The Behavioral Regulation in Exercise Questionnaire (BREQ-3) Portuguese-Version: Evidence of Reliability, Validity and Invariance Across Gender

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INTRODUCTION

Several mainstream theories have been used to study motivational processes in different contexts. Self-Determination Theory (SDT: Deci and Ryan, 2000) has been widely used to study participant’s motivation to exercise (Markland and Tobin, 2010; Ng et al., 2012). The authors of SDT postulate that two types of motivation influence personal behavior: the intrinsic motivation (doing a task for the inherent pleasure) and extrinsic motivation (doing an activity for instrumental reasons, often for external rewards like praise or grades). SDT emphasizes the importance of the environment in determining the type of motivation individuals experience. To support this, they developed the Behavioral Regulation in Exercise Questionnaire (BREQ-3) to measure the different types of motivation in the exercise domain. This tool assesses the regulation of exercise by measuring the level of intrinsic (inherent pleasure) and extrinsic motivation (instrumental reasons). The BREQ-3 has been validated in several languages, including Portuguese, with male and female samples. However, the study by Cid et al. (2018) aimed to analyze the psychometric properties of the BREQ-3 in a Portuguese sample and across gender, to ensure its validity and reliability in this context.
obtaining separable outcomes or to avoid disapproval) (Sebire et al., 2009; Ryan and Deci, 2017). The extrinsically motivated behaviors are expressed in four regulations: external regulation (influenced by external contingencies), introjected regulation (performing to obtain social approval or avoiding internal pressure), identified regulation (recognition and acceptance of the behavior) and the integrated regulation (accepting and integrating behavior in others aspects of the self) (Deci and Ryan, 2000). In SDT, these regulatory mechanisms indicate degrees of behavior internalization, reflecting the transitioning of habits and requests into endorsed values and self-regulations. This presents as particularly important in the study of exercise behavior. As this process is progressively successful, exercisers may vary between controlled (extrinsic and introjected regulations) to autonomous motivation (identified and integrated regulations) (Deci and Ryan, 2000). The latter represent well-internalized extrinsic motivation, which alongside with intrinsic motivation, have been highlighted as important factors in continuous exercise adherence (Ryan and Deci, 2017).

Several instruments have been developed to measure these essential variables in different domains. The Behavioural Regulation in Exercise Questionnaire (BREQ) proposed by Mullan et al. (1997) was a first attempt to develop an instrument capable of tapping behavioral regulation according to SDT in the exercise domain. Limitations in accessing the full spectrum of behavioral regulations, particularly in the amotivation factor, led to the inclusion of four new items to surpass this limitation (Markland and Tobin, 2004). This new measure was called BREQ-2 and has become one of the most widely use instruments in exercise motivation studies. This questionnaire is composed of a 19-item scale with five factors (amotivation, external, introjected, identified and intrinsic motivation) and have been validated with a sample of 201 exercisers. Both factor structure and internal consistency presented reasonable scores.

In Portugal, BREQ-2 was translated and validated in a sample of 703 Portuguese exercisers, presenting good model fit and internal consistency (Palmeira et al., 2007), maintaining itself as one of the main instruments used in the analysis of behavioral regulations in this particular domain. A few years later, Cid et al. (2012) tested psychometric properties and also a hierarchical model that includes two second-order factors that represent an index of autonomous and controlled motivation in a sample of 550 Portuguese gym and health club exercisers. The results supported the use of Portuguese BREQ-2 in exercise for the evaluation of behavioral regulation underlying SDT, as well as for the assessment of autonomous (intrinsic and identified) and controlled (external and introjected) motivation.

However, one of the main issues regarding BREQ-2 was the inability to access one of the SDT proposed behavioral regulations (integrated regulation). For this matter, Wilson et al. (2006) suggested the inclusion of the integrate subscale in BREQ-2, allowing the complete analysis of the behavioral regulations proposed by SDT framework. The integrated subscale (reflecting personal endorsed values, goals and needs) is the most autonomous form of extrinsic motivation, reflecting congruence between behavior regulation and the self (Deci and Ryan, 2000; Wilson et al., 2006). The implications of the analysis of this regulation seems undisputable, as it allows a better and refined understating of the extrinsically motivated exercisers (particularly in the gap between accepting the behavior and obtaining a separable and pleasurable outcome), and the ability to capture SDT’s motivational continuum in exercise.

