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Behavioral Regulation Assessment in Exercise: Exploring an Autonomous and Controlled Motivation Index

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The main purpose of this study was to examine the psychometric properties of the Portuguese version of the *Behavioral Regulation in Exercise Questionnaire* (BREQ-2) and to test the hypothesis that the different types of behavioral regulation can be combined on a single factor to assess autonomous and controlled motivation. Data were collected from 550 members of private fitness centres who ranged in age from 14 to 69 years. The analysis supported an 18-item, 5-factor model after excluding one item (S-Bχ^2 = 221.7, *df* = 125, *p* = .000, S-Bχ^2/*df* = 1.77; SRMR = .06; NNFI = .90; CFI = .92; RMSEA = .04, 90% CI = .03-.05). However, the analysis also revealed a lack of internal consistency. The results of a hierarchical model based on 2 second-order factors that reflected controlled motivation (external and introjected regulation) and autonomous motivation (identified and intrinsic regulation) provided an acceptable fit to the data (S-Bχ^2 = 172.6, *df* = 74, *p* = .000, S-Bχ^2/*df* = 2.33; SRMR = .07; NNFI = .90; CFI = .92; RMSEA = .05, 90% CI = .04-.06), with reliability coefficients of .75 for controlled motivation and .76 for autonomous motivation. The study findings indicated that when item 17 was excluded, the Portuguese BREQ-2 was an appropriate measure of the controlled and autonomous motivation in exercise.
Keywords: psychological assessment, confirmatory factor analysis, self-determination theory, exercise.

El objetivo principal de este estudio fue examinar las cualidades psicométricas de la versión portuguesa de *Behavioral Regulation in Exercise Questionnaire* (BREQ-2) y probar la hipótesis de un modelo jerárquico que permitiese evaluar la motivación autónoma y la motivación controladora a través de un único factor. En el estudio participaron 550 practicantes de ejercicio físico en gimnasios, con edades comprendidas entre los 14 y los 69 años. Los resultados soportan la adecuación de un modelo de 5 factores y 18 ítems, tras la exclusión de un ítem (S-Bχ^2 = 221.7; *df* = 125; *p* = .000; S-Bχ^2/*df* = 1.77; SRMR = .06; NNFI = .90; CFI = .92; RMSEA = .04; 90% IC RMSEA = .03-.05). No obstante, este análisis también reveló la falta de consistencia interna de algunos factores. Los resultados del modelo jerárquico con dos factores de 2º orden, que incluyen la motivación controladora (regulación externa e introyectada) y la motivación autónoma (regulación identificada e intrínseca), revelaron valores de ajuste aceptables (S-Bχ^2 = 172.6; *df* = 74; *p* = 0.000; S-Bχ^2/*df* = 2.33; SRMR = .07; NNFI = .90; CFI = .92; RMSEA = .05; 90% IC RMSEA = .04-.06), así como una consistencia interna razonable (motivación controlada .75 y motivación autónoma .76). De este modo, se concluye que la versión portuguesa de BREQ-2 (con la exclusión del ítem 17), puede ser utilizada en la evaluación de la motivación controladora y autónoma (a través de la combinación de sus factores), en el contexto del ejercicio practicado en gimnasios.
Palabras clave: evaluación psicológica, análisis factorial confirmatorio, teoría de la autodeterminación, ejercicio.

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Self-Determination Theory (SDT: Deci & Ryan, 1985) is a "macro theory of human motivation" (Deci & Ryan, 2008b, p. 182), which assumes that people are naturally self-motivated in actively pursuing their goals. The different types of motivation range from controlled (less self-determined) to autonomous (more self-determined) forms of behavioral regulation (Deci & Ryan, 1985, 2000, 2008a; Ryan & Deci, 2000a, 2000b, 2002, 2007). SDT has generated a great deal of interest because it regards the basic intrinsic/extrinsic dichotomy as insufficient (Ryan & Deci, 2002, 2007; Vallerand & Losier, 1999) and instead adopts a multidimensional conceptualisation of motivation (Markland & Tobin, 2004). A considerable body of research has used this approach to study the behavioral regulation of exercise (Hagger & Chatzisarantis, 2008).

Ryan and Deci (2007) have noted that the different reasons that prompt people to engage in activities exert a combined effect on motivation. Therefore, the Organismic Integration Theory (OIT), one of the SDT mini-theories, categorises the various forms of motivation according to the degree of autonomy that they exhibit (Ryan & Deci, 2002) and distinguishes among the various types of extrinsic motivation based on the extent to which the individual has internalised the behavior. In this view, some forms of extrinsic motivation are more internalised (and thus autonomous) while others are more closely related to the external pressures on the individual.

According to SDT (Deci & Ryan, 1985, 2000, 2008a; Ryan, 1995; Ryan & Deci, 2000a, 2000b, 2002, 2007; Vallerand & Losier, 1999), the different types of motivation fall along a continuum that ranges from the more controlled (external and introjected) to the more autonomous (identified, integrated, and intrinsic) forms of behavior regulation, that are "the most central distinction in SDT" (Deci & Ryan, 2008b, p. 182).

