Physical self-efficacy is associated to body mass index in schoolchildren

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

\textsuperscript{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
\textsuperscript{b} Universidade Federal do Rio Grande do Sul (UFRGS), Programa de Pós-Graduação em Psiquiatria e Ciências do Comportamento, Porto Alegre, RS, Brazil
\textsuperscript{c} Universitat de Barcelona, Facultat de Psicologia, Departamento de Psiquiatria y Psicobiologia Clínica, Barcelona, Spain
\textsuperscript{d} Universitat de Barcelona, Institut de Recerca en Cervell, Cognició i Conducta (IR3C), Barcelona, Spain
\textsuperscript{e} Università di Bologna, Dipartimento di Psicologia, Bologna, Italy
\textsuperscript{f} Seconda Università degli Studi di Napoli, Dipartimento di Psicologia, Caserta, Italy
\textsuperscript{g} Universidade Federal do Rio Grande do Sul (UFRGS), Faculdade de Medicina, Departamento de Psiquiatria e Medicina Legal, Porto Alegre, RS, Brazil
\textsuperscript{h} Università di Bologna, Dipartimento di Medicina Specialistica, Diagnostica e Sperimentale, Bologna, Italy

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- Obesity;
- Overweight;
- Childhood;
- Physical self-efficacy;
- Perceived Physical Ability Scale for Children

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 overweight 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.

\textsuperscript{***} 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.
\textsuperscript{*} Corresponding author.
E-mail: alicia.ufrgs@gmail.com (A. Carissimi).
Introduction

The health benefits of regular physical activity for children are well known. To gain a better understanding of psychological aspects 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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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 minutes. 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) 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. 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, overweight, and obese.

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.

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 (β = −0.15; p = 0.001; adjusted R² = 0.044; F = 12.98; p < 0.001); in girls lower PPASC score was related to higher BMI (β = −0.06; p = 0.012), older age (β = −0.29; p < 0.001), and nationality; it was found that Brazilian girls had the lowest score (β = −0.24; p = 0.043; adjusted R² = 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. Boys and girls with a higher BMI tend to have a lower self-perception of physical effectiveness. Fairclough et al. 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.
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,\textsuperscript{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.\textsuperscript{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

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

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

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

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

\textsuperscript{a} Mann–Whitney’s U test.

\textsuperscript{b} Chi-squared test.

\textsuperscript{c} Statistically significant differences (p < 0.05).

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

<table>
<thead>
<tr>
<th>Variables</th>
<th>Multivariate B (std error)</th>
<th>Beta</th>
<th>Multivariate t</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boys</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted $R^2 = 0.044$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>−0.19 (0.11)</td>
<td>−0.060</td>
<td>−1.668</td>
<td>0.096</td>
</tr>
<tr>
<td>BMI</td>
<td>−0.15 (0.03)</td>
<td>−0.202</td>
<td>−5.768</td>
<td>&lt;0.001\textsuperscript{a}</td>
</tr>
<tr>
<td>Nationality</td>
<td>−0.10 (0.14)</td>
<td>−0.024</td>
<td>−0.678</td>
<td>0.498</td>
</tr>
<tr>
<td><strong>Girls</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted $R^2 = 0.032$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>−0.29 (0.09)</td>
<td>−0.119</td>
<td>−3.218</td>
<td>0.001\textsuperscript{b}</td>
</tr>
<tr>
<td>BMI</td>
<td>−0.06 (0.03)</td>
<td>−0.090</td>
<td>−2.518</td>
<td>0.012\textsuperscript{b}</td>
</tr>
<tr>
<td>Nationality</td>
<td>−0.24 (0.12)</td>
<td>−0.074</td>
<td>−2.031</td>
<td>0.043\textsuperscript{b}</td>
</tr>
</tbody>
</table>

BMI, body mass index.

\textsuperscript{a} Significant at $p < 0.001$.

\textsuperscript{b} Significant at $p < 0.05$. 

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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 programs focused on developing physical skills could consider the association between physical self-efficacy and BMI, 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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Physical self-efficacy and BMI