



ORIGINAL ARTICLE

Physical self-efficacy is associated to body mass index in schoolchildren^{☆,☆☆}



Alicia Carissimi^{a,b,*}, Ana Adan^{c,d}, Lorenzo Tonetti^e, Marco Fabbri^f,
Maria Paz Hidalgo^{a,b,g}, Rosa Levandovski^{a,b}, Vincenzo Natale^e, Monica Martoni^h

^a Universidade Federal do Rio Grande do Sul (UFRGS), Hospital de Clínicas de Porto Alegre (HCPA), Laboratório de Cronobiologia e Sono, Porto Alegre, RS, Brazil

^b Universidade Federal do Rio Grande do Sul (UFRGS), Programa de Pós-Graduação em Psiquiatria e Ciências do Comportamento, Porto Alegre, RS, Brazil

^c Universitat de Barcelona, Facultat de Psicologia, Departament de Psiquiatria y Psicobiologia Clínica, Barcelona, Spain

^d Universitat de Barcelona, Institut de Recerca en Cervell, Cognició i Conducta (IR3C), Barcelona, Spain

^e Università di Bologna, Dipartimento di Psicologia, Bologna, Italy

^f Seconda Università degli Studi di Napoli, Dipartimento di Psicologia, Caserta, Italy

^g Universidade Federal do Rio Grande do Sul (UFRGS), Faculdade de Medicina, Departamento de Psiquiatria e Medicina Legal, Porto Alegre, RS, Brazil

^h Università di Bologna, Dipartimento di Medicina Specialistica, Diagnostica e Sperimentale, Bologna, Italy

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Abstract

Objective: The present study aimed to investigate the relationship between physical self-efficacy and body mass index in a large sample of schoolchildren.

Methods: The Perceived Physical Ability Scale for Children was administered to 1560 children (50.4% boys; 8–12 years) from three different countries. Weight and height were also recorded to obtain the body mass index.

Results: In agreement with the literature, the boys reported greater perceived physical self-efficacy than girls. Moreover, the number of boys who are obese is double that of girls, while the number of boys who are underweight is half that found in girls. In the linear regression model, the increase in body mass index was negatively related to the physical self-efficacy score, differently for boys and girls. Furthermore, age and nationality also were predictors of low physical self-efficacy only for girls.

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^{☆☆} Study conducted at University of Bologna, Bologna, Italy; Hospital de Clínicas de Porto Alegre (HCPA), Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil; and University of Barcelona, Barcelona, Spain.

* Corresponding author.

E-mail: alicia.ufrgs@gmail.com (A. Carissimi).

PALAVRAS-CHAVE

Obesidade;
Sobrepeso;
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Escala de Capacidade Física Percebida para Crianças

Conclusion: The results of this study reinforce the importance of psychological aspect of obesity, as the perceived physical self-efficacy and body mass index were negatively associated in a sample of schoolchildren for boys and girls.

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Autoeficácia física associada ao índice de massa corporal em crianças em idade escolar

Resumo

Objetivo: Este estudo visou investigar a relação entre a autoeficácia física e o índice de massa corporal em uma grande amostra de crianças em idade escolar.

Métodos: A Escala de Capacidade Física Percebida para Crianças foi administrada a 1560 crianças (50,4% meninos; 8-12 anos) de três países diferentes. O peso e a altura também foram registrados para obter o índice de massa corporal.

Resultados: De acordo com a literatura, os meninos relataram maior autoeficácia física percebida que as meninas. Além disso, o número de meninos obesos é o dobro do de meninas, ao passo que o número de meninos abaixo do peso é metade do de meninas. No modelo de regressão linear, o aumento no índice de massa corporal foi negativamente relacionado ao escore de autoeficácia física, diferentemente em meninos e meninas. Além disso, a idade e a nacionalidade também foram preditoras de autoeficácia física baixa apenas para meninas.

