

Original article

Validation and adaptation of the Physical Activity Enjoyment Scale (PACES) in fitness group exercisers

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Abstract

Background: Recently, Mullen et al. (2011) presented an 8-item version of the Physical Activity Enjoyment Scale (PACES) that provides a valid instrument for assessing enjoyment in physical activity. The present paper investigated the psychometric properties of a Portuguese adaptation of PACES.

Methods: After a process of back-to-back translation into Portuguese, 395 members of fitness centers who ranged in age from 18 to 66 years (31.11 ± 8.90 , mean \pm SD) completed the translated version of the PACES. On average, participants had 3.2 years of experience in fitness group classes and practiced for approximately 3.3 times per week.

Results: An initial exploratory factor analysis ($n = 139$) revealed a unidimensional structure with factor loadings ranging from 0.79 to 0.89. Results also showed acceptable internal consistency. A confirmatory factor analysis in an independent sample ($n = 256$) provided additional support for the unidimensional structure of the questionnaire. In addition, moderate positive correlations between enjoyment and intrinsic and identified regulation, and moderate negative correlations between enjoyment and external and amotivation, demonstrate the convergent validity of the instrument. Finally, measurement invariance between 2 independent samples was also found.

Conclusion: The 8-item Portuguese version of PACES is a valid and reliable instrument for measuring enjoyment of physical activity in Portuguese adult fitness exercisers, and it is therefore suitable to use as a measure of affect in exercise adherence interventions studies.

Keywords: Confirmatory factor analysis; Construct validity; Enjoyment; Exploratory factor analysis; Fitness; Measurement invariance; Self-determination theory

1. Introduction

Enjoyment has been described as the process of experiencing joy, reflecting general feelings of pleasure, fun, and happiness.¹ Within the physical activity (PA) context, enjoyment represents a positive attitude toward PA practice² and constitutes one of the most important correlates for PA participation.³ Indeed, researchers have found enjoyment to be related with a number of psychological and behavioral variables in exercise participants, which include intrinsic motivation,² commitment, persistence, well-being,^{4,5} and adherence.⁶

Enjoyment in PA can be derived from a variety of sources. An important source of enjoyment is the degree to which PA participation results in the satisfaction of individuals' basic psychological needs of competence, relatedness, and autonomy. Satisfaction of these needs has been shown to result in "optimal motivational functioning" (p. 7).⁷ Self-determination theory (SDT)⁸ specifies the motivational basis of regulatory processes, which established a continuum of self-determination corresponding to varying degrees of perceived autonomy and locus of causality. This model espouses a multidimensional approach to motivation by proposing the existence of several forms of extrinsic motivation that represent varying degrees of autonomy and perceived locus of causality: external regulation, introjected regulation, identified regulation, and integrated regulation. These regulations are represented on a

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continuum of self-determination, which varies from amotivation to extrinsic motivation, and to intrinsic motivation. Externally motivated behavior includes controlled forms of motivational regulations (i.e., external and introjected regulations) and autonomous forms of motivational regulations (i.e., identified and integrated regulations). External regulation represents the role of external rewards on an individual's behavior (e.g., winning a reward or someone's approval). Introjected regulation represents motives that aim at preventing negative emotional states for not engaging in the behavior (e.g., guilt, shame). The first form of autonomous regulation in the continuum is identified regulation, which embodies the motives for participation in an activity that are highly valued due to its effects on health and fitness. Lastly, integrated regulation typifies engagement in behaviors that are broadly in line with an individual's overarching goals, needs, and values.⁹ In this case, specific behaviors are part of a larger set of integrated behaviors that represent a way of life (e.g., healthy lifestyles that may include good nutrition, PA, and appropriate sleeping patterns). Autonomous or self-determined forms of motivational regulations are associated with more adaptive behavioral patterns characterized by increased effort and persistence compared to controlling of less self-determined forms of behavioral regulations.⁷ Intrinsic motivation constitutes the most self-determined form of behavioral regulations as individuals engage in exercise due to the enjoyment they derive from it. Thus, high self-determined regulations have the potential to promote positive affective responses, such as enjoyment, which influences well-being.¹⁰

The Physical Activity Enjoyment Scale (PACES)¹¹ was originally an 18-item scale developed to assess PA enjoyment in young adults. Further efforts were made to validate this instrument in a variety of populations, notably children,¹² adolescent girls,¹³ and older adolescents.¹⁴ More recently, Mullen et al.¹⁵ validated an 8-item version among a sample of older adults involved in a yearlong exercise program. Still, the measurement properties of the PACES within fitness groups are unknown. This is unfortunate because PACES might be particularly useful to evaluate enjoyment as a predictor of greater adherence to group exercise programs or a consequence of involvement in such programs.¹⁶ Considering the significance of the development of a valid instrument to measure enjoyment in fitness groups, we recognize the good psychometric qualities of the 8-item version of PACES that resulted from the analysis by Mullen et al.¹⁵ of the original instrument. Thus, we aim to translate, adapt, and validate a Portuguese version of the 8-item PACES¹⁵ that can be administered to participants in fitness classes.

