding of this study was that the results of those children with lower PA levels were more negative in the psychosocial, physical and anthropometric variables compared to those who did carry out PA. These results are important because they are physical and mental health indicators which affect the overall growth of schoolchildren.

The children evaluated in this research who reported lower PA levels obtained higher scores for dissatisfaction with body image and girls scored higher than boys. While research conducted with Spanish adolescents revealed that body dissatisfaction is negatively associated with PA in both sexes[24], a study with Brazilian schoolchildren showed the same association but with girls scoring significantly higher than boys[25], as did previous research with Chilean schoolchildren[26].

Table 1. Description of the study variables by sex.

Variables	Girls (n=272)	Boys (n=333)	p-value
Age (years)	12 (10-14)	12 (10-14)	0.08
Weight (kg)	50.4 (32.5-72)	49 (33.2-81.7)	0.66
Height (m)	1.53 (1.39-1.67)	1.55 (1.38-1.74)	0.009
BMI (kg/m^2)	21.31 (15.7-30.2)	20.2 (15.3-24.5)	0.05
WC (cm)	71 (59-95)	72 (57-98)	0.30
WHR (WC/height^2)	0.46 (0.38-0.61)	0.47 (0.38-0.6)	0.94
BF (%)	24.6 (13.9-35.8)	23.7 (10.5-37.9)	0.02
Body image (score)	48 (34-134)	45 (34-122)	0.03
Self-esteem (score)	52 (33-68)	50 (34-66)	0.73
20mSRT (min)	3 (2-7)	5 (2-10)	<0.001
Physical Activity (score)	31 (10-40)	34 (15-50)	<0.001
SBP (mmHg)	120 (88-135)	123 (96-141)	0.007
DBP(mmHg)	78.5 (54-98)	80 (57-110)	0.01

The data shown represent median and 5th-95th percentiles, p-value, Mann-Whitney U test. BMI: body mass index; WC: waist circumference; WHR: waist-height ratio; 20mSRT: 20m shuttle run test; SBP: systolic blood pressure; DBP: diastolic blood pressure.

Table 2. Frequency of cardiometabolic risk, physical activity and body perception parameters in Chilean schoolchildren.

Variables	Total n=605	Girls n=272	Boys n=333	p-value
Weight category n (%)				0.01
Normal weight	323 (53.4)	143 (52.6)	180 (54.1)	
Overweight	138 (22.8)	75 (27.6)	63 (18.9)	
Obesity	144 (23.8)	54 (19.8)	90 (27.0)	
CMR n (%)				**0.39**
No risk	496 (82.0)	227 (83.5)	269 (80.8)	
At risk	109 (18.0)	45 (16.5)	64 (19.2)	
Body dissatisfaction n (%)				**0.17**
None	525 (86.8)	228 (83.8)	297 (89.1)	
Slight	41 (6.8)	23 (8.5)	18 (5.4)	
Moderate	23 (3.8)	14 (5.2)	9 (2.7)	
Extreme	16 (2.6)	7 (2.6)	9 (2.7)	
Self-esteem n (%)				**0.17**
Normal	535 (88.4)	237 (87.1)	298 (89.5)	
Low	59 (9.8)	27 (9.9)	32 (9.6)	
Very low	11 (1.89)	8 (2.9)	3 (0.9)	
Physical activity n (%)				**<0.001**
≥ 40 high	95 (15.7)	24 (8.8)	71 (21.3)	
20-39 moderate	355 (58.7)	195 (71.7)	160 (48.1)	
<20 low	155 (25.6)	53 (19.5)	102 (30.6)	

The data shown represent number and proportions, p-value, Chi-squared test.

Table 3. Comparison of study variables by Physical Activity Level.