Behavioral regulation processes are critical for exercise (Hagger & Chatzisarantis, 2008; Markland & Ingledew, 2007; Markland & Tobin, 2010; Standage, Gillison, & Treasure, 2007). Although most people exercise for extrinsic reasons (e.g., to improve physical fitness and appearance, to lose weight, or for health reasons), they are unlikely to persist if they do not enjoy exercise or find it inherently satisfying. For this reason, "intrinsic motivation may be among the most important factors in maintaining exercise over time" (Ryan & Deci, 2007, p. 5).

However, reliable and valid measures are essential to determine the processes that motivate individuals to exercise (Hagger & Chatzisarantis, 2008). To assess how individuals regulated their behavior over the motivational continuum, Markland and Tobin (2004) developed the *Behavioral Regulation in Exercise Questionnaire* (BREQ-2), a 19-item scale with 5 factors (amotivation, external, introjected, identified, and intrinsic regulation). The instrument was validated in a sample of 201 individuals, 136 women with a mean age of 54.2 years (SD = 13.3), 60 men with a mean age of 56.3 years (SD = 12.9) (the remaining 5 did not disclose their sex), who had a moderate to low risk of morbidity and had benefited from a specific exercise programme within the past three years. The study found a satisfactory factor structure and reasonable levels of internal consistency. However, a careful analysis of the study results revealed that the reported degrees of freedom (df = 125) reflected an 18-item, 5-factor model rather than a 19-item, 5-factor model (df = 142) and that item 17 of the introjected regulation subscale ("I get restless if I don't exercise regularly") was excluded from the analysis due to an unspecified error.

The BREQ-2 was translated into Portuguese and validated (Palmeira, Teixeira, Silva, & Markland, 2007) using data collected in health clubs from a sample of 703 university students and individuals who exercised (431 female; 272 male) with a mean age of 27.3 years (SD = 9.0); 56% of these participants had engaged in regular physical activity for more than six months. The results of the confirmatory factor analysis indicated that the model validating the BREQ-2 also provided a good fit for the data from the Portuguese sample and was internally consistent, although item 17 of the scale had a low loading on the factor of identified regulation.

Because of the inconsistencies associated with item 17 and the heterogeneous sample used to validate both the BREQ-2 (Markland & Tobin, 2004) and the Portuguese BREQ-2 (Palmeira et al., 2007), the primary objective of the present study was to validate the Portuguese BREQ-2 with a homogenous sample of gym and health club members.

In literature is usual to integrate the different types of behavioral regulation into the Relative Autonomy Index (RAI), which is a single motivation index that significantly reduces the number of variables needed to represent the different types of motivation (Vallerand & Ratelle, 2002). According to Ryan and Deci (2000a), considerable evidence supports the hypothesis that the various types of behavioral regulation are related to each other along the motivational continuum. The initial attempts to create an instrument to measure the various types of regulation revealed an organised pattern of correlations between the different types of motivation (Ryan & Connell, 1989). The types of regulation that were adjacent on the continuum were highly and positively correlated, while those that were further apart on the continuum were correlated more weakly or were negatively correlated (Ryan & Deci, 2007). This hypothesis could easily be tested by examining the magnitude and direction of the correlations between the different factors in either the original BREQ-2 (Markland & Tobin, 2004; Mullan, Markland, & Ingledew, 1997) or the Portuguese BREQ-2 (Palmeira, et al., 2007).

In SDT, behavioral regulation evolved from a simple dichotomy between extrinsic and intrinsic motivation to a continuum ranging from controlled to autonomous

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motivation (Deci & Ryan, 2008a). As a result, the fundamental premises of SDT (Deci & Ryan, 2000, 2008a, 2008b; Ryan & Deci, 2000a, 2000b, 2002) are consistent with an approach that integrates the different types of motivation regulation to form global indices of autonomous and controlled motivation (Pelletier & Sarrazin, 2007; Ryan & Deci, 2000b). This approach has already been utilised in research in the areas of education (Ratelle, Guay, Vallerand, Larose, & Senécal, 2007; Zhou, Ma, & Deci, 2009), health (Ingledew & Fergunson, 2007; Pavey & Sparks 2008), the family (Knafo & Assor, 2007), sports (Mouratidis, Vansteenkiste, Lens, & Sideridis, 2008; Ntoumanis & Standage, 2009), and exercise (Ingledew & Markland, 2008).

Thus, a second objective of the present study was to test which hierarchical model of BREQ-2 provided a better fit: a) one that included a single second-order factor that represented a single self-determination index (SDI) or b) one based on 2 second-order factors that represented an index of autonomous motivation and a separate index of controlled motivation.

Method

Participants

A total of 550 Portuguese individuals (264 female, 286 male) ranging in age from 14 to 69 years (M = 30.0 years, SD = 10.2) participated in the study. All participants were gym or health club members who took part in several types of exercise, such as: weight training (n = 147); group activities that included cycling, aerobic, dance, step, yoga, body combat, body pump, and body jump (n = 175); and cardio-fitness exercises that combined strength training and aerobic activities (n = 231). Their exercise experience ranged from 1 to 240 months (M = 16.6 months, SD = 24.1). The weekly frequency of their exercise participation ranged from 1 to 6 sessions per week (M = 3.1 sessions, SD = 1.1), and their average session duration was approximately 90 minutes since they spend 1 to 15 hours of exercise per week (M = 4.9 hours, SD = 2.4).

