

EXERCISE

Validity and reliability of Physical Activity Enjoyment Scale questionnaire (PACES) in children with asthma

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Abstract

Objective: The aim of this study is to test the psychometric properties of the Physical Activity Enjoyment Scale (PACES) in children with asthma. **Method:** Participants included 185 children (age = 11.38 ± 1.12 years; body mass index = 20.66 ± 4.13 kg/m²): 107 children with asthma and 78 healthy children. To test the enjoyment of physical activity, PACES of Motl et al. was used in its Spanish version. In addition, the Physical Activity Questionnaire for Children (PAQ-C), Paediatric Asthma Quality of Life Questionnaire (PAQLQ) and Physical Self-Concept Questionnaire (CAF) have been used. **Results:** The results have shown a two-factor structure corresponding to the model whose settings have been good. PACES internal consistency was very high (Cronbach's $\alpha = 0.906$). The PACES test-retest reliability indicates a good temporal concordance (Spearman $\rho = 0.868$, $p < 0.001$). This presents an adequate concurrent validity with the total PAQLQ, the PAQ-C as well as with ability, fitness, attractiveness, strength and general physical self-concept. **Conclusions:** The findings confirm that PACES is a valid and reliable measure of physical activity enjoyment in children with asthma.

Keywords

Asthma, children, physical activity enjoyment, validation

History

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Introduction

Physical activity may be useful in the controlling of asthma [1], in its development, and in improving [2] the management of asthma symptoms, pulmonary function, mental health [3] and quality of life [4]. High physical fitness seems to be associated with a reduced risk for the development of asthma [5]. However, children with asthma, especially those with more severe clinical disease, tend to have a sedentary lifestyle and therefore a lower aerobic capacity than healthy children [6]. Fear of breathlessness and induced asthma attacks inhibits participation in physical activity and sports in many patients [7]. All this causes a deterioration of the physical condition [8] and a reduced cardiorespiratory capacity compared to healthy children [9]. Muscle strength and peripheral resistance decrease in patients with chronic lung disease and appear to contribute to the exercise intolerance of patients [10]. People with asthma are less prone to exercise, either due to worsening asthma symptoms during set exercise or for other reasons, such as lack of physical fitness as a result of inactivity, medical advice and family influence. The end result is an overall reduction in fitness, which further discourages children from taking part in physical activity [11].

All this affects the enjoyment of physical activity, which can dishearten children [11,12]. The development of positive

attitudes and behaviors toward exercise can increase children's participation in exercise, which in turn contributes to mental and physical health, better management of the disease, prevention of complications and delay of disease development [12]. Certain psychological factors such as self-identity, self-efficacy, perceived competence, enjoyment of physical activity and motivation influence the subject's attitude and therefore his/her participation in physical activity [13]. Previous research has revealed that perceived physical competence is linked to enjoyment of physical exercise [14] and there was strong evidence for a positive association between self-efficacy and physical activity [15]. Children who are more active are characterized as those who enjoy sport, have confidence in their capability to be physically active, feel competent and perceive fewer barriers to physical activity as well as more inclined to enjoy physical activity [16,17].

The enjoyment of physical activity is defined as a positive affective state, either cognitive or physiological, that involves feelings of pleasure and fun associated with the completion of or performance in physical activities [18]. Enjoyment is often cited as an important correlate, or predictor, of physical activity participation and is included in many health promotion models and theories of behavior motivation [19,20]. In this regard, expecting negative emotions is a strong predictor in studying participants who did not regularly participate in physical activity in the past than in those who did [17,21]. Negative experiences with exercise may result in unpleasant perceptions of physical activity involvement, leading to a vicious cycle of sedentary habits [12,22].

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Children with asthma who experience the benefits of exercise are more likely to be active throughout their lives [21–23]. However, there is limited research focusing on attitudes toward exercise from the perspective of school-aged children with asthma [23]. More research focusing on the connection between children with asthma to physical activity is needed. It is important that research progresses such that a clearer understanding of the motivational mechanisms that underlie the positive or negative outcomes of physical education can ultimately be acquired, particularly those pertaining to children with asthma.

