Convergent validity of a questionnaire for assessing physical activity in Spanish adolescents with overweight

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ABSTRACT

Objective: To evaluate the convergent validity of the PAQ-A for assessing physical activity (PA) in overweight (including obese) adolescents.

Material and method: Two hundred and three Spanish adolescents (96 females), aged 13–17 years, were selected for this study. Levels of PA were self-reported by 3-day activity diary, activity rating and PAQ-A. Adolescents wore the ActiGraph accelerometer for 7 days. Overweight was classified according to International Obesity Task Force age- and sex-specific body mass index cut offs.

Results: Fifty-four (33 male and 21 female) adolescents (27%) were classified as overweight or obese. The PAQ-A was moderately related in the overweight adolescent group to an activity rating ($r$=0.52), total PA and moderate-to-vigorous PA assessed by activity monitor ($r$=0.52 and 0.43) and total PA and moderate-to-vigorous PA assessed by activity diary ($r$=0.32 and 0.47). There were no significant differences in the correlation coefficients between non-overweight and overweight adolescents.

Conclusion: The PAQ-A shows a reasonable validity for assessing PA in Spanish overweight adolescents.

Validez convergente de un cuestionario para valorar la actividad física en adolescentes españoles con sobrepeso

RESUMEN

Objetivo: El objetivo de este estudio fue evaluar la validez convergente del cuestionario PAQ-A para valorar actividad física (AF) en adolescentes con sobrepeso.

Material y métodos: Doscientos y tres adolescentes (96 mujeres) con edades de entre 13 y 17 años fueron seleccionados para este estudio. Los niveles de AF fueron obtenidos de un diario de 3 días, una escala comparativa y el PAQ-A. Los adolescentes llevaron el acelerómetro ActiGraph durante 7 días. Los adolescentes fueron clasificados como sobrepeso a partir de los puntos de corte del índice de masa corporal para edad y género de la International Obesity Task Force.

Resultados: Cincuenta y cuatro (33 hombres y 21 mujeres) adolescentes (27%) fueron clasificados como sobrepeso. En el grupo de adolescentes con sobrepeso, el PAQ-A mostró correlaciones moderadas con la escala comparativa ($r$=0.52), la AF total y AF de moderada a vigorosa del acelerómetro ($p$=0.52 y 0.43), y la AF total y AF de moderada a vigorosa del diario ($p$=0.32 y 0.47). No hubo diferencias significativas entre los coeficientes de correlación de los grupos de adolescentes con y sin sobrepeso.

Conclusión: El cuestionario PAQ-A muestra una razonable validez para valorar actividad física en adolescentes españoles con sobrepeso.

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Introduction

Physical activity (PA) is critical for both the effective prevention and treatment of chronic diseases in children and adolescents. Numerous instruments are available to assess PA in children and adolescents but they vary with regard to validity, reliability, practicality and reactivity. The most accurate techniques are not very feasible in large samples or to assess PA in free-living conditions. Other objective techniques such as heart rate monitors, pedometers or accelerometers also have limitations for large-scale research projects (e.g., costs, data processing challenges). Self-report instruments offer some advantages for assessing large populations but, because they are subjective in nature and typically rely on recall, it is important to carefully take all limitations into account when interpreting the data.

The Physical Activity Questionnaire for Adolescents (PAQ-A) is among the most widely used tools for research involving adolescents. The PAQ-A has been shown to have reasonable validity to assess PA in adolescents. The PAQ-A has also recently shown a similar reliability and validity as the original version for assessing PA in Spanish adolescents. One major issue that has not been addressed is whether the PAQ-A provides valid estimates of activity in adolescents that are overweight or obese. Past research indicates that overweight adolescents tend to over report their PA behavior; hence it is important to determine if the PAQ-A is valid for assessing PA in this specific population group. Addressing these issues will improve the utility of future studies employing the PAQ-A. Therefore, the aim of this study was to evaluate the convergent validity of the PAQ-A in Spanish overweight and obese adolescents.

Material and methods

Participants. The participants in the study included a subsample of 203 healthy Spanish adolescents (96 females) aged 13–17 years, enrolled in the AFINOS study. Before participating, all adolescents were informed about the nature of the study and gave their consent, and their parents gave signed written consent. This study was approved by the Ethics Committee of Puerta de Hierro Hospital (Madrid, Spain). Data collection lasted for 4 months between November 2007 and February 2008.

The Physical Activity Questionnaire for Adolescents (PAQ-A). The PAQ-A is a self-administered 7-day recall questionnaire used to assess usual moderate-to-vigorous PA (MVPA) in adolescents. The PAQ-A uses a series of 8 items designed to capture activity levels at different times during school days and weekend days. Each item is scored on a 5-point scale and the total score is computed as a mean of the 8 items. The Spanish version of the PAQ-A showed a reasonable validity compared against the ActiGraph activity monitor (r = 0.39) for assessing total PA in Spanish adolescents.