The purpose of the present study was to translate and adapt the 8-item version of the PACES¹⁵ to the Portuguese language and test its validity and reliability in a sample of fitness group exercisers. First, we report the translation and adaptation of the 8 statements included in the PACES by expert review and evaluate its factorial structure using exploratory factor analysis (EFA). Second, we propose to test the validity and reliability of the factor structure obtained in EFA. Third, we test the degree to which the measurement model is invariant across 2

independent samples and across gender. Fourth, we assess the construct validity of the adapted PACES by exploring its associations with exercise behavior regulations as defined by SDT. Hence, we expect to observe negative correlations between enjoyment and less self-determined form of behavioral regulations, and positive correlations between enjoyment and more self-determined forms of behavioral regulation. Finally, we expect to find significant correlations between enjoyment and frequency of participation in fitness group classes per week and length (in months) of exercise participation.

2. Methods

2.1. Participants

In the present paper, data analyses were based on 2 independent samples composed by participants recruited from 6 health clubs situated in the central coastal region of Portugal. The first sample was recruited for the EFA. It consisted of 139 (74 females and 65 males) exercisers of fitness group classes, aged between 18 and 52 years (30.21 ± 8.25 , mean \pm SD). Participants had completed their undergraduate degree (39.2%), secondary education (36.8%), master degree (12.8%), and high school education (11.2%). On average, participants had 3.9 years of experience in fitness group classes (e.g., body combat, body pump, cross fit, cycling, Pilates, power jump, Zumba) and practiced for approximately 3.5 h/week.

The second sample was utilized for the confirmatory factor analysis (CFA), measurement invariance testing, and construct validity estimation. It consisted of 256 participants (151 females and 105 males) aged between 18 and 66 years old (31.59 ± 9.21). Concerning education levels, 42.6% had completed undergraduate degree, 38.3% completed secondary education, 12.3% master degree, 5.1% high school education, and 1.7% doctoral degree. On average, study participants had 3.04 years of experience in fitness group classes (e.g., body combat, body pump, body jam, circuit training, cycling, cross fit, running, Zumba) and practiced for approximately 3.2 h/week.

2.2. Procedures

Ethical approval was granted by the Scientific Committee of the Polytechnic Institute of Maia Research Centre. After, managers from 6 fitness centers were contacted to inform them about the study and to give researchers permission to conduct research in their fitness centers. All the managers approved having their clients contacted to request participation in the study. Initially, participants' written informed consent was obtained. Participants were informed that the survey was voluntary and that they had the right to end the participation from the study at any point of time and without any reason. Participants were guaranteed that all the information would remain confidential and anonymous. It was further explained that their fitness instructors did not have the opportunity to access their responses.

2.3. Measures

2.3.1. Preliminary version of the Portuguese 8-item PACES

All statements of PACES¹⁵ were adapted using a 2-stage process. First, a bilingual speaker translated the scale into Portuguese. Next, a second translator independently translated the Portuguese version back to the original.¹⁷ The first author followed the translation and back-translation processes to assure the translation's conceptual validity. Second, the translated items were reviewed by a panel of experts.¹⁸ The panel consisted of 2 exercise psychologists and 1 fitness instructor with experience in conducting research in the fitness area. Each member of the panel received an e-mail containing the purpose of this study, a description of the procedures, and the list of the proposed 8 items. Panel members provided feedback about the items included in the translated version of the questionnaire, and no changes were noted. The final version was the 8-item translated version of the PACES¹⁵ in Portuguese.

2.3.2. Enjoyment

Respondents were questioned to rate "how you feel at the moment about the physical activity you have been doing" using a 7-point Likert scale (1 = *unpleasurable*; 7 = *pleasurable*). Two items are reverse-coded. The sum of all the items form a unidimensional measure of enjoyment. Higher values reflect greater levels of enjoyment.