Conclusão: Os resultados deste estudo reforçam a importância do aspecto psicológico da obesidade, uma vez que a autoeficácia física percebida e o índice de massa corporal foram negativamente associados em uma amostra de crianças em idade escolar para meninos e meninas.

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Introduction

The health benefits of regular physical activity for children are well known.¹ To gain a better understanding of physical activity behavior in children, there has been an increased focus on determining the relationship between physical activity and psychosocial correlates.^{2,3} Self-efficacy, defined as people's beliefs about their capacity or ability to perform a certain action required to achieve results in a specific situation,⁴ is a variable that is considered to be associated with physical activity in adolescents, which can be an important mediator in providing more effective participation in these activities.⁵⁻⁷

A recent study on 281 children (116 boys and 165 girls) showed that those who have high physical self-efficacy scores participated in significantly more physical activity compared to their low physical self-efficacy score counterparts.⁸ Girls are generally less active and report lower perceived physical ability, as well as higher perceived body fat and greater body dissatisfaction than boys in a school setting.^{1,2,6,9,10} Thus, the perceived competence for physical activity seems to be sex-related, due to the fact that boys are more physically active, and perceive greater strength and sporting competence than girls.^{6,11,12}

In addition to gender, age is a factor that may influence physical self-efficacy, most evidently during adolescence,^{6,7} given that physical self-efficacy tends to decrease with increase of biological age. Another factor, which correlates with self-efficacy, is the body mass index (BMI), an index

of weight-for-height that is used to classify overweight and obesity. Changes in perceived physical abilities^{9,10,13,14} are influenced by excess of weight, related to a low perception of competence and motivation to perform physical activity, impacting on physical activity participation and physical appearance.¹⁵ In fact, higher BMI has been associated to lower levels of self-efficacy for physical activity, including weight status predicted by physical self-efficacy and healthy eating.¹⁶ Indeed, older children and those with a higher BMI perform less physical activity.¹² Based on this evidence, a significant relationship between physical self-efficacy and BMI was expected to be found.

As demonstrated in the literature, gender is related to BMI, and boys tend to have higher BMI, thus this effect was expected. Therefore, the relationship was explored between physical self-efficacy and BMI in a large sample of schoolchildren, controlling for confounding variables that can influence physical self-efficacy, such as age, gender, and nationality. Three countries where there is a concern with the increased prevalence of overweight and obesity were selected: Italy,¹⁷ Spain,¹⁸ and Brazil.¹⁹

Methods**Sample**

This was a cross-sectional study on 1560 children (50.4% male). The sample comprised 1110 Italian (10.01 ± 0.65 years), 280 Brazilian (10.52 ± 1.27 years), and 170

Spanish (10.54 ± 1.02 years) participants. Students were enrolled between January and October 2013 on the condition that parents signed the informed consent form.

Measures and procedure

This study presents data from a transcultural project that aims to investigate factors linked to energy gain and eating habits, considering the influence of the rhythmicity of behavior from a chronobiological point of view. During the school year, students were invited to answer a set of questionnaires aimed at gathering data on timing of food intake, sleep habits, and physical activity. During school hours, two members of the research group administered questionnaires in the presence of the teacher. The team went to the schools at a prearranged time and students completed the questionnaires in about 30 min. The ethics committee of the universities involved in the project approved this study.

The present study focuses on the data regarding physical self-efficacy measured through the Perceived Physical Ability Scale for Children (PPASC)²⁰ in relation to age, gender, nationality, and BMI. Participants completed the PPASC, which consists of six items: (1) run, ranging from 1 ("I run very slowly") to 4 ("I run very fast"); (2) exercise, ranging from 1 ("I am able to do only very easy exercises") to 4 ("I am able to do very difficult exercises"); (3) muscles, ranging from 1 ("My muscles are very weak") to 4 ("My muscles are very strong"); (4) move, ranging from 1 ("I move very slowly") to 4 ("I move very rapidly"); (5) sure, ranging from 1 ("I feel very insecure when I move") to 4 ("I feel very sure when I move"); (6) tired, ranging from 1 ("I feel very tired when I move") to 4 ("I don't feel tired at all when I move"). The total test score can range from 6 to 24, and high scores indicate the greatest perceived physical self-efficacy. The PPASC assess individuals' perceptions of physical abilities such as strength, speed, and coordinative abilities.²⁰ Studies have found that the PPASC is a reliable and valid measure of physical self-efficacy in children.^{9,10,20} Back translation was performed in order to use the PPASC in Brazilian Portuguese and Spanish.