A number of scales has been developed and used to quantify enjoyment of physical activity but most lack sufficient evidence of their validity [18]. This study highlights the scales developed by Kendzierski and De Carlo [24], Crocker *et al.* [25] and Motl *et al.* [26].

Considering the importance of physical activity in managing asthma, the influence of attitudes regarding exercise is a critical measure to test. With positive attitudes, children will develop an active lifestyle [12]; however, the absence of the necessary instruments to measure attitudes in children with asthma creates the basis of the need for this test, using this sample. Therefore, the aim of this study is to test the psychometric properties of the PACES in children with asthma.

Methods

Participants

Participants included 185 students (age = 11.38 ± 1.12 years; age range = 10–15 years; body mass index (BMI) = 20.66 ± 4.13 kg/m²). One hundred seven children were diagnosed with asthma by the allergy specialists in hospitals in Ubeda and Jaen (Andalusia, Spain) (age = 11.51 ± 1.19 years; BMI = 20.50 ± 4.04 kg/m²). The sample size of this study was considered appropriate according to psychometric recommendations described by Nunnally [27]. All children with asthma were deemed eligible by the following criteria: they were diagnosed with a case of severe asthma as defined by the Global Initiative for Asthma [28], have undergone treatment for at least 6 months before the study, were in a stable phase of the disease and did not suffer from other cardiopulmonary diseases, musculoskeletal problems or mental disabilities. Also, a control group of 78 healthy children participated (age = 11.21 ± 0.99 years; BMI = 20.88 ± 4.27 kg/m²) in the study. These children did not suffer from other cardiopulmonary diseases, musculoskeletal problems or mental disabilities. All subjects belonged to different schools in Jaen (Andalusia). No significant differences ($p \geq 0.05$) were found between age and BMI from the two groups (asthmatic and healthy children). All parents of students completed an informed consent. The study was conducted in adherence to the standards of the Declaration of Helsinki (2008 version) and following the European Community's guidelines for Good Clinical Practice (111/3976/88 of July 1990), as well as the Spanish legal framework for clinical research on humans (Real Decreto 561/1993 on clinical trials). The informed consent and the study were approved by the Bioethics Committee from the University of Jaen, Spain.

Materials and testing

To test the enjoyment of the physical activity, Physical Activity Enjoyment Scale (PACES) of Motl *et al.* [26] was used in its Spanish version [29]. This scale consists of 16 items, preceded by the sentence “When I am active...”, and evaluates the enjoyment from the highest level (e.g. “I enjoy”, “It is very exciting”, “I find it enjoyable”) to the lowest (e.g. “I am bored”, “I do not like it”, “It frustrates me”). The answers were collected on a Likert scale whose scores oscillate from 1 (totally disagree) to 5 (totally agree). Cronbach's alpha in this study was 0.907. Physical activity was calculated with the Physical Activity Questionnaire For Children (PAQ-C) [30]. The PAQ-C, which is deemed appropriate for school children, registers the physical activity completed in 7 days before its administration. The researchers have used the adolescent version of Martínez-Gómez *et al.* [31] translated into Spanish and updated from its children's version to be used with the participants. Cronbach's alpha in this study was 0.726. To analyze the quality of life of children with asthma, Paediatric Asthma Quality of Life Questionnaire (PAQLQ) was used in its Spanish version [32]. This questionnaire was developed for children with asthma between the ages of 7 and 17 years to evaluate the quality of life. It is composed of 23 questions (items) distributed into three fields: symptoms, limitation in activities and emotional function. Their answers are coded on a Likert scale with options from 1 (lowest quality of life) to 7 (highest quality of life). Cronbach's alpha in this study was 0.958. To test the physical self-questionnaire, CAF was used (physical self-concept questionnaire) [33]. This questionnaire consists of 36 items divided into four scales of physical self (physical attractiveness, physical ability, fitness and strength) and two of general physical self-concept and general self-concept. Cronbach's alpha in this study was 0.922.

The anthropometric parameters analyzed were height (cm), measured with a stadiometer (Seca 22, Hamburg, Germany); weight (kg), recorded with a Seca 634 (Hamburg, Germany) and the BMI, obtained from the average BMI (=weight (kg)/height (m²)).