2.3.3. Self-regulation of exercise behavior

We evaluated exercisers' self-regulation behavior using the Portuguese version of the revised Behavioral Regulation in Exercise Questionnaire adapted to gym and health club members (BREQ-2^{19,20}). The BREQ-2 consists of 18 items grouped into 5 domains of self-regulated behavior (amotivation, external, introjected, identified, and intrinsic regulation) representing the motivational continuum of the SDT.⁸ Responses were scored on a 5-point scale (0 = *strongly disagree* to 4 = *strongly agree*). The composite reliability (CR) estimates for 2 factors in the present study were lower than 0.70; identified and introjected regulation factors had CR estimates of 0.43 and 0.61, respectively. Therefore, these factors were excluded from further analysis.

2.3.4. Self-reported exercise behavior

Participants were asked to indicate how many times per week they exercised in fitness group classes and how long (in months) they regularly engaged in fitness activities.

2.4. Data analysis

2.4.1. EFA

EFA is important in the early stages of scale development to avoid incorrect factor specification.²¹ Thus, the factorial structure of the preliminary version of the Portuguese 8-item PACES was evaluated using EFA. The EFA was conducted using principal component analysis with oblique rotation in SPSS Version 23.0 (IBM Corp., Armonk, NY, USA). The determination of the number of factors was based on

eigenvalues higher than 1.0. In terms of items individual reliability, factor loadings higher than 0.40 were considered acceptable.²² CR was chosen instead of the commonly used Cronbach α as Raykov²³ criticized the latter for representing a criterion that underestimates the scale reliability. It is recommended that the CR should be equal to or greater than 0.70.²²

2.4.2. CFA

A CFA was conducted using AMOS Version 23.0 (IBM Corp.) with maximum likelihood estimation. The quality of the model was assessed through a variety of goodness-of-fit indexes. The χ^2 statistic assessed the absolute fit of the model to the data. We used as guidance the following cutoff values recommended by Hair et al.:²² comparative fit index (CFI) and Tucker-Lewis index (TLI) > 0.90, root-mean-square error of approximation (RMSEA) < 0.06, and standardized root-mean-square residual (SRMR) < 0.08. Internal consistency was assessed through CR.²²

2.4.3. Measurement invariance

A multi-group CFA was performed to test the models' invariance. Invariance between models was evaluated considering χ^2 tests of significance and CFI difference (ΔCFI) values.²⁴ If χ^2 for model comparison is not statistical significant ($p > 0.05$), then the hypotheses of invariance is retained; however, because χ^2 is influenced by sample size, Cheung and Rensvold²⁴ proposed using changes in the ΔCFI of greater than 0.01 as an alternate criterion for assessing measurement invariance. Finally, we successively tested a series of nested models in the following order: unconstrained model (Model 1), constrained factor loadings (Model 2), and constrained factor variances-covariances (Model 3).

3. Results

3.1. The factor structure of the PACES in EFA

Preliminary inspection of the data revealed that there were no missing values, but 6 cases appeared as univariate outliers ($z > 3.00$). These participants were removed prior to conducting any further analysis. Item-level descriptive statistics indicated no deviations from univariate normality (skewness values ranged from -0.14 to 0.29; kurtosis values ranged from -1.21 to 0.75).²²

Results demonstrated preliminary support for the unidimensional structure of the scale validated by Mullen et al.¹⁵ An examination of the scree plot displayed 1 factor with an eigenvalue of 6.05 explaining 75.72% of the variance. Factor loadings ranged from 0.79 to 0.89 (Table 1). The CR estimate was 0.91, revealing good internal consistency.²²

3.2. Factorial validity of the PACES in CFA and internal consistency

The 8-item unidimensional structure of the PACES was examined via CFA. Examination of Mardia's coefficient (14.01, $p < 0.001$) indicated that the data departed from multivariate normality.²⁵ Therefore, Bollen-Stine bootstrap on 2000

Table 1
Means, standard deviations, and standardized factor loadings.