Activity monitor. Participants wore the small, lightweight and uniaxial ActiGraph GT1M (ActiGraph, Pensacola, FL, USA) activity monitor. Epochs of 15-s were used in the current study and recording of at least 10-h/day, for 4 days, of which one was a weekend day, was necessary to be included in this study. Bouts of 10-min of consecutive zeros (non-wearing time) were identified and removed to identify days with valid data. In this study, counts per minute (cpm) were used as the total PA variable, and the age-specific cut-point proposed by Freedson et al. was used to estimate time spent (min) in MVPA.

Activity diary. The 3-day Bouchard activity diary was administered to provide additional context about children’s PA. The Bouchard diary uses a time grid that divides each day into 96 15-min periods. Participants recorded the main activity in each 15-min block and rated the activities on an intensity level scale (1–9). Each numeric activity code refers to a specific energy cost and can be converted into a metabolic ratio of energy expended (MET). In addition, the 3-day Bouchard diary has been shown to correlate moderately well with total PA (r = 0.33–0.35) and MVPA (r = 0.36) measured with the ActiGraph in Spanish adolescents. The MET values proposed by Bratteby for categories were used in this study to calculate MET-min and time spent (min) in MVPA (categories 7–9) using the 3-day mean.

Activity rating. The activity rating consists of one question: “Compared to others of your age and sex, how much PA do you get?” It is rated on a 5-point scale ranging from 1 (much less active) to 5 (much more active). In Spanish adolescents, the activity rating showed r = 0.39 against PA assessed by the ActiGraph.

Procedures. Groups of participants (average group size = 15) were assessed over an entire school week. Weight and height were obtained by standardized procedures. Body mass index (BMI) was calculated as weight/height squared (kg/m2). An overweight status was established according to the International Obesity Task Force BMI cut-off values for adolescents by gender and age (www.iotf.org). Beginning on an assessment day (Wednesday), the activity monitor was worn for 7 days at the lower back using an elasticated belt and was only removed during water-based activities and sleeping. The activity diary was also kept for 3 days (Thursday, Friday and Saturday) concurrently. The activity diary and activity monitor were returned the following week and the PAQ-A was administrated on that day (Wednesdays).

Statistical analyses. All variables were checked for normal distribution and only the PAQ-A score was not normally distributed. The characteristics of participants and outcomes of the study are described as mean ± SD or mean (95% CI). Student’s t-test and the Mann–Whitney U-test were performed to examine differences in normally distributed variables and the PAQ-A score, respectively, by gender and weight status. The convergent validity of the PAQ-A was evaluated using Spearman’s correlation coefficient (r). Convergent validity tests, whose measures were obtained by different methods that should be related, are in fact related. Thus, the PAQ-A and recorded PA should be related. In this study, all relationships were examined for large populations but, because they are subjective in nature and typically rely on recall, it is important to carefully take all limitations into account when interpreting the data. The Physical Activity Questionnaire for Adolescents (PAQ-A) is among the most widely used tools for research involving adolescents. The PAQ-A has been shown to have reasonable validity to assess PA in adolescents. The PAQ-A has also recently shown a similar reliability and validity as the original version for assessing PA in Spanish adolescents. One major issue that has not been addressed is whether the PAQ-A provides valid estimates of activity in adolescents that are overweight or obese. Past research indicates that overweight adolescents tend to over report their PA behavior; hence it is important to determine if the PAQ-A is valid for assessing PA in this specific population group. Addressing these issues will improve the utility of future studies employing the PAQ-A. Therefore, the aim of this study was to evaluate the convergent validity of the PAQ-A in Spanish overweight and obese adolescents.

Results

Descriptive characteristics and PA assessments are given in Table 1. There were no significant differences between genders for

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Males (n = 107)</th>
<th>Females (n = 96)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>14.9 ± 1.2</td>
<td>15.0 ± 1.2</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>64.3 ± 14.0</td>
<td>57.8 ± 9.4***</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.7 ± 0.1</td>
<td>1.6 ± 0.1***</td>
</tr>
<tr>
<td>BMI (kg/m2)</td>
<td>22.4 ± 6.0</td>
<td>21.7 ± 3.2</td>
</tr>
<tr>
<td>PAQ-A (score)</td>
<td>2.5 (2.4, 2.6)</td>
<td>2.1 (2.0, 2.2)***</td>
</tr>
<tr>
<td>Activity rating (score)</td>
<td>3.5 ± 1.3</td>
<td>2.8 ± 1.3***</td>
</tr>
</tbody>
</table>

Activity monitor

<table>
<thead>
<tr>
<th></th>
<th>Total PA (cpm)</th>
<th>Moderate-to-vigorous PA (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>288 ± 91</td>
<td>84 ± 28</td>
</tr>
<tr>
<td>Females</td>
<td>209 ± 58***</td>
<td>62 ± 19***</td>
</tr>
</tbody>
</table>

Activity diary

<table>
<thead>
<tr>
<th></th>
<th>Total PA (MET-min)</th>
<th>Moderate-to-vigorous PA (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>2592 ± 518</td>
<td>66 ± 52</td>
</tr>
<tr>
<td>Females</td>
<td>2462 ± 274</td>
<td>36 ± 37***</td>
</tr>
</tbody>
</table>

Values are mean ± SD or mean (95% CI).