Procedure

After acquiring parental and scholar centers' consent, the questionnaires were individually applied to a sample of children with asthma and a sample of healthy children from different schools in Andalusia by researchers of this study, who clarified any questions or concerns that could arise. All answers were confidential and anonymous.

Statistical analysis

Data were analyzed using SPSS Version 19.0 for Windows (SPSS Inc., Chicago, IL) and the significance level was set at $p < 0.05$. Principal component factor analysis was done for the PACES components. The internal consistency of PACES was assessed, calculating Cronbach's alpha coefficients in all asthmatic subjects. The test–retest reliability was performed using the Spearman correlation coefficient with a total of 47 participants, between the pretest and posttest and with an

Table 1. PACES results, PAQ-C, PAQLQ and CAF in children with asthma and healthy children.

	Children with asthma, mean (SD)	Healthy children, mean (SD)	<i>p</i> Value
Average Total PACES	4.09 (0.70)	4.41 (0.50)	0.005
PAQ-C	2.58 (0.66)	2.83 (0.55)	0.004
PAQLQ			
Limitation of activities	3.74 (1.50)	NA	
Symptoms	4.08 (1.49)	NA	
Emotional Function	4.78 (1.51)	NA	
Average PAQLQ	4.20 (1.39)	NA	
Ability	22.54 (4.76)	23.24 (4.02)	0.443
CAF			
Fitness	20.86 (5.45)	23.01 (4.82)	0.008
Attractiveness	20.21 (3.93)	19.64 (4.51)	0.477
Strength	21.48 (5.39)	20.65 (4.65)	0.162
General physical self-concept	24.54 (4.59)	25.38 (4.49)	0.161
General self-concept	23.40 (4.38)	25.17 (4.26)	0.006

PACES, enjoyment in physical activity questionnaire; PAQ-C, participation in physical activities; PAQLQ, paediatric Asthma Quality of Life Questionnaire; CAF, physical self-concept questionnaire; SD, standard deviation; NA, not applicable.

interval of 25 days. The convergent validity was performed using Spearman correlation between the total score and PACES, PAQLQ, PAQ-C and CAF questionnaires. The Mann-Whitney test was performed to compare the scores of the different questionnaires between healthy children and children with asthma. The researchers used the statistical program AMOS, version 19, to check the factor structure of the scale. The Adjusted Goodness of Fit of the model was evaluated with different indices: chi-square, Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA).

Results

Table 1 shows the results of PACES, PAQ-C and CAF between the group of children with asthma and the group of healthy children. Lower scores are obtained in children with asthma compared with healthy children in PACES ($p=0.005$), PAQ-C in children ($p=0.004$) and fitness ($p=0.008$) and general self-concept ($p=0.006$) of CAF.

Exploratory factorial analysis for PACES

When the principal component factor analysis was done (Table 2), results showed that PACES among children with asthma consist of two factors. The KMO index reached a value of 0.876 and Bartlett's test of sphericity reached 814.526 ($p<0.001$). Then, it was determined that commonalities, or variance proportion, were explained by the common factors. In general, in the absence of values close to zero, it can be assumed that the seven items are explained by the components. The principal components analysis and the varimax rotation showed convergence in two factors, which explain a variance of 53.23%: 42.89% in the first factor and a 10.34% in the second factor. The items were configured as shown in Table 2 according to the degree of saturation, which was higher than 0.3.

Table 2. Factor loadings (varimax rotated) in exploratory factor analysis with 107 subjects (principal component analysis with varimax rotation).

	Factors	
	Physical activity enjoyment	Physical activity boredom
1. I enjoy it	0.745	
2. I feel bored		0.640
3. I dislike it		0.732
4. I find it pleasurable	0.657	
5. It's no fun at all		0.703
6. It gives me energy	0.573	
7. It makes me depressed		0.719
8. It's very pleasant	0.706	
9. My body feels good	0.797	
10. I get something out of it	0.745	
11. It's very exciting	0.603	
12. It frustrates me		0.664
13. It's not at all interesting		0.754
14. It gives me a strong feeling of success	0.600	
15. It feels good	0.847	
16. I feel as though I would rather be doing something else		0.347

Confirmatory factor analysis

As shown in Figure 1, the factorial analysis provides an adequate goodness index ($CFI=911$, $X^2=201.363$, $df=103$, $RMSEA=0.071$ [$0.05 \leq 0.071 \leq 0.08$]). Therefore, the confirmatory factor analysis results show an acceptable fit rate to consider the factorial structure of the scale of enjoyment with physical activity. The results confirm that the instrument contains two factors.