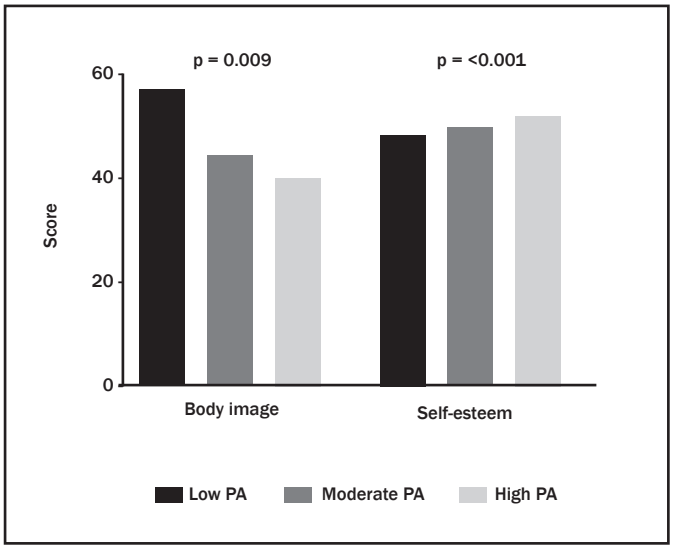
Variables	Low PA < 20	Moderate PA 20-39	High PA > 39	p-value
n (%)	155 (25.6)	297 (49.0)	153 (25.3)	
Age (years)	12 (10-14)	12 (10-14)	12 (10-14)	0.62
BMI (kg/m2)	25.8 (16.0-32.0)	20.46 (15.9-24.8)	19.2 (14.7-27.8)	<0.001
WC (cm)	81 (62- 102)	70 (59-86)	68 (55-90)	<0.001
WHR (WC/height2)	0.53 (0.39-0.64)	0.45 (0.39-0.57)	0.44 (0.37-0.58)	<0.001
BF (%)	26 (16.4-35.1)	23.5 (12.5-38)	22,9 (10.5-39)	<0.001
Body image (score)	57 (34-144)	45 (34-100)	40 (34-106)	0.009
Self-esteem (score)	48 (33-56)	50 (38-68)	52 (39-68)	<0.001
20mSRT	4 (2-7)	4 (2-9)	6 (2-11)	<0.001
SBP (mmHg)	123 (94-147)	121 (89-137)	122 (90-132)	0.41
DBP (mmHg)	80 (57-108)	79 (55-100)	79 (56-100)	0.86

The data shown represent median and 5th-95th percentiles, p-value, Kruskal-Wallis test. BMI: body mass index; WC: waist circumference; WHR: waist-height ratio; 20mSRT: 20m shuttle run test; SBP, systolic blood pressure; DBP: diastolic blood pressure.

The children with lower PA levels scored lower for self-esteem. This is worrying because low self-esteem has been associated with family problems, lower perceived social support and is even considered a predictor of higher suicide rates[27]. A significant association between PA and physical self-concept and its various subdomains has been consistently demonstrated in children and adolescents[9]. Research conducted with Chilean schoolchildren reported a positive relationship between PA levels and self-esteem[28]. Similarly, a systematic review showed that PA interventions led to improvements in self-concept and self-esteem in children and adolescents, and that the best place to carry out such interventions was at school[29].

PA can bring psychological benefits. Literature increasingly suggests that PA may improve aspects of mental health, including depression, anxiety and self-esteem[9]. It has been demonstrated that higher PA

Figure 1. Comparison of dissatisfaction with body image and self-esteem scores by physical activity level.



levels at the ages of 9 and 11 predict higher self-esteem at the ages 11 and 13[30], self-esteem being considered key to academic performance. These findings highlight the need to promote physical activity among adolescents as a way to encourage positive self-esteem.

The schoolchildren with lower PA levels also had lower CRF levels. International epidemiological reviews show that CRF is one of the physiological variables most subject to examination, particularly regarding functional capacity and human performance[31]. Meanwhile, a recent review focusing on adolescents found that certain factors are associated with low CRF levels, such as low PA levels, excessive screen time and excess body fat[32]. In the last three decades, CRF has established itself as a strong, independent predictor of mortality from both all causes and specific diseases, and as a marker for physical health, mental health and cognition[33].

In the sample studied, the children with low PA levels had elevated anthropometric parameters. This result is reinforced in several countries, where a lack of PA increases individual risk factors for developing overweight and obesity[34]. A major study which evaluated children aged 9 to 11 in 12 different countries reported that, along with other associated factors (insufficient sleep and hours of TV), a lack of PA is an important behavioural risk factor[35].

This research did not reveal any comparative differences in SBP and DBP according to PA levels, although it should be emphasised that PA has a beneficial effect on blood pressure in children[36]. One study reported an increased risk of hypertension in people with low PA levels combined with overweight or obesity[37]; these factors also increase the risk of developing diabetes, with higher levels of insulin in the circulation[38].

Finally, associations between PA and different psychosocial parameters can be defended[39]. Increasing PA among children should be a priority, because increasing it at early ages also increases self-esteem later on in life. However, it is also important to note that such interventions should equally emphasise the support of parents and their ability to promote PA in their children by providing positive feedback, serving as active models and facilitating participation in PA programmes[40]. Schools, therefore, would seem to be a favourable environment for such interventions because they are capable of joining up school, teachers, environment, guardians, parents and students.

Limitations and strengths

The main limitation of the study lay in measuring PA levels because this was done through a survey where each of the schoolchildren reported their own activity. One of the strengths of the study was that it was conducted in the school environment with a large sample, making it possible to supply the schools with information and contribute to the development of educational policies to increase PA.

Conclusion

In conclusion, we found that those schoolchildren with higher PA levels obtain better results in psychosocial variables such as body image and self-esteem, in CRF and in various anthropometric parameters. For this reason, it is necessary to encourage an increase in PA at schools, because this tends to improve biopsychosocial aspects, while low PA levels are associated with many negative aspects of health in schoolchildren.

Conflict of interest

The authors do not declare a conflict of interest.

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