Therefore, the analysis of the feasibility of extending the BREQ-2 and its application in the Portuguese exercise domain determines its two main objectives: (1) to validate the Behavioral Regulation Exercise Questionnaire (BREQ-3) in a Portuguese sample of gym exercisers and (2) to analyze model invariance across gender.

### MATERIALS AND METHODS

#### Participants

Two independent samples of gym exercisers were enrolled in this study from several types of fitness activities provided in gym, such as: weight training, group activities (e.g., indoor cycling, aerobic, step, pump, combat), cardio-fitness activities (i.e., combined strength training and aerobic activities), and water activities. With an average age of 40.29 (SD = 16.24) years old in both samples, the years of practice ranged between 0.3 and 25 years (M = 7.34; SD = 7.25), with an average of 2.8 sessions per week (SD = 1.03) and exercise sessions ranged between 60 and 180 min per session. The first sample consisted of 448 subjects and reflected the calibration sample; the second sample consisted of 374 subjects and reflected the validation sample, to prove the robustness of the measurement instrument in a different sample with the same characteristics. The samples are characterized as follows: (a) calibration sample: this sample was composed of 448 exercisers enrolled in several activities (266 female; 182 male) aged between 16 and 78 years old (M = 39.96; SD = 16.25); (b) validation sample: this sample was composed of 374 exercisers enrolled in several activities (229 female; 145 male), aged between 17 and 77 years old (M = 40.51; SD = 16.07); (c) male sample: this sample consisted of 327 exercisers of different activities, aged between 16 and 78 years (M = 38.60; SD = 15.92); (d) female sample: this sample consisted of 495 exercisers of different activities, aged between 16 and 77 years (M = 41.27 and 16.74, respectively). Before data collection, Ethical approval was obtained from the committee of the Research Center in Sports Sciences, Health Sciences and Human Development (CIDESD), unit that is registered in the Portuguese National Science Foundation (FCT) under the reference UID/DTP/04045/2013.

#### Measures

The Behavioral Regulation Exercise Scale (BREQ-2: Markland and Tobin, 2004). For this study, we used the Portuguese version of BREQ-2, translated and preliminarily validated by Palmeira et al. (2007) and validated by Cid et al. (2012), to include an integrated regulation scale (Wilson et al., 2006). This questionnaire (BREQ-3) consisted of 24 items1 with a five-point

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1 19 items of BREQ-2 (Markland and Tobin, 2004), four items of integrated regulation scale (Wilson et al., 2006), and one new item of introjected regulation...
Likert scale, which varied between 1 (“Strongly Disagree”) and 4 (“Strongly Agree”). The items were grouped posteriorly into six factors (with four items each), which reflected the motivational continuum of SDT (Deci and Ryan, 2000).

**Procedures: Data Collection**

Permission to collect information at gyms was given by the administrators. The researchers approached randomly selected prospective participants in the reception area before exercise sessions and at the end of the day when most individuals frequented the gyms. All participants provided signed informed consent. Confidentiality were granted and assured, clarifying that the information would not be released to third parties. After a short explanation of the study general objective, the assessment instrument was applied separately to each participant, which took approximately 15 min.

**Procedures: Translation of the Integrated Regulation Subscale**

For the translation and adaptation of the four item integrated subscale (Wilson et al., 2006) from the original language (English) to the Portuguese language, we adopted methodological procedures suggested by Vallerand (1989). However, instead the translation/back translation technique proposed by Vallerand (1989) was used the committee approach methodology (Brislin, 1980), developed in five stages.

**Data Analysis**

The analysis was performed using a Confirmatory Factor Analysis (CFA) according to the recommendations of several authors (Marsh et al., 2004; Byrne, 2010; Hair et al., 2014), using as method of estimation the maximum likelihood (MLE) through chi-square test (\(\chi^2\)), degrees of freedom (df) and significance levels (p), and also the following goodness-of-fit indices: standardized root mean square residual (SRMR), comparative fit index (CFI), non-normed fit index (NNFI), root mean square error of approximation (RMSEA) and respective confidence interval (RMSEA 90% CI). In the present study, and for the aforementioned indices, the following cut-off values were adopted: SRMR \(\leq 0.08\), CFI and NNFI \(\geq 0.90\), and RMSEA \(\leq 0.08\) (Marsh et al., 2004; Byrne, 2010; Hair et al., 2014). Analyses were carried out using AMOS 20.0 software.