*p < 0.05, **p < 0.01, ***p < 0.001, denotes statistical significance between genders.
The PAQ-A was moderately correlated in the overweight adolescent group, the PAQ-A was also moderately correlated with the activity diary (concurrent validity). Differences in levels of PA between normal-weight and overweight adolescents showed no significant differences by the PAQ-A, activity monitor, activity diary and activity rating variables (all p > 0.05). Correlations between the PAQ-A and PA instruments are shown in Table 2. The PAQ-A was moderately correlated in the total sample with the activity rating (r = 0.55), activity monitor (r = 0.39 and 0.31) and activity diary (r = 0.36 and 0.46). In the overweight adolescent group, the PAQ-A was also moderately correlated with the activity rating (r = 0.52), activity monitor (r = 0.52 and 0.43) and activity diary (r = 0.47 and 0.32). Correlations between the PAQ-A and PA variables were similar in normal-weight and overweight adolescents after Z-transformation.

### Discussion

In the current study we examined the convergent validity of the PAQ-A in overweight (including obese) adolescents for possible use in this specific population. The findings in the present study show that the PAQ-A is reasonably valid for assessing PA in overweight and obese adolescents. Overweight adolescents showed slightly higher correlations between the PAQ-A and the activity monitor, but slightly worse against the activity diary (concurrent validity). Correlations in our study in the overweight adolescent sample were similar to those observed in previous studies with a randomized adolescent sample comparing the PAQ-A against the ActiGraph.3

On the other hand, the activity rating (construct validity) also showed moderate correlations with the PAQ-A scores similar to the previous studies in adolescents.2 Initially, we may think that (1) overweight adolescents have a better recall of their activities because they do less PA and, therefore, it is easier for them to recall; (2) overweight adolescents overestimate self-reported PA owing to the effect of social desirability.5 However, no significant differences in PA levels, including PA objectively measured by activity monitor, were found between both groups. Thus, these results suggest that overweight adolescents are able to accurately recall PA using the PAQ-A. Hence, these results provide some evidence for the consideration of the PAQ-A to obtain valid PA assessments in adolescents with overweight and obesity who participate in population-based interventions for preventing obesity.9

The US Health department has demanded methods for identifying and tracking PA patterns among people with disabilities and chronic diseases (www.hhs.gov). To our knowledge, there are no studies evaluating whether PA self-reports are valid for assessing PA in adolescent populations according to weight status. Ekelund et al.10 validated a self-report method in 49 17-year-old adolescents with a wide variation in body fat (percentage of body fat ranged from 4.4% to 53.3%), but the hypothesis about their specific use in overweight adolescents was not determined. Our study shows that the PAQ-A may be an easy, feasible and valid instrument to assess PA in adolescents with overweight and obesity.

### Conflict of Interest

The authors declare no conflicts of interest.

### Acknowledgements

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### References


### Table 2

Correlations between the PAQ-A score and physical activity (PA) and fitness measurements according to weight status

<table>
<thead>
<tr>
<th>PAQ-A (score)</th>
<th>All (n = 203)</th>
<th>Non-overweight (n = 149)</th>
<th>Overweight* (n = 54)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity rating (score)</td>
<td>0.55***</td>
<td>0.56***</td>
<td>0.52***</td>
</tr>
<tr>
<td>Activity monitor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total PA (cpm)</td>
<td>0.39***</td>
<td>0.34***</td>
<td>0.52***</td>
</tr>
<tr>
<td>Moderate-to-vigorous PA (min)</td>
<td>0.31***</td>
<td>0.28**</td>
<td>0.43**</td>
</tr>
<tr>
<td>Bouchard activity diary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total PA (MET-min)</td>
<td>0.36***</td>
<td>0.38***</td>
<td>0.32*</td>
</tr>
<tr>
<td>Moderate-to-vigorous PA (min)</td>
<td>0.46***</td>
<td>0.47***</td>
<td>0.47**</td>
</tr>
</tbody>
</table>

No significant differences in correlation coefficients between weight status groups.
* p < 0.05, ** p < 0.01, *** p < 0.001, denotes statistical significance.
* Including obesity.