Measurements of weight and height were recorded on the same day that children completed the questionnaire, using portable scale and a portable stadiometer to obtain the BMI, i.e., weight in kg divided by height in m². Children were measured barefoot and without outerwear in a separate room. BMI for age was calculated according to gender, and children were divided into four categories, according to the international classification by Cole et al.: normal weight, underweight,²¹ overweight, and obese.²²

Statistical analyses

The Kolmogorov–Smirnov test was performed for age, BMI, and self-efficacy; the results showed that the variables did not have normal distribution (p -value < 0.05). To compare each of the considered variables (age, BMI, self-efficacy, and nationality) between males and females, the Mann–Whitney U test for independent samples was used. To compare weight categories (underweight, normal weight, overweight, and obese), nationality (Brazilian, Italian, and Spanish), and gender, the chi-squared test was employed. To analyze BMI

differences in relation to nationality (Brazilian, Italian, and Spanish), separately by gender, and to compare the weight categories and the total PPASC score, Kruskal–Wallis H tests were performed. The effect size was calculated for the Mann–Whitney U test and the Kruskal–Wallis H test.²³

Finally, a linear regression was performed to evaluate, separately for gender, how the BMI increase, age, and nationality could be related to total perceived physical self-efficacy score, using the 'enter' method. SPSS (SPSS Inc. 2009. Statistics for Windows, version 18.0, USA) v.18 was used for all statistical analysis. Statistical significance was set at $p < 0.05$.

Results

Descriptive data on the sample are displayed in Table 1. The median BMI was significantly higher for boys compared with girls ($p = 0.043$; effect size = 0.059). The frequency of thinness underweight was higher in girls (3.4%) than in boys (1.5%). A higher percentage of boys were overweight (12.3%) or obese (5.1%) than girls (12.2%, 2.8%), ($p < 0.001$). The boys (PPASC 19; 18–21) reported greater perceived physical self-efficacy than girls (PPASC 18; 17–19); ($p < 0.001$; effect size = 0.339).

The BMI factor showed no difference between countries (Brazil, Italy, Spain), when analyzed separately by gender in the Kruskal–Wallis H test comparison. The total PPASC score was significantly different for weight categories ($p < 0.001$; effect size = 0.003), with a mean rank self-efficacy score of 724.53 for underweight, 826.43 for normal weight, 702.28 for overweight, and 639.22 for obese; and for nationality ($p < 0.001$; effect size = 0.003), with a mean rank self-efficacy score of 687.55 for Brazilian, 812.89 for Italian, and 722.11 for Spanish.

Results from the linear regression model (Table 2), controlling for the confounders age, BMI, and nationality separately by gender, demonstrated that lower PPASC score was significantly related to higher BMI in boys ($\beta = -0.15$; $p < 0.001$; adjusted $R^2 = 0.044$; $F = 12.98$; $p < 0.001$); in girls lower PPASC score was related to higher BMI ($\beta = -0.06$; $p = 0.012$), older age ($\beta = -0.29$; $p = 0.001$), and nationality; it was found that Brazilian girls had the lowest score ($\beta = -0.24$; $p = 0.043$; adjusted $R^2 = 0.032$; $F = 9.53$; $p < 0.001$).

Discussion

The present study showed a significant relationship between perceived physical ability and BMI in a sample of schoolchildren. This relationship emerged as significantly different for boys and girls, and for nationality in the linear regression analysis.