Convergent validity was analyzed via the calculation of the average variance extracted (AVE), considering values of AVE \(\geq 0.50\). Discriminant validity was also analyzed and was establish when the AVE for each construct exceeded the squared correlation between that construct and any other. Finally, composite reliability (CR) was analyzed and adopted CR \(\geq 0.70\) as a cut-off values, as suggested by Hair et al. (2014). Convergent validity was analyzed via the calculation of the AVE, considering values of AVE \(\geq 0.50\).

Additionally, the multi-group analysis was conducted to assess whether the measurement model structure was equivalent in different groups with different characteristics (calibration vs. validation samples and male vs. female samples). Thus, the following criteria were established for the invariance of the models: (Cheung and Rensvold, 2002; Byrne, 2010): (1) a factorial model analysis for each group individually and (2) a multi-group analysis by restricting the model parameters, considering the following types of invariance: the free parameters model (configural invariance), the fixed factorial measurement model (measurement invariance), the fixed factorial and covariance measurement model (scale-invariance) and the fixed factorial, covariance and error measurement model (residual invariance).

According to Marsh (1993), when analyzing models with this procedure, the measurement invariance is considered a minimal criterion for the invariance of the model, and the residual invariance (last criterion) is not suggestive of a lack of model invariance. Some authors even considered that the analysis of this criterion was infrequent due to it being too restrictive (Byrne, 2010). As suggested by Cheung and Rensvold (2002), the difference in values between the unrestricted and the restricted model (i.e., free parameters vs. fixed parameters) should be \(\Delta\text{CFI} \leq 0.01\).

**RESULTS**

A preliminary analysis of the data revealed 10 missing value cases. These participants were removed prior to conducting the analysis, as advocated by several authors (Hair et al., 2014). As presented in Table 1, individuals that used all answer levels (from 0 to 4) had higher means associated with items related to identified and integrated regulation and intrinsic motivation subscales. These answers also depicted a non-normal univariate distribution of the data, which presented a bias to the left, and could be explained by the tendency for the individuals to use the highest levels of an answer (i.e., three and four) in this kind of questionnaire.

Moreover, Mardia’s coefficient for multivariate kurtosis exceeded expected values multivariate normality assumption (> 5.0) in all samples (Byrne, 2010). As suggested in literature, Bollen-Stine bootstrap with 2000 samples was employed for subsequent analysis (Nevitt and Hancock, 2001).

As seen in Table 2, the initial model (six factors and 24 items – Figure 1) did not fit to the data. Potential issues were sought through the analysis of the residual values between the items and the modification indices, obtaining a better adjusted model with six items removal (one for each factor), after which the model’s adjustment indices improved slightly (Table 2). After this procedure, the measurement model fit to the data, being in agreement with the cut-off values suggested in the methodology for each of the analyzed samples.
According to the results presented in Figure 2 (calibration sample final model) and Figure 3 (validation sample final model), we verify in the first place that the correlation patterns between the different types of motivation evidence a simplex structure. In other words, the regulation types closer through the continuum varied from 0.62 to 0.74 (amotivation); 0.68 to 0.73 (external regulation); 0.63 to 0.78 (introjected regulation); 0.54 to 0.84 (identified regulation); 0.64 to 0.77 (integrated regulation); and 0.61 to 0.70 (intrinsic motivation). For the validation sample final model (six factors and 18 items - Figure 3), the factorial weights varied from 0.50 to 0.78 (amotivation); 0.68 to 0.82 (external regulation); 0.63 to 0.78 (introjected regulation); 0.62 to 0.78 (identified regulation); 0.64 to 0.78 (integrated regulation); and 0.61 to 0.70 (intrinsic motivation). For the validation sample final model (six factors and 18 items - Figure 3), the factorial weights varied from 0.50 to 0.78 (amotivation); 0.68 to 0.82 (external regulation); 0.63 to 0.78 (introjected regulation); 0.62 to 0.78 (identified regulation); 0.64 to 0.78 (integrated regulation); and 0.61 to 0.70 (intrinsic motivation). For the validation sample final model (six factors and 18 items - Figure 3), the factorial weights varied from 0.50 to 0.78 (amotivation); 0.68 to 0.82 (external regulation); 0.63 to 0.78 (introjected regulation); 0.62 to 0.78 (identified regulation); 0.64 to 0.78 (integrated regulation); and 0.61 to 0.70 (intrinsic motivation). For the validation sample final model (six factors and 18 items - Figure 3), the factorial weights varied from 0.50 to 0.78 (amotivation); 0.68 to 0.82 (external regulation); 0.63 to 0.78 (introjected regulation); 0.62 to 0.78 (identified regulation); 0.64 to 0.78 (integrated regulation); and 0.61 to 0.70 (intrinsic motivation).
0.70 to 0.71 (intrinsic motivation). Furthermore, more than 25% of the variance of the latent factor were explained by all items, a value commonly accepted (Hair et al., 2014).