Instruments

Behavioral Regulation in Exercise Questionnaire (BREQ-2: Markland & Tobin, 2004). The BREQ-2 consists of 19 items on a 5-point Likert-type scale with responses that range from 0 ("strongly disagree") to 4 ("strongly agree"). Items are grouped into five domains (amotivation, external, introjected, identified, and intrinsic regulation), which represent the types of behavioral regulation underlying the motivational continuum of SDT (SDT: Deci & Ryan, 1985). This study used the (BREQ-2p: Palmeira et al., 2007).

Procedures: Data Collection

Administrators at the gyms and health clubs were informed of the purpose of the study and provided permission to collect information at their facilities. The researchers and research assistants 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 the individuals who voluntarily agreed to participate provided signed informed consent; they were guaranteed confidentiality and assured that responses would not be released to third parties. After a brief explanation of the study objectives, the assessment instrument was administered separately to each individual under comfortable conditions that allowed the individual to concentrate during the completion of the questionnaire, which took approximately 15 minutes.

Procedures: Confirmatory Factor Analysis (CFA)

Because the maximum likelihood estimation method (MLE) assumes that the data must have a normal multivariate distribution (Kahn, 2006; Kline, 2005), the more robust chi-square statistic (χ^2) called the Satorra-Bentler scaled statistic (SBχ^2) (see Satorra & Bentler, 1994) was used. This test corrects for the non-normality of data distribution (Bentler, 2007; Byrne, 2006; Hu & Bentler, 1999) and produces more accurate results (Chou & Bentler, 1995).

Model fit was assessed through the SBχ^2 with degrees of freedom and significance level, and complemented by the recommended following fit indices (Bentler, 2007; Brown, 2006; Byrne, 2001; Hair, Black, Babin, Anderson, & Tatham, 2006; Kahn, 2006; Kline, 2005; Worthington & Whittaker, 2006): the Standardized Root Mean Square Residual (SRMR), the Comparative Fit Index (CFI), the Non-Normed Fit Index (NNFI), and the Root Mean Square Error of Approximation (RMSEA) with 90% confidence interval (RMSEA 90% CI). In this study, the following cutoff values were adopted (Hu & Bentler, 1999): SRMR $\leq$ .08, CFI and NNFI $\geq$ .95, and RMSEA $\leq$ .06. The confirmatory factor analysis was performed with the use of EQS 6.1 software (Bentler, 2002).

Results and Discussion

Because the data did not have a normal distribution (multivariate kurtosis = 327.33; normalised value = 135.88) and the normalised value of Mardia's coefficient (Mardia, 1970) was greater than 5.0 (Byrne, 2006), the analysis used the Satorra-Bentler χ^2 (S-Bχ^2).

Table 1 reveals that the 19-item, 5-factor model of the Portuguese BREQ-2 (Model 1) did not provide a reasonable fit to the data from the gym and health club members who

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Table 1
Fit Indexes for the 5-Factor BREQ-2 Models

BREQ-2	S-B χ^2	*df*	*p*	χ^2/df	SRMR	NNFI	CFI	RMSEA	90% IC
Original Marlkland and Tobin (2004)	136.5	125	.230	1.09	.05	.94	.95	.02	.00-.04
Portuguese Palmeira et al. (2007)	447.8	142	.001	3.15	*	*	.96	.06	.05-.06
Present Study Model 1 5 Factors – 19 Items	328.2	142	.001	2.31	.08	.84	.87	.05	.04-.06
Present Study Model 2 5 Factors – 18 Items**	221.7	125	.001	1.77	.06	.90	.92	.04	.03-.05

* Values not reported by authors; ** Item 17 excluded.

participated in the study (S-Bχ^2 = 328.2, *df* = 142; *p* = .000, S-Bχ^2/df = 2.31; SRMR = .08; NNFI = .84; CFI = .87; RMSEA = .05, 90% CI = .04-.06). The model met a few of the criteria for good fit with an SRMR ≤ .08 and a RMSEA ≤ .06 (Hu & Bentler, 1999), and the factor structure was consistent both with the original model (Markland & Tobin, 2004) and the Portuguese model (Palmeira et al., 2007). However, the incremental indices values (NNFI = .84, CFI = .87), which provide a better estimate of model fit than the null model, were not acceptable because only values greater than .90 indicate a good model fit (Brown, 2006; Hair et al., 2006; Kline, 2005; Marsh, Hau, & Wen, 2004; Worthington & Whittaker, 2006).

The structural equation modeling rarely involves estimation of a single model, and identifying alternative models is a common strategy, particularly when the estimation process reveals major flaws in the main model (Hoyle & Panter, 1995). As a result, the standard errors, residual values, and modification indices (Lagrange Multiplier Test) were examined (Byrne, 1994, 2001, 2006; Chou & Bentler, 1995; Hoyle, 1995; Worthington & Whittaker, 2006).

Further analyses led to the elimination of item 17 (associated with the identified motivation subscale). First, the parameter estimate had a high standard error (*SE* = .33). Second, the standardised residual matrix showed high residual values between item 17 and items associated with more controlled behavioral regulation, such as items 2 and 13 (associated with introjected motivation), item 16 (associated with external motivation), and item 9 (associated with amotivation). Finally, the Lagrange Multiplier test found cross-loadings between item 17 and all other factors, with the highest loading on the factor of introjected motivation.