Internal consistency

The internal consistency analysis allowed for a Cronbach's alpha value of 0.906, which provides a high reliability for the questionnaire. The corrected item-to-total-correlation was optimal with the lowest value of $\rho=0.446$ (item 12: It frustrates me) and the highest value of $\rho=0.683$ (item 1: I enjoy it). There is no improvement in internal consistency to necessitate removing any item (Table 3). The first factor reaches a Cronbach's alpha value of 0.806 and a 0.890 for the second factor.

Test-retest reliability

Table 4 shows the results of the test-retest in PACES questionnaire. Significant correlations are achieved ($p<0.05$) in most of the items except for five of them, highlighting a Spearman $\rho=0.868$, $p<0.001$ in the total score of PACES and obtaining adequate temporal reliability values.

Convergent validity

Table 5 shows the convergent validity of the PACES survey with questionnaires PAQLQ, PAQ-C and CAF. PACES presents a significant correlation ($p<0.05$) with all the dimensions of the PAQLQ questionnaire, with the PAQ-C questionnaire ($p<0.01$) and all dimensions of CAF ($p<0.05$) except for general self-concept.

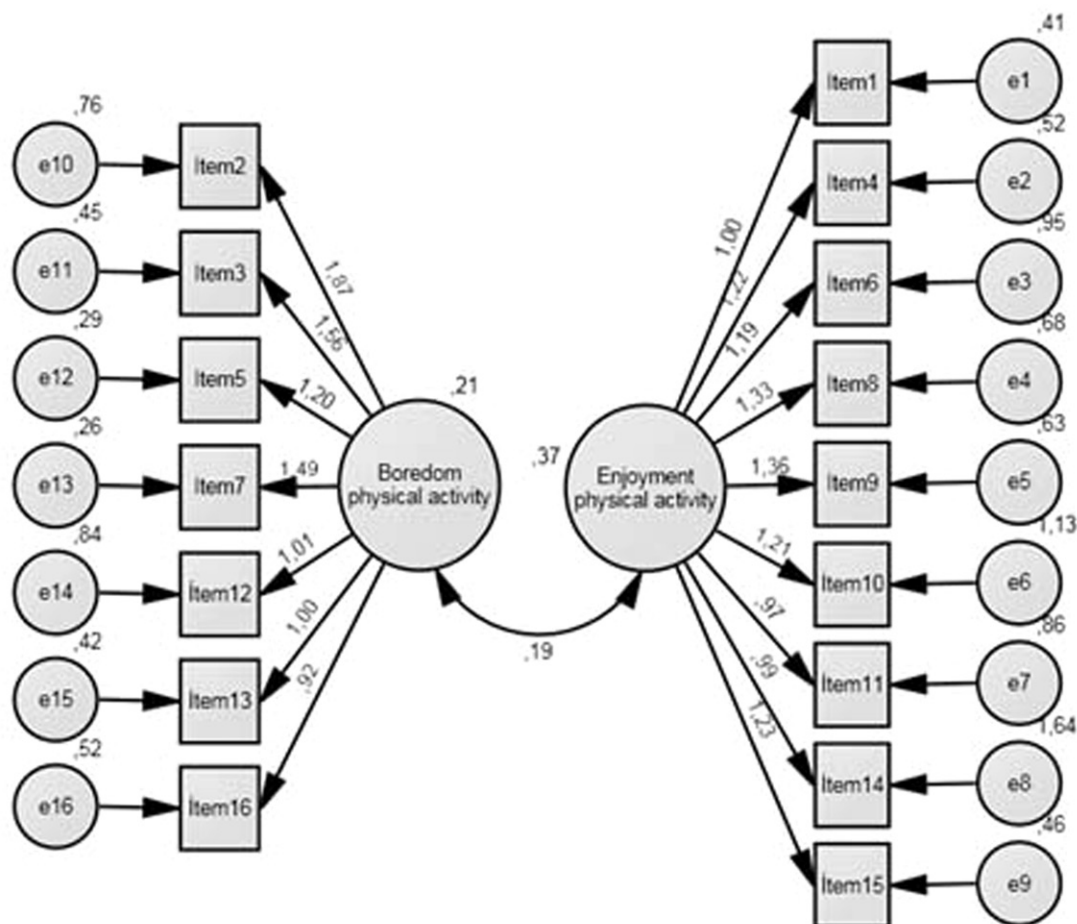


Figure 1. Confirmatory factor analysis.

Table 3. Internal consistency in PACES.

	Scale mean if item deleted	Scale variance if item deleted	Correlation factor-corrected total	Cronbach's alpha if item deleted
1. I enjoy it	61.37	114.972	0.683	0.898
2. I feel bored	61.95	108.649	0.638	0.898
3. I dislike it	61.57	116.247	0.501	0.902
4. I find it pleasurable	61.79	112.731	0.647	0.898
5. It's no fun at all	61.35	118.304	0.555	0.901
6. It gives me energy	61.84	112.135	0.559	0.901
7. It makes me depressed	61.43	114.832	0.641	0.898
8. It's very pleasant	61.99	110.368	0.644	0.898
9. My body feels good	61.83	110.764	0.631	0.898
10. I get something out of it	62.22	109.213	0.672	0.897
11. It's very exciting	61.84	113.399	0.617	0.899
12. It frustrates me	61.65	116.643	0.446	0.904