According to Table 3, all the factors underlying the measurement model presented an adjusted composite reliability (≥0.70) in both calibration and validation samples. Regarding the convergent validity, minor issues were found in the calibration (amotivation, external and introjected regulations and intrinsic motivation factors) and validation samples (i.e., amotivation and intrinsic motivation factors), because the values of AVE were inferior to the value adopted in the methodology (Hair et al., 2014). In respect to the discriminant validity, issues between AM-EX, ID-IG, and ID-IM for the calibration sample and between AM-EX, ID-INTG, ID-MI, and IG-MI for the validation sample were found, because the square of the factor’s correlation between these factors were higher than the AVE (Hair et al., 2014).

The data from Table 4 indicates that the model was invariant across samples (showing evidences of cross-validation) and gender (the final model is equivalent across male and female samples). The results also indicate the following: the same number of factors was present in all groups, with each factor associated with the same group of items (measurement invariance); BREQ-3 factors had the same meaning for both groups (metric invariance); the comparison of the latent and observable means was valid among the groups (scale invariance); and comparison between observable items is assured (residual invariance).

DISCUSSION

Taking into account the study objective, the validation of the Portuguese version of BREQ-3 in a sample of exercisers, as well as evidence of criteria of cross-validity between samples and invariance between gender, increases the scientific evidence contributing to what (Deci and Ryan, 2008) designated as the “development of knowledge about the universality of the variables underlying the theory of self-determination,” that in this case, refers to the regulation of motivation in the exercise domain.
In the descriptive analysis, the results show that the participants tend to value the items of the questionnaire, which in fact seems to be demonstrated by the moderate and high averages in all of them; thus, evidencing the theoretical importance underlying the motivational continuum of the SDT. These results are in line with BREQ validations in other languages (Markland and Tobin, 2004; González-Cutre et al., 2010; Moustaka et al., 2010; Cid et al., 2012; Guedes and Sofiati, 2015; Liu et al., 2015).

Regarding the psychometric properties of BREQ-3 for a sample of Portuguese exercisers, the results showed that the initially hypothesized model (six factors and 24 items) did not fit the data according to the values adopted in the methodology (Marsh et al., 2004; Byrne, 2010; Hair et al., 2014). Bearing this in mind, individual parameters were analyzed, based on residual values and modification indices of the Lagrange test, and items 1 (amotivation – “I don’t see why I should have to exercise”), 2 (external regulation – “I exercise because other people say I should”), 6 (intrinsic motivation – “I exercise because it’s fun”), 9 (introjected regulation – “I feel ashamed when I miss an exercise session”), 11 (integrated regulation – “I consider exercise to be part of my identity”) and 22’ (identified regulation – “I value exercise and I get restless if I don’t exercise regularly”) were removed due to: (1) standardized residual matrix showed high residual values between mentioned items and other types of behavior regulations items, and (2) modification indices found cross-loadings between mentioned items and other factors.