The 18-item, 5-factor model (Model 2 in Table 1) provided an acceptable fit after item 17 was dropped (S-Bχ^2 = 221.7, *df* = 125, *p* = .000, S-Bχ^2/df = 1.77; SRMR = .06; NNFI = .90; CFI = .92; RMSEA = .04, 90% CI = .03-.05), although the model did not meet all of the adopted criteria (Hu & Bentler, 1999). Some authors (Marsh, Hau, & Wen, 2004) have argued that strict adherence to the cutoff values of Hu and Bentler risks rejecting appropriate models. Markland (2007) has recommended that researchers seek explanations for study results that are based not only on statistical analysis but also on the theory underlying the models, particularly when models have been respecified. The problems encountered with item 17 ("Because I get restless if I don't exercise regularly") appear to have been related to the meaning of the terms used, especially the term "restless" (translated as "anxious" in the Portuguese BREQ-2). Participants may have understood this item as referring to introjected rather than identified motivation. Based on the definitions found in the literature (Deci & Ryan, 2000, 2008a, 2008b; Ryan & Deci, 2000a, 2000b, 2002, 2007; Vallerand & Losier, 1999), the description in item 17 is closer to the definition of introjected regulation (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). In addition, the terms used in the introjected subscale items ("guilty", "ashamed", and "failure") refer to negative feelings, that approximates the term used in item 17 ("restless" – "ansioso"), but that also can be translated into Portuguese as "worried" ("inquieto"), "agitated" ("agitado"), or "impatient" ("impaciente"). Although item 17 is included in the identified regulation subscale, it does not seem to fit with the other items in that subscale, which refer to the value and/or the importance of the behavior to the individual (e.g., "I value the benefits of exercise"). Inconsistencies with item 17 have been found in other studies employing the BREQ-2 or translations of the BREQ-2.

In the study that validated the original version of BREQ-2, item 17 was deleted from the model "due to an error" (Markland & Tobin, 2004, p. 193). In the preliminary validation study of the Portuguese BREQ-2 that employed an exploratory factor analysis, item 17 was associated with

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Table 2
Standardized Parameter Estimates for the Portuguese BREQ-2 Items (item 17 excluded)

Item(Factor)	Min-Max	*M*±*SD*	FL	EV	SMC
Item1 (EX)	0-4	0.51±1.00	.66	.75	.44
Item2 (IJ)	0-4	1.83±1.32	.53	.85	.28
Item3 (ID)	0-4	3.62±0.75	.46	.89	.21
Item4 (MI)	0-4	2.77±1.30	.43	.91	.18
Item5 (AM)	0-4	0.26±0.73	.59	.81	.35
Item6 (EX)	0-4	0.44±0.95	.79	.62	.62
Item7 (IJ)	0-4	0.66±1.08	.56	.83	.31
Item8 (ID)	0-4	3.39±1.02	.50	.87	.25
Item9 (AM)	0-4	0.29±0.83	.71	.70	.51
Item10 (MI)	0-4	3.41±0.82	.61	.80	.37
Item 11 (EX)	0-4	0.29±0.78	.68	.74	.46
Item 12 (AM)	0-4	0.26±0.80	.58	.82	.33
Item 13 (IJ)	0-4	1.66±1.41	.48	.88	.23
Item 14 (ID)	0-4	3.26±0.99	.43	.91	.18
Item 15 (MI)	0-4	3.51±0.81	.78	.63	.60
Item 16 (EX)	0-4	0.33±0.86	.74	.68	.54
Item 18 (MI)	0-4	3.55±0.74	.78	.63	.60
Item 19 (AM)	0-4	0.13±0.54	.65	.76	.43

MI (Intrinsic); ID (Identified); IJ (Introjected); EX (External); AM (Amotivation); Min-Max (minimum-maximum); FL (factor loading); EV (error variance); SMC (squared multiple correlation).

the introjected regulation factor (with a factor loading of .63) rather than the identified regulation factor (Palmeira & Teixeira, 2006). However, in the study carried out to confirm the validity of the model, item 17 was associated with identified regulation, despite a low loading of .44 on that factor (Palmeira et al., 2007). In the present study, the strong positive correlation between introjected and identified regulation (r = .68) decreased significantly after item 17 was eliminated (r = .23), again revealing an association of this item with the introjected regulation factor.

In the Spanish version of the BREQ-2 (Murcia, Gimeno, & Camacho, 2007) item 17 was excluded from the model due to a factor loading of less than .40 on the identified regulation factor.

Table 2 provides the standardised factor loadings of the scale items, which were all statistically significant (p < .001) and ranged from .43 to .79. Although there were four items (3, 4, 13, and 14) that had factor loadings below the established criterion of .50, factor loadings greater than .40 are acceptable when the sample size is taken into account (Hair et al., 2006). However, factor loadings of this magnitude reveal that the latent variable is weakly associated with the item.

In the case of item 4 ("I exercise because it's fun"), which was clearly associated with the factor of intrinsic motivation, the low factor loading revealed that responses to item 4 (M = 2.77; SD = 1.30) indicated the respondents' lack of agreement with the statement. The respondents tended to engage in exercise not because it was inherently enjoyable but for more instrumental reasons.