Perception of physical abilities tends to be higher in boys than in girls.^{1,2,10,18} Boys and girls with a higher BMI tend to have a lower self-perception of physical effectiveness.^{24,25} Fairclough et al.¹¹ demonstrated that boys with lower BMI values were the most likely to engage in weekday physical activity. In the present study, boys had higher PPASC than girls and the categories of weight showed different total PPASC scores. Low physical self-efficacy can be stimulated

Table 1 Descriptive statistics for age, weight status, perceived physical self-efficacy score, and nationality.

	Boys (n = 787)	Girls (n = 773)	Total (n = 1560)	p-Value
Age of child ^a	10 (9.8–10.8)	10 (9.6–11)	10 (9.8–10.9)	0.77
BMI ^a	18.5 (16.7–21.4)	18.3 (16.4–20.6)	18.4 (16.6–21)	0.043 ^c
PPASC ^a	19 (18–21)	18 (17–19)	18 (17–20)	<0.001 ^c
Weight groups, n (%) ^b				<0.001 ^c
Underweight	24 (3.0)	53 (6.9)	77 (4.9)	
Normal weight	492 (62.6)	486 (62.9)	978 (62.7)	
Overweight	192 (24.4)	190 (24.6)	382 (24.5)	
Obese	79 (10.0)	44 (5.7)	123 (7.9)	
Nationality, n (%) ^b				<0.001 ^c
Brazilian	122 (15.5)	158 (20.4)	280 (17.9)	
Italian	587 (74.6)	523 (67.7)	1110 (71.2)	
Spanish	78 (9.9)	92 (11.9)	170 (10.9)	

BMI, body mass index; PPASC, Perceived Physical Ability Scale for Children.

Data shown as median (25th to 75th percentile) or n (%).

^a Mann–Whitney's *U* test.

^b Chi-squared test.

^c Statistically significant differences ($p < 0.05$).

by excessive weight, which contributes to increased concern with self-perceptions of physical abilities.

Of the children evaluated in this study, approximately 24% of children had excess weight and 8% had obesity (Table 1); these statistics are similar to the data found in the literature,^{18,26} and these percentages differ between genders. The BMI results demonstrate no difference among the three countries considered; however, it is important to highlight that the prevalence of overweight and obesity is high in these countries. The sample was collected in southern Brazil, a population of Italian and German descent, which is culturally similar to European countries such as Italy and Spain, suggesting that the similarities in BMI are more biological than socio-culturally derived. Besides, physical self-efficacy may be less affected in a society where having increased BMI is normal.

In the linear regression model, for boys and girls, the increase in BMI was related to a decrease in perceived physical self-efficacy score (Table 2). One explanation for the

increase in BMI and decrease in physical self-efficacy score is that someone who is classified as overweight or obese may have a self-perception of obesity that makes him or her feel unfit to perform physical activity. Therefore, a child who is classified as obese avoids taking part in physical activity so as not to be judged as being unable to perform, and thus, enters a vicious circle. The physically inactive lifestyle is a trigger to weight gain and vice versa.²⁷ Furthermore, age and nationality also were predictors of low physical self-efficacy only for girls. The results underlined the differences in physical self-efficacy for girls related to older age and differences between the countries, since in Italy (mean rank: 408.17) there is a higher score of self-efficacy compared to Brazil (mean rank: 330.78). In Spain, girls (mean rank: 363.24) presented similar PPASC scores to boys (373.24).

Some limitations may have an impact on the generalizability of the present findings. The cross-sectional design of this study excludes statements about causality and directionality in relation to the variables of interest. The

Table 2 Linear regression model of total perceived physical self-efficacy score, separately for gender, and age, body mass index, and nationality.

Variables	Multivariate B (std error)	Beta	Multivariate <i>t</i>	p-Value
Boys				
<i>Adjusted R² = 0.044</i>				
Age	−0.19 (0.11)	−0.060	−1.668	0.096
BMI	−0.15 (0.03)	−0.202	−5.768	<0.001 ^a
Nationality	−0.10 (0.14)	−0.024	−0.678	0.498
Girls				
<i>Adjusted R² = 0.032</i>				
Age	−0.29 (0.09)	−0.119	−3.218	0.001 ^b
BMI	−0.06 (0.03)	−0.090	−2.518	0.012 ^b
Nationality	−0.24 (0.12)	−0.074	−2.031	0.043 ^b

BMI, body mass index.