Comparing the results of the present study with the results of other BREQ3 versions, we verified that there is some contradiction regarding the final structure of the measurement model. In the Portuguese version of BREQ3, the model only adjusted to the data after the elimination of some items, which did not happen in the Spanish and Brazilian versions. The Spanish version of BREQ3 (González-Cutre et al., 2010) used a sample that includes practitioners from different exercise contexts, being slightly different from the one used in the present study, which may explain some differences found in the initial model adjustment. The Brazilian version of BREQ3 (Guedes and Sofiati, 2015), whose content of the items in the questionnaire is very close to those of the Portuguese version, used a sample very similar to the one used in the present study, and the original model fit the data. However, it is interesting to note that the Brazilian version of the BREQ2 (Klaine et al., 2015), also validated in a sample of gym exercisers, only adjusted to the data after the elimination of two items (one of intrinsic motivation and one of identified regulation), suggesting inconsistencies in some items. Similar results were found in a recent study carried out with a sample of patients diagnosed with schizophrenia (Costa et al., 2017), who identified problems in the Portuguese version of BREQ-3 structure (i.e., cross-loading between some items of controlled and autonomous motivation, particularly, in introjected and identified regulations), which highlights the need to further develop studies than can improve and refine the use of this scale.

In sum, the items mentioned above are the ones that showed higher fragilities, which led to their elimination. After this procedure, the final model (six factors and 18 items) fitted the data, in all samples according to the values adopted (Marsh et al., 2004; Byrne, 2010; Hair et al., 2014).

Taking into account previous studies performed with the Portuguese version of BREQ-2, we can verify that item 1 (amotivation) and item 6 (intrinsic motivation) had a lower factorial weight in the study done by Cid et al. (2012), and item 9 (introjected regulation) had a lower factorial weight in the preliminary study (Palmeira et al., 2007).

However, the greatest weaknesses were found with item 22 (identified regulation) (corresponding to item 17 of BREQ-2). This item proved to be more inconsistent (because it was not associated with the factor for which it was supposed to be associated), either in the original version (Markland and Tobin, 2004) or in the Portuguese version (Cid et al., 2012), as well as in the Spanish version (Moreno-Murcia et al., 2007; González-Cutre et al., 2010), in the Greek version (Moustaka et al., 2010) and in the Chinese version (Liu et al., 2015). In fact, this fragility led to

2New item of identified regulation developed to address the problems found with original item: “I get restless if I don’t exercise regularly.”
pressures and to avoid feelings of guilt and/or anxiety) than to the individual engages in the activity due to internal pressures and to avoid feelings of guilt and/or anxiety) than to

Because I get restless if I

2017), the description in item 22 ("Because I get restless if I don't exercise regularly") is closer to the introjected regulation factor, and the model adjusted to the data. This was also the strategy used in the present study, which obtained the same result regarding this item. In fact, results tend to suggest that individuals may have understood this item as referring to introjected rather than identified motivation. Accordingly with some definitions found in literature, (Ryan and Connell, 1989; Deci and Ryan, 2000; Ryan and Deci, 2017), the description in item 22 (“Because I get restless if I don’t exercise regularly”) is closer to the introjected regulation definition (the individual engages in the activity due to internal pressures and to avoid feelings of guilt and/or anxiety) than to identified regulation (although not enjoying the activity itself, the individual values the activity as personally important and inherently valuable).

The results also showed that the questionnaire presents good psychometric qualities, which according to Hair et al. (2014) relates mainly to construct validity, because a set of items reflects the latent theoretical constructs expected to be measured. As far as reliability, all factors showed good internal consistency, with values of composite reliability ≥ 0.70 (Hair et al., 2014). Nevertheless, the questionnaire revealed small problems of convergent validity (values close to the cut-off value) in the amotivation factor, external regulation and introjected and intrinsic motivation factors in the calibration sample. However, the validation sample only revealed problems in the amotivation and intrinsic motivation factors, since stroke values were lower than the recommended value adopted in the methodology (AVE ≤ 0.50) (as suggested by some authors, e.g., Hair et al., 2014), although all factorial weights of this construct are equal to or greater than 0.54 (calibration sample) and 0.50 (validation sample) and all are statistically significant (p ≤ 0.05). These results are in line with the Brazilian