Items	EFA (Sample 1)			CFA (Sample 2)			
	<i>M</i>	<i>SD</i>	<i>FL</i>	<i>M</i>	<i>SD</i>	<i>FL</i>	<i>SE</i>
I find it pleasurable; I find it unpleasurable	5.01	1.32	0.790	4.88	1.45	0.821	–
It's no fun at all; It's a lot of fun	5.16	1.20	0.887	5.23	1.24	0.878	00.085
It's very pleasant; It's very unpleasant	5.17	1.13	0.882	5.27	1.28	0.822	00.080
It's very invigorating; It's not at all invigorating	5.11	1.26	0.878	5.11	1.17	0.830	00.087
It's very gratifying; It's not at all gratifying	5.12	1.27	0.863	5.24	1.12	0.840	00.090
It's very exhilarating; It's not at all exhilarating	5.30	1.25	0.863	5.32	1.22	0.872	00.083
It's not at all stimulating; It's very stimulating	5.10	1.36	0.858	5.15	1.24	0.895	00.085
It's very refreshing; It's not at all refreshing	5.25	1.17	0.812	5.27	1.25	0.852	00.082

Abbreviations: CFA = confirmatory factor analysis; EFA = exploratory factor analysis; FL = factor load; M = mean; SD = standard deviation; SE = standard error.

samples was employed for subsequent analysis.²⁶ The model displayed an acceptable fit to the data ($\chi^2(20)=80.18$, B-S $p < 0.001$, $CFI=0.966$, $TLI=0.952$, $RMSEA=0.087$, $CI: 0.086-0.098$, $SRMR=0.028$) and the scale demonstrated good internal consistency, with a CR value of 0.94. In addition, standardized factor loadings were all significant and greater than 0.82 (Table 1). These findings confirmed the accuracy of the unidimensional structure and internal consistency of the Portuguese version of the 8-item form of PACES.

3.3. Measurement invariance across samples

A multi-group CFA was performed to examine invariance across samples. The fit of the unconstrained (Model 1: $\chi^2(40)=194.78$, B-S $p < 0.001$, $TLI=0.924$, $CFI=0.946$, $RMSEA=0.09$), constrained factor loadings (Model 2: $\chi^2(47)=200.28$, B-S $p < 0.001$, $TLI=0.936$, $CFI=0.946$, $RMSEA=0.091$), and constrained factor variances-covariances (Model 3: $\chi^2(48)=200.30$, B-S $p < 0.000$, $TLI=0.938$, $CFI=0.947$, $RMSEA=0.090$) models were acceptable. The chi-square difference tests ($\Delta\chi^2$) and ΔCFI did not show significant differences between Model 1 and Model 2 ($\Delta\chi^2(7)=5.49$; $p=0.600$; $\Delta CFI \leq 0.01$) or Model 1 and Model 3 ($\Delta\chi^2(8)=5.51$; $p=0.701$; $\Delta CFI \leq 0.01$). Thus, results support the model's invariance in both samples indicating that the factorial structure is stable in 2 independent samples.

3.4. Measurement invariance across gender

A multi-group CFA was conducted comparing female ($n=225$) and male ($n=170$) participants. The unconstrained model (Model 1: $\chi^2(40)=185.30$, B-S $p < 0.001$, $TLI=0.919$, $CFI=0.942$, $RMSEA=0.101$), as well as the models with constrained factor loadings (Model 2: $\chi^2(47)=195.28$, B-S $p < 0.001$, $TLI=0.930$, $CFI=0.941$, $RMSEA=0.094$), and constrained variances-covariances (Model 3: $\chi^2(48)=195.34$, B-S $p < 0.001$, $TLI=0.931$, $CFI=0.941$, $RMSEA=0.093$) showed satisfactory fit. The χ^2 tests and ΔCFI did not show significant differences when comparing Models 1 and 2 ($\Delta\chi^2(7)=9.97$, $p=0.190$, $\Delta CFI \leq 0.01$), as well as Models 1 and 3 ($\Delta\chi^2(8)=10.03$, $p=0.263$, $\Delta CFI \leq 0.01$). These results provided support for the utility of the hypothesized model across participants' gender.²⁵

Table 2

Squared correlations among PACES, exercise frequency, and self-regulation of exercise behaviors.

	1	2	3	4	5
1.PACES	–				
2.External regulation	–0.55**	–			
3.Intrinsic regulation	0.56**	–0.63**	–		
4.Amotivation	–0.41**	0.46**	–0.60**	–	
5.Length of participation (in months)	0.27**	–0.33**	0.31**	–0.31**	–
6.Weekly participation (sessions)	–0.12*	0.02	0.00	–0.11*	–0.01

* $p < 0.05$,

** $p < 0.01$.

Abbreviation: PACES = Physical Activity Enjoyment Scale.