13. It's not at all interesting	61.50	118.366	0.468	0.903
14. It gives me a strong feeling of success	62.36	111.929	0.521	0.903
15. It feels good	61.56	113.305	0.659	0.898
16. I feel as though I would rather be doing something else	61.64	116.800	0.524	0.902

Discussion

The aim of this study was to validate the PACES questionnaire as a means of assessing physical activity enjoyment in children with asthma, which was made by exploratory and confirmatory factor analysis. The results have shown a

two-factor structure corresponding to the model whose settings have been good. The findings confirm that PACES is a valid and reliable measure of physical activity enjoyment in children with asthma. Evidence of construct convergent and discriminant validity, has also been provided previously [34–36]. PACES has a stable factor structure in relation to

Table 4. Test-retest reliability in PACES.

	Pretest, mean (SD)	Posttest, mean (SD)	Rho Spearman
1. I enjoy it	4.41 (1.07)	4.50 (0.99)	0.618**
2. I feel bored	3.41 (1.57)	4.44 (1.05)	0.400*
3. I dislike it	4.29 (1.11)	4.38 (1.12)	0.571**
4. I find it pleasurable	4.09 (1.02)	4.12 (1.36)	0.374*
5. It's no fun at all	4.38 (0.88)	4.21 (1.27)	0.150
6. It gives me energy	3.85 (1.48)	3.97 (1.29)	0.433*
7. It makes me depressed	4.35 (0.98)	4.44 (1.21)	0.429*
8. It's very pleasant	3.91 (1.19)	3.79 (1.49)	0.393*
9. My body feels good	4.09 (1.24)	4.35 (1.01)	0.410*
10. I get something out of it	3.59 (1.37)	3.79 (1.40)	0.735**
11. It's very exciting	4.12 (1.12)	3.15 (1.56)	0.361*
12. It frustrates me	3.91 (1.28)	4.26 (1.23)	0.081
13. It's not at all interesting	4.12 (1.17)	4.21 (1.27)	0.166
14. It gives me a strong feeling of success	3.29 (1.44)	3.59 (1.67)	0.335
15. It feels good	4.35 (1.07)	4.26 (1.21)	0.426*
16. I feel as though I would rather be doing something else	4.00 (1.23)	4.26 (1.13)	0.140
PACES total	4.01 (0.73)	4.10 (0.71)	0.868**

PACES, enjoyment in physical activity questionnaire; SD, standard deviation.