^a Significant at $p < 0.001$.

^b Significant at $p < 0.05$.

perceived physical ability is only one of many factors that influence obesity. Other psychosocial aspects correlating to physical activity could be studied in future research, such as self-confidence and self-esteem, in order to clarify the factors that can promote healthy behaviors. Clearly, age and gender can be considered, because they influence these variables. The difference in sample size between countries should be taken into account, however, this could be considered as a strong point of the present work: physical self-efficacy in children was assessed using the same questionnaire in Brazil, Italy, and Spain. Moreover, the authors considered the same international BMI classification criterion in each sample and a similar BMI distribution was observed in the three countries. Educational programs²⁸ focused on developing physical skills could consider the association between physical self-efficacy and BMI,^{29,30} and could be a means for improving the self-image of obese children, especially during childhood.

To conclude, these results reinforce the importance of the psychological aspect of obesity, as the perceived physical self-efficacy and body mass index were negatively associated in a sample of male and female schoolchildren. Furthermore, age and nationality also were predictors of low physical self-efficacy only for girls, given that lower physical self-efficacy was related to being older and Brazilian girls had the lowest score.

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Conflicts of interest

The authors declare no conflicts of interest.

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References

- Purslow LR, Hill C, Saxton J, Corder K, Wardle J. Differences in physical activity and sedentary time in relation to weight in 8–9 year old children. *Int J Behav Nutr Phys Act.* 2008;5:67.
- Fisher A, Saxton J, Hill C, Webber L, Purslow L, Wardle J. Psychosocial correlates of objectively measured physical activity in children. *Eur J Public Health.* 2011;21:145–50.
- King AC, Parkinson KN, Adamson AJ, Murray L, Besson H, Reilly JJ, et al. Correlates of objectively measured physical activity and sedentary behaviour in English children. *Eur J Public Health.* 2011;21:424–31.
- Tsang SK, Hui EK, Law BC. Self-efficacy as a positive youth development construct: a conceptual review. *Sci World J.* 2012;2012:452327.
- Kitzman-Ulrich H, Wilson DK, Van Horn ML, Lawman HG. Relationship of body mass index and psychosocial factors on physical activity in underserved adolescent boys and girls. *Health Psychol.* 2010;29:506–13.
- Spence JC, Blanchard CM, Clark M, Plotnikoff RC, Storey KE, McCargar L. The role of self-efficacy in explaining gender differences in physical activity among adolescents: a multilevel analysis. *J Phys Act Health.* 2010;7:176–83.
- de Souza CA, Rech CR, Sarabia TT, Añez CR, Reis RS. Self-efficacy and physical activity in adolescents in Curitiba, Paraná State, Brazil. *Cad Saude Publica.* 2013;29:2039–48.
- Suton D, Pfeiffer KA, Feltz DL, Yee KE, Eisenmann JC, Carlson JJ. Physical activity and self-efficacy in normal and over-fat children. *Am J Health Behav.* 2013;37:635–40.
- Colella D, Morano M, Robazza C, Bortoli L. Body image, perceived physical ability, and motor performance in nonoverweight and overweight Italian children. *Percept Mot Skills.* 2009;108:209–18.
- Morano M, Colella D, Robazza C, Bortoli L, Capranica L. Physical self-perception and motor performance in normal-weight, overweight and obese children. *Scand J Med Sci Sports.* 2011;21:465–73.
- Fairclough SJ, Ridgers ND, Welk G. Correlates of children's moderate and vigorous physical activity during weekdays and weekends. *J Phys Act Health.* 2012;9:129–37.
- Crespo NC, Corder K, Marshall S, Norman GJ, Patrick K, Sallis JF, et al. An examination of multilevel factors that may explain gender differences in children's physical activity. *J Phys Act Health.* 2013;10:982–92.
- Morano M, Colella D, Rutigliano I, Fiore P, Pettoello-Mantovani M, Campanozzi A. Changes in actual and perceived physical abilities in clinically obese children: a 9-month multi-component intervention study. *PLoS ONE.* 2012;7:e50782.
- Fairclough SJ, Boddy LM, Ridgers ND, Stratton G. Weight status associations with physical activity intensity and physical self-perceptions in 10- to 11-year-old children. *Pediatr Exerc Sci.* 2012;24:100–12.
- Zullig KJ, Matthews-Ewald MR, Valois RF. Weight perceptions, disordered eating behaviors, and emotional self-efficacy among high school adolescents. *Eat Behav.* 2016;21:1–6.
- Steele MM, Daratha KB, Bindler RC, Power TG. The relationship between self-efficacy for behaviors that promote healthy weight and clinical indicators of adiposity in a sample of early adolescents. *Health Educ Behav.* 2011;38:596–602.
- Lombardo FL, Spinelli A, Lazzeri G, Lamberti A, Mazzarella G, Nardone P, et al. Severe obesity prevalence in 8- to 9-year-old Italian children: a large population-based study. *Eur J Clin Nutr.* 2015;69:603–8.
- Ahrens W, Pigeot I, Pohlabeln H, De Henauw S, Lissner L, Molnár D, et al. Prevalence of overweight and obesity in European children below the age of 10. *Int J Obes (Lond).* 2014;38:S99–107.
- Aiello AM, Marques de Mello L, Souza Nunes M, Soares da Silva A, Nunes A. Prevalence of obesity in children and adolescents in Brazil: a meta-analysis of cross-sectional studies. *Curr Pediatr Rev.* 2015;11:36–42.
- Colella D, Morano M, Bortoli L, Robazza C. A physical self-efficacy scale for children. *Soc Behav Pers.* 2008;36:841–8.
- Cole TJ, Flegal KM, Nicholls D, Jackson AA. Body mass index cut offs to define thinness in children and adolescents: international survey. *BMJ.* 2007;335:194.
- Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ.* 2000;320:1240–3.