3.5. Construct validity

Construct validity was examined by assessing the relationships between enjoyment, exercise frequency, and factors associated with self-regulation of exercise behavior, such as amotivation, external, and intrinsic regulations. According to SDT,⁷ perceived enjoyment should be related with more autonomous self-regulation of exercise behavior. Moderate positive correlation between enjoyment and intrinsic regulation, and moderate negative correlations between enjoyment and external regulation and amotivation, were evidenced in this study. Additionally, enjoyment was positively correlated with the total number of months exercising, while a negative relationship emerged with the frequency of fitness group classes per week. Overall, these results provided support for the convergent and divergent validity of the PACES. Table 2 shows the descriptive statistics and correlations among enjoyment and exercise frequency, amotivation, external, and intrinsic self-regulation of exercise behavior.

4. Discussion

To date, no scale has been validated to assess perceived enjoyment in adults' fitness group classes in the Portuguese language. The purpose of the present paper was to validate a Portuguese translation and adaptation of the 8-item version of PACES¹⁵ and, in particular, to assess the validity and reliability of this scale. As expected, results indicate satisfactory psychometric properties. Specifically, exploratory and confirmatory factor analyses supported the unidimensional structure

of PACES. Moreover, consistent with other validation studies,^{12–15} support was obtained for the internal consistency, measurement invariance between the 2 samples, and as well as cross-validated for the first time to the Portuguese.

In line with predictions based on SDT,⁷ the convergent validity of the scale was supported by the correlations detected between the PACES and exercise-related behavioral regulations as defined by the model. Based on this model, enjoyment represents a psychological variable that should be positively related with self-determined forms of motivation and negatively related with less self-determined forms of motivation. Overall, the pattern of correlations supports these hypotheses. Findings indicate moderate positive relationships between more self-determined forms of behavioral regulations, such as identified regulation and intrinsic motivation and enjoyment, and moderate negative relationships between external regulation and enjoyment. The findings of the present study are in line with previous studies on the facilitative role of autonomously self-regulated behavior in enjoyment in exercise.¹⁰

Further, results showed a positive relationship between enjoyment with the total number of months individuals exercise, and a negative relationship with the frequency of participation in fitness group classes per week. In line with SDT,⁷ exercisers with high forms of autonomous motivation are expected to maintain exercise participation for a long period.²⁷ However, the negative relationship between enjoyment and the frequency of strenuous exercise per week in fitness group classes observed in the current study indicates that this type of activity may weaken participants' enjoyment, if practiced many times per week. This finding supports previous research indicating that enjoyment responses decrease with high-intensity continuous exercise in comparison with moderate-intensity continuous exercise and high-intensity interval exercise.²⁸ In addition, Greene and Petruzzello²⁹ discussed that individuals tend to experience more positive affective responses to aerobic exercise at intensities below the ventilatory threshold and that these results were replicated in resistance training. Nevertheless, it is unclear how these experiences relate to long-term exercise adherence. Therefore, more research is needed to understand the association between enjoyment and the type of fitness group classes. For example, it would be valuable to explore whether different motivational regulations or the pursuit of basic psychological needs underlie participation in different types (or intensities) of exercise programs.

While the present results support the psychometric properties of the PACES, its validation process requires additional testing. First, similar to the study by Mullen et al.,¹⁵ which examined longitudinal invariance of the PACES in a sample of community-dwelling older adults, future studies should examine the longitudinal stability of the scale across time-frames (e.g., 3, 6, 12 months) with this population of fitness exercisers. Second, no version of the PACES has been tested for predictive validity. Thus, research is required to examine predictive relationships between enjoyment and PA outcomes. Third, cross-cultural validity of the Portuguese scale could be investigated by examining whether measurement invariance of

the PACES will be observed across samples of exercise participants in different countries through multi-group CFA.³⁰ Fourth, it is essential to establish whether the PACES needs to be adapted to other fitness settings, such as strength and physical conditioning classes. Finally, researchers could assess the extent to which enjoyment from different PA programs influence exercise adoption and adherence (e.g., studies by Banville et al.¹⁷ and Dunton and Vaughan³¹) to support the development of effective practice strategies.

5. Conclusion

Notably, results of this study provide support for the validation of a measure of enjoyment in fitness exercisers' population that is invariant across samples and gender, and shows convergent and divergent validity with a measure of self-regulation of exercise behavior. The 8-item version of PACES¹⁵ is particularly promising in applied settings where time constraints make the use of long forms of measurement less feasible or in studies designed to test multiple hypotheses with the same sample, which reduces participant time requirements.

Authors' contributions

PT and LC participated in the design, data collection and analysis, and writing of the manuscript; CS and CB participated in study design, data collection and drafted the manuscript. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

Competing interests

The authors declare that they have no competing interests.

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