In the validation studies for the BREQ-2 (Markland & Tobin, 2004) and the Portuguese BREQ-2 (Palmeira et al., 2007), the correlations between the subscales exhibited an organised pattern of relationships, such that types of behavioral regulation closer along the motivational continuum were strongly and positively correlated, while those that were further apart were correlated more weakly or were negatively correlated (Ryan & Connell, 1989; Ryan & Deci, 2007).

However, the reliability coefficients for two factors in the present study were less than .70, revealing a lack of internal consistency. The identified and introjected regulation factors had Cronbach's alphas of .45 and .53, respectively, which indicated that these subscale items might not be measure the same construct. However, this result might be due to the number of items in each subscale (3 items after dropping item 17) because the value of Cronbach's alpha is positively related to the number of items (Hair et al., 2006)

Table 4 reveals that the SDI hierarchical model with 1 second-order factor (a global index of self-determination) and 5 first-order factors (intrinsic, identified, introjected, external, and amotivation) did not fit the data. Thus, the hypothesis that a single second-order factor of the Portuguese BREQ-2 representing a single motivation index, such as the Relative Autonomy Index (RAI: Grolnick & Ryan, 1987; Ryan & Connell, 1989) or Self-Determination Index (SDI: Vallerand & Losier, 1999; Vallerand & Ratelle, 2002), was

Table 3
Portuguese BREQ-2 Factor Correlations, and Reliability (Cronbach alpha coefficients are displayed on diagonal)

Factors	*M*±*SD*	MI	ID	IJ	EX	AM
Intrinsic (MI)	3.31±0.68	α=.74				
Identified (ID)	3.42±0.63	.92	α=.45			
Introjected (IJ)	1.38±0.92	.04	.23	α=.53		
External (EX)	0.39±0.71	–.19	–.16	.55	α=.80	
Amotivation (AM)	0.23±0.54	–.29	-.49	.43	.74	α=.73

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Table 4
Fit Indexes for the Portuguese BREQ-2 Hierarchical Models

Models	S-B χ^2	*df*	*p*	χ^2/df	SRMR	NNFI	CFI	RMSEA	90% IC
1 Second-order factor SDI Model	361.86	130	.001	2.78	.10	.78	.81	.06	.05-.07
2 Second-order factors MA/MC Model	172.55	74	.001	2.33	.07	.90	.92	.05	.04-.06
Amotivation factor AM Model	3.50	2	.173	1.75	.03	.95	.98	.04	.00-.10

Notes: a) SDI (Self-Determination Index) and MA/MC (Autonomous Motivation/Controlled Motivation) models were tested without item 17; b) subscale amotivation wasn't included in model MA/MC; c) AM (Amotivation) model included only the 4 items of subscale amotivation.