23. King BM, Minium EW. *Statistical reasoning in psychology and education*. 4th ed. New York: John Wiley & Sons; 2003.
24. Herman KM, Sabiston CM, Tremblay A, Paradis G. Self-rated health in children at risk for obesity: associations of physical activity, sedentary behaviour, and BMI. *J Phys Act Health*. 2014;11:543–52.
25. Hjorth MF, Chaput JP, Ritz C, Dalskov SM, Andersen R, Astrup A, et al. Fatness predicts decreased physical activity and increased sedentary time, but not vice versa: support from a longitudinal study in 8- to 11-year-old children. *Int J Obes (Lond)*. 2014;38:959–65.
26. Flores LS, Gaya AR, Petersen RD, Gaya A. Trends of underweight, overweight, and obesity in Brazilian children and adolescents. *J Pediatr (Rio J)*. 2013;89:456–61.
27. Pietiläinen KH, Kaprio J, Borg P, Plasqui G, Yki-Järvinen H, Kujala UM, et al. Physical inactivity and obesity: a vicious circle. *Obesity (Silver Spring)*. 2008;16:409–14.
28. Farias Edos S, Gonçalves EM, Morcillo AM, Guerra-Júnior G, Amancio OM. Effects of programmed physical activity on body composition in post-pubertal schoolchildren. *J Pediatr (Rio J)*. 2015;91:122–9.
29. Martin A, Saunders DH, Shenkin SD, Sproule J. Lifestyle intervention for improving school achievement in overweight or obese children and adolescents. *Cochrane Database Syst Rev*. 2014;3:CD009728.
30. de Onis M. Preventing childhood overweight and obesity. *J Pediatr (Rio J)*. 2015;91:105–7.