| TABLE 3 | Internal reliability, convergent and discriminant validity, and average variance extracted of calibration and validation samples. |
| CR | AVE | AM | EX | IJ | ID | IG | IM |
| --- | --- | -- | -- | -- | -- | -- | -- |
| **Calibration sample** | | | | | | | |
| Amotivation (AM) | 0.72 | 0.47 | 1 | 0.89 | 0.04 | 0.05 | 0.00 | 0.04 |
| External (EX) | 0.74 | 0.49 | – | 1 | 0.04 | 0.04 | 0.00 | 0.04 |
| Introjected (IJ) | 0.73 | 0.48 | – | – | 1 | 0.38 | 0.40 | 0.16 |
| Identified (ID) | 0.77 | 0.52 | – | – | – | 1 | 0.53 | 0.58 |
| Integrated (IG) | 0.75 | 0.51 | – | – | – | – | 1 | 0.51 |
| Intrinsic (IM) | 0.70 | 0.45 | – | – | – | – | – | 1 |
| **Validation sample** | | | | | | | |
| Amotivation (AM) | 0.73 | 0.48 | 1 | 0.76 | 0.03 | 0.02 | 0.01 | 0.01 |
| External (EX) | 0.77 | 0.55 | – | 1 | 0.04 | 0.03 | 0.04 | 0.02 |
| Introjected (IJ) | 0.75 | 0.51 | – | – | 1 | 0.44 | 0.50 | 0.26 |
| Identified (ID) | 0.76 | 0.52 | – | – | – | 1 | 0.63 | 0.68 |
| Integrated (IG) | 0.77 | 0.52 | – | – | – | – | 1 | 0.56 |
| Intrinsic (IM) | 0.75 | 0.49 | – | – | – | – | – | 1 |

Correlation among factors (in diagonal) represents the squared values (r²); CR, composite reliability; AVE, average variance extracted; AM, amotivation; EX, external regulation; IJ, introjected regulation; ID, identified regulation; IG, integrated regulation; IM, intrinsic motivation.

| TABLE 4 | Goodness-of-fit indices for invariance of the BREQ-3 across gender and across calibration and validation samples. |
| x² | df | x²/df | Δx² | Δdf | p | CFI | ΔCFI |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Male sample - female sample** | | | | | | | |
| Configural Invariance | 702.72 | 240 | 2.93 | – | – | – | 0.917 | – |
| Measurement Invariance | 721.71 | 252 | 2.86 | 18.98 | 12 | 0.089 | 0.915 | 0.002 |
| Scale Invariance | 769.29 | 273 | 2.82 | 66.56 | 33 | 0.001 | 0.911 | 0.006 |
| Residual Invariance | 842.10 | 291 | 2.89 | 139.38 | 51 | 0.001 | 0.901 | 0.016 |
| **Calibration sample – validation sample** | | | | | | | |
| Configural Invariance | 585.94 | 240 | 2.44 | – | – | – | 0.936 | – |
| Measurement Invariance | 613.17 | 252 | 2.43 | 27.23 | 12 | 0.005 | 0.933 | 0.003 |
| Scale Invariance | 625.16 | 273 | 2.29 | 39.22 | 33 | 0.007 | 0.935 | 0.006 |
| Residual Invariance | 710.30 | 291 | 2.44 | 124.36 | 51 | 0.022 | 0.923 | 0.013 |

x², chi-squared; df, degrees of freedom; x²/df, normative chi-square; Δx², differences in the value of chi-squared; Δdf, differences in the degrees of freedom; CFI, comparative fit index; ΔCFI, differences in the value of the comparative fit index.
According to Hair et al. (2014) if minor issues in convergent validity (particularly in the introjected motivation, social development, and well-being. Disabil. Rehabil., 39, 1520–1528. doi: 10.5209/rev_SJOP.2012.v15.n3.39436

Costa, R., Probst, M., Bastos, T., Vilhena, E., Seabra, A., and Corredeira, R. (2017). Behavioural regulation in exercise questionnaire in people with schizophrenia: construct validity of the Portuguese versions. Disabil. Rehabil. doi: 10.1080/09638288.2017.1342277 [Epub ahead of print].

Deci, E., and Ryan, R. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. Am. Psychol. 55, 68–78. doi: 10.1037/0003-066X.55.1.68

REFERENCES

Brislin, R. (1980). “Translation and content analysis for oral and written material,” in Handbook of Cross-Cultural Psychology, Vol. 2, eds H. Triandis and J. Berry (Needham Heights, MA: Allyn and Bacon), 389–444.