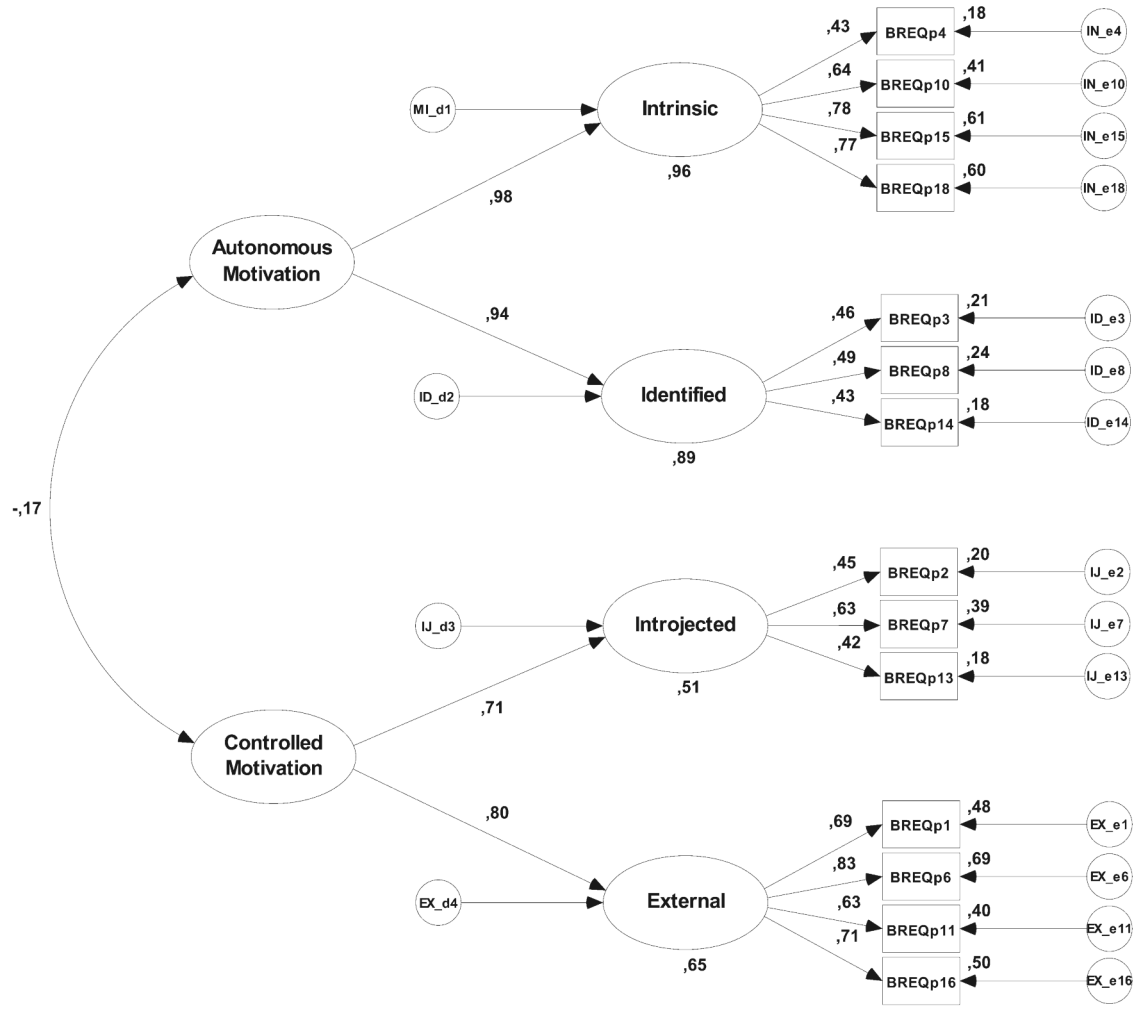

Figure 1. Hierarchical Model for the Portuguese BREQ-2: Autonomous and Controlled Motivation (Standardized Parameters Estimates)

not empirically supported in the present study. Furthermore, the factor loadings indicated a positive relationship with the controlled forms of regulation and a negative relationship with the autonomous forms of regulation, which also did not support the theoretical conception that the assessment of self-determination based on a single motivation index.

In contrast, although Model MA/MC did not meet all the adopted cutoff values (Hu & Bentler, 1999), the hierarchical

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model with 2 second-order factors (autonomous and controlled motivation) and 4 first-order factors (intrinsic, identified, introjected, and external regulation) provided an acceptable fit to the data (S-Bχ^2 = 172.55, *df* = 74, *p* = .000, S-Bχ^2/*df* = 2.33; SRMR = .07; NNFI = .90; CFI = .92; RMSEA = .05, 90% CI = .04-.06). Because all the criteria adopted were met (Hu & Bentler, 1999) by Model AM, which included only the amotivation subscale with a Cronbach's α of .73 and factor loadings between .61 and .72, the fit of this model was excellent (S-Bχ^2 = 3.50; *df* = 2; *p* = .173; S-Bχ^2/*df* = 1.75; SRMR = .03; NNFI = .95; CFI = .98; RMSEA = .04, 90% CI = .00-.10).

These results suggest that the Portuguese BREQ-2 provides a measure of autonomous motivation (an index incorporating the factors of intrinsic and identified regulation) and controlled motivation (an index incorporating the factors of introjected and external regulation) that is consistent with the central distinction that underlie the motivational continuum of self-determination theory (Deci & Ryan, 2000, 2008a; Ryan & Deci, 2000a, 2000b, 2002, 2007).

Figure 1 reveals that both of the second-order factors exhibited acceptable internal consistency, with (α = .76) for autonomous motivation and (α = .75) for controlled motivation. Factor loadings of the second-order factors were .98 for intrinsic regulation (with autonomous motivation explaining 96% of the variance), .94 for identified regulation (with autonomous motivation explaining 89% of the variance), .71 for introjected regulation (with controlled motivation explaining 51% of the variance), and .80 for external regulation (with controlled motivation explaining 65% of the variance). In addition, there was also a low negative correlation (*r* = -.17) between the 2 second-order factors.

The results of this study are consistent with the findings of other studies (Ingledew & Ferguson, 2007; Ingledew & Markland, 2008; Lonsdale, Hodge, & Rose, 2008) that have used overall measures for assessing autonomous and controlled motivation. In the study of Lonsdale et al. (2008, p. 349) "the results indicated that there was a basic distinction between autonomous and controlled motivation scores and provided further support for the factorial validity of the scale scores", and the results of the present study can lead us to similar conclusions.

Conclusions

The results of the present study revealed that the 19-item 5-factor model of the Portuguese BREQ-2 did not have acceptable psychometric properties because this model exhibited a poor fit to the data and several factors exhibited poor internal consistency.

Although the analyses of alternative models revealed that these solutions also did not meet all the adopted criteria, these models were more acceptable because a critical principle of factor analysis is: "models at their best can be expected to provide only a close approximation to observed data, rather than an exact fit" (MacCallum, 1995, p. 17). However, the greatest benefit of choosing the appropriate model is the increased probability of obtaining clearer and more interpretable results; choosing a less appropriate model will produce ambiguous results.

Overall, results of this study support the use of the Portuguese BREQ-2 for the assessment of the types of behavioral regulation underlying self-determination theory for gym and health club exercisers. However, because of the problems encountered with item 17 of the scale, this item should be excluded, and a combination of factors should be used to independently assess autonomous motivation (intrinsic and identified regulation) and controlled motivation (introjected and external regulation). Further empirical studies are needed to confirm the psychometric robustness of the model identified in the present study.

Referencias

Bentler, P. (2002). *EQS 6 Structural equations program manual*. Encino, CA: Multivariate Software, Inc.