* $p < 0.05$.

** $p < 0.01$.

Table 5. Convergent validity of PACES survey with questionnaires PAQLQ, PAQ-C and CAF.

	Rho Spearman
Limitation of activities	0.215*
Symptoms	0.202*
Emotional function	0.235*
Average PAQLQ	0.240*
Average PAQ-C	0.378**
Ability	0.400**
Fitness	0.255*
Attractiveness	0.259**
Strength	0.346**
General physical self-concept	0.365**
General self-concept	0.095

PACES, enjoyment in physical activity questionnaire; PAQLQ, paediatric asthma quality of life questionnaire; PAQ-C, participation in physical activities; CAF, physical self-concept questionnaire.

* $p < 0.05$.

** $p < 0.01$.

culture, race, age and sex [18,26,35]. Factor analysis yields two factors, or positively worded items, loaded on one factor and negatively formulated on another factor. These results corroborate the best fit to two-factor version of Molt et al. [26]. However, these results do not match the dimensional structure of the Spanish version in people aged 12 to 54 years and involves the removal of three items from the original version [36]. Similarly, Hales [18] found a unifactorial structure for adolescents. However, Moore et al. [35] confirmed that the two-factor model has better fit indices than the one-factor model in children. As reported in previous studies in children [26,35], the results of confirmatory factor analysis on a two-factor structure were caused by the positive and negative wording of the items. PACES internal consistency was very high (Cronbach's $\alpha = 0.906$) and it was similar to other studies [24,35]. PACES test-retest reliability

indicates a good temporal concordance (Spearman $\rho = 0.868$, $p < 0.001$). It presents an adequate concurrent validity with the total PAQLQ, the PAQ-C and also with ability, fitness, attractiveness, strength and general physical self-concept. In this sense, Davison et al. [37] showed significant PACES correlations with athletic competition and self-reported physical activity. Similarly, Moore et al. [35] showed that PACES presents significant correlations with perceived competence ($r = 0.23$, $p < 0.01$), physical appearance ($r = 0.20$, $p < 0.01$) and self-reported physical activity ($r = 0.16$, $p < 0.01$) in children.

The enjoyment of physical activity is an important motivating factor for children in relation to their participation in physical activities [19,38,39]. In this study, children with asthma show lower physical activity levels than healthy children. Another important finding is the generally perceived lower values of fitness and self-concept in children with asthma. The physical competence perceived is linked to the enjoyment of physical activity [14]. In this sense, PACES shows significant differences between both groups. The results therefore indicate that there is greater enjoyment of physical activity in healthy children compared to children with asthma.

Limitations

Although the psychometric properties of the PACES in children with asthma are correct, one of the limitations of this study is that it does not differentiate factorial analysis by sex. According to Moore et al. [35], the factorial loading is different in healthy children so that the comparison of physical activity enjoyment between sexes may not be appropriate as Meade and Lautenschlager [40] confirmed. The interests and motivations of children toward physical activity might be different as is demonstrated in various studies [41,42]. This could affect the factorial structure and concurrent validity as Moore et al. [35] suggested. Future research should clarify this possibility.

Conclusions

PACES is a valid and reliable instrument to measure the physical activity enjoyment in children with asthma. If future research reinforces the validity and reliability of PACES as a measure of enjoyment, this instrument may be used to analyze the effectiveness of physical-sport activity programs in children with asthma. Furthermore, it may also ensure an adequate adherence to physical-sport activity that is very relevant in the treatment of asthma [9], in its development [10] and in the improvement of the symptoms of asthma, lung function and mental health [11]. It could allow rapid detection in those children at risk of prematurely abandoning physical-sport activity practice in the transition from childhood to adolescence, where a considerable abandonment of the practice of physical-sport activity [41] has been described. This presents, among other factors, the lack of fun [43], which may be aggravated by the conditions of asthma, and less enjoyment in physical-sport practice as compared to healthy children as reflected in this study. Therefore, enjoyment in physical-sport activities may be relevant in asthmatic children's participation in physical-sport activities.

Declaration of interest

The authors declare that they have no competing financial interests related to this work. The authors alone are responsible for the content and writing of the paper.

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