Byrne, B. (2010). Structural Equation Modeling with AMOS. Basic Concepts, Applications, and Programming, 2nd Edn. New York, NY: Taylor & Francis Group, LLC.

Cheung, G., and Rensvold, R. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. Struct. Equ. Modeling 9, 233–255. doi: 10.1207/S15328007SEM0902-5

Cid, L., Lettnin, C., Stobäus, C., Monteiro, D., Davoglio, T., and Moutão, J. (2016). Cross-cultural validation of the basic psychological needs in physical education between Portugal and Brazil samples. Span. J. Psychol. 19, 1–10. doi: 10.1017/sjp.2016.6

Cid, L., Moutão, J., Leitão, C., and Alves, I. (2012). Behavioural regulation assessment in exercise: exploring an autonomous and controlled motivation index. Span. J. Psychol. 15, 1520–1528. doi: 10.5209/rev_SJOP.2012.v15.n3.39436

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Hair, J., Black, W., Babin, B., and Anderson, R. (2014). Multivariate Data Analysis. 7th Edn. New Jersey, NJ: Pearson Educational, Inc.

Marsh, H. (1993). The multidimensional structure of physical fitness: invariance over gender and age. Res. Q. Exercise Sport 64, 256–273. doi: 10.1080/02701367.1993.10608810

Marsh, H., Hau, K., and Wen, Z. (2004). A modification to the behavioural regulation in exercise questionnaire to include an assessment of amotivation. J. Sport Exerc. Psychol. 26, 191–196. doi: 10.1123/jsep.26.2.191

Markland, D., and Tobin, V. (2010). Need support and behavioural regulations for exercise among exercise referral scheme clients: the mediating role of psychological need satisfaction. Psychol. Sport Exerc. 11, 91–99. doi: 10.1016/j.psychsport.2009.07.001

Marsh, H., and Riding, R. (2006). The influence of self-determination and perceived autonomy support on exercise motivation: a longitudinal analysis. J. Sports Med. Phys. Fit. 56, 1239–1248. doi: 10.1037/0022-3514.57.5.749

Mullan, E., Markland, D., and Ingledew, D. (1997). A graded conceptualisation of the self-regulation in the regulation of exercise behaviour: development of a measure using confirmatory factor analytic procedures. Pers. Individ. Differ. 23, 745–752. doi: 10.1016/S0191-8869(97)00107-4

Ng, J., Ndoumanis, N., Thogersen-Ntoumanis, C., Deci, E., Ryan, R., Duda, J., et al. (2012). Self-determination theory applied to health contexts: a meta-analysis. Perspect. Psychol. Sci. 7, 325–340. doi: 10.1177/174569161247309

Palmeira, A., Teixeira, P., Silva, M., and Markland, D. (2007). “Confirmatory factor analysis of the BREQ-2 - Portuguese version,” in Paper Presented at the 12th European Congress of Sport Psychology, Halkidiki.

Ryan, R., and Connell, J. (1989). Perceived locus of causality and internalization: examining reasons for acting in two domains. J. Pers. Soc. Psychol. 57, 749–761. doi: 10.1037/0022-3514.57.5.749

Vallerand, R. (1989). Vers une méthodologie de validation transculturelle de questionnaires psychologiques: implications pour la recherche en langue française [Towards a transcultural validation methodology for psychological questionnaires: implications for French language research]. Can. Psychol. 30, 347–363. doi: 10.1037/h00797856

Vlachopoulos, S., Asci, F., Cid, L., Erzso, G., González-Cutre, D., Moreno-Murcia, J., et al. (2013). Cross-cultural invariance of the basic psychological needs in exercise scale and latent mean differences among Greek, Spanish, Portuguese, and Turkish samples. Psychol. Exerc. Sport 14, 622–631. doi: 10.1016/j.jsep.2013.03.002

Vlaeyen, J., Práxedes, A., Abarca-Sos, A., Del Vilar, F., and García-González, L. (2016). Levels of physical activity, motivation and barriers to participation in university students. J. Sports Med. Phys. Fit. 56, 1239–1248.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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