Bentler, P. (2007). On tests and índices for evaluating structural models. *Personality and Individual Differences, 42*, 825–829. http://dx.doi.org/10.1016/j.paid.2006.09.024

Brown, T. (2006). *Confirmatory factor analysis for applied research*. New York, NY: The Guiford Press.

Byrne, B. (1994). *Structural equation modeling with EQS and EQS/Windows. Basic concepts, applications, and programming*. Thousand Oaks, CA: Sage Publications.

Byrne, B. (2001). *Structural equation modeling with AMOS. Basic concepts, applications and programming*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Byrne, B. (2006). *Structural equation modeling with EQS. Basic concepts, applications, and programming* (2nd Ed.) Mahawah, NJ: Lawrence Erlbaum Associates, Publishers

Chou, C., & Bentler, P. (1995). Estimates and tests in structural equation modeling. In R. Hoyle (Ed.), *Structural equation modeling. Concepts, issues, and applications* (pp. 37-54). Thousand Oaks, CA: Sage Publications, Inc.

Deci, E., & Ryan, R. (1985). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum Press.

Deci, E., & Ryan, R. (2000). The "What" and "Why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*, 227–268. http://dx.doi.org/10.1207/S15327965PLI1104_01

Deci, E., & Ryan, R. (2008a). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian Psychology/Psychologie Canadienne, 49*, 14–23. http://dx.doi.org/10.1037/0708-5591.49.1.14

Deci, E., & Ryan, R. (2008b). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology/Psychologie Canadienne, 49*, 182–185. http://dx.doi.org/10.1037/a0012801

Grolnick, W., & Ryan, R. (1987). Autonomy in children's learning: An experimental and individual difference investigation. *Journal of Personality and Social Psychology, 52*, 890–898. http://dx.doi.org/10.1037/0022-3514.52.5.890

Hagger, M., & Chatzisarantis, N. (2008). Self-determination theory and the psychology of exercise. *International Review of Sport and Exercise Psychology, 1*, 79–103. http://dx.doi.org/10.1080/17509840701827437

Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (2006). *Multivariate data analysis* (6th Ed.). UpperSaddle River, NJ: Pearson Educational, Inc.

Hoyle, R. (1995). The structural equation modeling approach. Basic concepts and fundamental issues. In R. Hoyle (Ed.), *Structural equation modeling approach. Concepts, issues, and applications* (pp. 1-15). Thousand Oaks, CA: Sage Publications.

Hoyle, R., & Panter, A. (1995). Writing about structural equation medels. In R. Hoyle (Ed.), *Structural equation modeling. Concepts, issues, and applications* (pp. 158-176). Thousand Oaks, CA: Sage Publications, Inc.

Hu, L., & Bentler, P. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1–55. http://dx.doi.org/10.1080/10705519909540118

Ingledew, D., & Fergunson, E. (2007). Personality and riskier sexual behavior: Motivational mediators. *Psychology and Health, 22*, 291–315. http://dx.doi.org/10.1080/14768320600941004

Ingledew, D., & Markland, D. (2008). The role of motives in exercise participation. *Psychology and Health, 23*, 807–828. http://dx.doi.org/10.1080/08870440701405704

Kahn, J. (2006). Factor analysis in counseling psychology. Research, trainning, and practice: Principles, advances and applications. *The Counseling Psychologist, 34*, 684–718. http://dx.doi.org/10.1177/0011000006286347

Kline, R. (2005). *Principles and practice of structural equation modeling* (2nd Ed.). New York, NY: The Guilford Press.

Knafo, A., & Assor, A. (2007). Motivation for agreement with parental values: Desirable when autonomous, problematic when controlled. *Motivation and Emotion, 31*, 232–245. http://dx.doi.org/10.1007/s11031-007-9067-8

Lonsdale, C., Hodge, K., & Rose, E. (2008). The Behavioral Regulation in Sport Questionnaire (BRSQ): Instrument development and initial validity evidence. *Journal of Sport & Exercise Psychology, 30*, 323–355.

MacCallum, R. (1995) Model specification. Procedures, strategies, and related issues. In R. Hoyle (Ed.), *Structural equation modeling. Concepts, issues, and applications*. Thousand Oaks, CA: Sage publications, Inc.

Mardia, K. (1970). Measures of multivariate skewness and kurtosis with applications. *Biometrika, 57*, 519–530. http://dx.doi.org/10.1093/biomet/57.3.519

Markland, D. (2007). The golden rule is that there are no golden rules: A commentary on Paul Barrett's recommendations for reporting model fir in structural equation modelling. *Personality and Individual Differences, 42*, 851–858. http://dx.doi.org/10.1016/j.paid.2006.09.023

Markland, D., & Ingledew, D. (2007). Exercise participation motives. In M. Hagger & N. Chatzisarantis (Eds.), *Intrinsic motivation and self-determination in exercise and sport* (pp. 23-34). Champaing, IL: Human Kinestics.

Markland, D., & Tobin, V. (2004). A modification to the behavioral regulation in exercise questionnaire to include an assessment of amotivation. *Journal of Sport & Exercise Psychology, 26*, 191–196.

Markland, D., & Tobin, V. (2010). Need support and behavioral regulations for exercise among exercise referral scheme clients: The mediating role of psychological need satisfation. *Psychology of Sport and Exercise, 11*, 91–99. http://dx.doi.org/10.1016/j.psychsport.2009.07.001

Marsh, H., Hau, K., & Wen, Z. (2004). In search of golden rules: Comment on hypothesis-testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's (1999) findings. *Structural Equation Modeling, 11*, 320–341. http://dx.doi.org/10.1207/s15328007sem1103_2

Mouratidis, M., Vansteenkiste, M., Lens, W., & Sideridis, G. (2008). The motivating role of positive feedback in sport and physical education: Evidence for a motivational model. *Journal of Sport & Exercise Psychology, 30*, 240–268.

Mullan, E., Markland, D., & Ingledew, D. (1997). A graded conceptualisation of self-determination in the regulation of exercise behavior: Development of a measure using confirmatory factor analytic procedures. *Personality and Individual Differences, 23*, 745–752. http://dx.doi.org/10.1016/S0191-8869(97)00107-4

Murcia, J., Gimeno, J., & Camacho, A. (2007). Measuring self-determination motivation in a physical fitness settings: Validation of the Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2) in a Spanish sample. *The Journal of Sport Medicine and Physical Fitness, 47*, 366–378.

Ntoumanis, N., & Standage, M. (2009). Morality in sport: A self-determination theory perspective. *Journal of Applied Social Psychology, 21*, 365–380. http://dx.doi.org/10.1080/10413200903036040

Palmeira, A., & Teixeira, P. (2006, September). *Adaptação preliminar do BREQ-2 para a língua portuguesa.* [Preliminar adaptation of BREQ-2 to Portuguese language]. Paper presented at the V Congresso Luso-Espanhol de Psicologia do Desporto, Lisboa.

Palmeira, A., Teixeira, P., Silva, M., & Markland, D. (2007, September). *Confirmatory Factor Analysis of the BREQ-2 - Portuguese version.* Paper presented at the 12th European Congress of Sport Psychology, Halkidiki, Greece.

Pavey, L., & Sparks, P. (2008). Threats to autonomy: Motivational responses to risk information. *European Journal of Social Psychology, 38*, 852–865. http://dx.doi.org/10.1002/ejsp.477

Pelletier, L., & Sarrazin, P. (2007). Measurement issues in self-determination theory and sport. In M. Hagger & N. Chatzisarantis (Eds.), *Intrinsic motivation and self-determination in exercise and sport* (pp. 143-152). Champaing, IL: Human Kinetics.

Ratelle, C., Guay, F., Vallerand, R., Larose, S., & Senécal, C. (2007). Autonomous, controlled, and amotivated types of academic motivation: A person-oriented analysis. *Journal of Educational*

Psychology, 99, 734–746. http://dx.doi.org/10.1037/0022-0663.99.4.734

Ryan, R. (1995). Psychological needs and the facilitation of integrative processes. *Journal of Personality, 63*, 397–427. http://dx.doi.org/10.1111/j.1467-6494.1995.tb00501.x

Ryan, R., & Connell, J. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*, 749–761. http://dx.doi.org/10.1037//0022-3514.57.5.749

Ryan, R., & Deci, E. (2000a). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25*, 54–67. http://dx.doi.org/10.1006/ceps.1999.1020

Ryan, R., & Deci, E. (2000b). Self-determination theory and the dacilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*, 68–78. http://dx.doi.org/10.1037//0003-066X.55.1.68

Ryan, R., & Deci, E. (2002). Overview of self-determination theory: An organismic dialectial perspective. In E. Deci & R. Ryan (Eds.), *Handbook of delf-determination research* (pp. 3-33). Rochester, NY: The University of Rochester Press.

Ryan, R., & Deci, E. (2007). Active human nature: Self-determination theory and the promotion and maintenance of sport, exercise, and health. In M. Hagger & N. Chatzisarantis (Eds.), *Intrinsic motivation and self-determination in exercise and sport* (pp. 1-19). Champaing, IL: Human Kinetics.

Satorra, A., & Bentler, P. (1994). Corrections to test statistics and standard errors in covariance structure analysis. In A. Eye & C. Clogg (Eds.), *Latent variables analysis: Applications for development research*. Thousand Oaks, CA: Sage Publications.

Standage, M., Gillison, F., & Treasure, D. (2007). Self-determination and motivation in physical education. In M. Hagger & N. Chatzisarantis (Eds.), *Intrinsic motivation and self-determination in exercise and sport* (pp. 71-85). Champaign, IL: Human Kinetics.

Vallerand, R., & Losier, G. (1999). An integrative analysis of intrinsic and extrinsic motivation in sport. *Journal of Applied Social Psychology, 11*, 142–169. http://dx.doi.org/10.1080/10413209908402956

Vallerand, R., & Ratelle, C. (2002). Intrinsic and exterinsic motivation: A hierarchical model. In E. Deci & R. Ryan (Eds.), *Handbook of self-determination research* (pp. 37-63). Rochester, NY: The University of Rochester Press.

Worthington, R., & Whittaker, T. (2006). Scale Development Research. A content analysis and recommendations for best practices. *The Counseling Psychologist, 34*, 806–838. http://dx.doi.org/10.1177/0011000006288127

Zhou, M., Ma, W., & Deci, E. (2009) The importance of autonomy for rural Chinese children's motivation for learning. *Learning & Individual Differences, 19*, 492–498. http://dx.doi.org/10.1016/j.lindif.2009.05.003

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