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Translation and Construct Validity of the Feeling Scale and the Felt Arousal Scale in Portuguese Recreational Exercisers

Traducción y Validez de Constructo de la Feeling Scale y la Felt Arousal Scale en Ejercitadores Recreativos Portugueses

Tradução e Validade de Constructo da Feeling Scale e Felt Arousal Scale em Praticantes Portugueses de Exercício Recreacional

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RESUMEN

La Feeling Scale y la Felt Arousal Scale son escalas ampliamente utilizadas en la investigación del deporte. En este estudio, las escalas originales fueron traducidas del inglés al portugués. Posteriormente, se comprobó si las puntuaciones de afecto y activación en el Self-Assessment Manikin, una escala basada en imágenes, predecían las puntuaciones en la Feeling Scale y en la Felt Arousal Scale en 47 deportistas recreativos portugueses, antes y después de una sesión de ejercicio. El Self-Assessment Manikin mostró correlaciones de moderadas a fuertes con la Feeling Scale ($r = 0.70$ y $r = 0.56$, $p < 0.01$) y la Felt Arousal Scale ($r = 0.65$ y $r = 0.72$, $p < 0.01$), y un poder predictivo sustancial sobre la Feeling Scale ($R^2 = 47\%$ y $R^2 = 31\%$) y la Felt Arousal Scale ($R^2 = 42\%$ y $R^2 = 52\%$). En base a este estudio, la Feeling Scale y la Felt Arousal Scale demostraron ser instrumentos válidos para medir el afecto y la excitación en los ejercitantes recreativos portugueses.

Palabras clave: feeling scale, felt arousal scale, validez de constructo; traducción; validez convergente.

ABSTRACT

The Feeling Scale and Felt Arousal Scale are widely used in sport research. They provide a practical assessment of self-reported affect and arousal during exercise. The original scales were translated for English to Portuguese. Afterwards, it was tested if the affect and arousal scores in the picture-based Self-Assessment Manikin predicted the scores in the Feeling Scale and the Felt Arousal Scale in 47 Portuguese recreational exercisers, before and after an exercise session. Self-Assessment Manikin showed moderate-to-strong correlations with the Feeling Scale ($r = 0.70$ and $r = 0.56$, $p < 0.01$) and the Felt Arousal Scale ($r = 0.65$ and $r = 0.72$, $p < 0.01$), and substantial predictive power over the Feeling Scale ($R^2 = 47\%$ and $R^2 = 31\%$) and the Felt Arousal Scale ($R^2 = 42\%$ and $R^2 = 52\%$). The Feeling Scale and Felt Arousal Scale are valid instruments to measure affect and arousal in Portuguese exercisers.

Keywords: feeling scale, felt arousal scale, construct validity, translation, convergent validity.

RESUMO

A Feeling Scale e a Felt Arousal Scale são amplamente utilizadas na investigação em desporto. Fornecem uma avaliação prática dos estados psicológicos de afeto e da ativação durante o exercício. Neste estudo, as escalas originais foram traduzidas do inglês para português. Posteriormente, testou-se se a pontuação do afeto e da ativação na Self-Assessment Manikin, uma escala baseada em imagens, previa a pontuação na Feeling Scale e na Felt Arousal Scale em 47 desportistas recreativos portugueses, antes e depois de uma sessão de exercício. A Self-Assessment Manikin mostrou correlações moderadas a fortes com a Feeling Scale ($r = 0.70$ e $r = 0.56$, $p < 0.01$) e com a Felt Arousal Scale ($r = 0.65$ e $r = 0.72$, $p < 0.01$), e um poder preditivo substancial sobre a Feeling Scale ($R^2 = 47\%$ e $R^2 = 31\%$) e a Felt Arousal Scale ($R^2 = 42\%$ e $R^2 = 52\%$). A Feeling Scale e a Felt Arousal Scale são instrumentos válidos para medir o afeto e a ativação em desportistas recreativos portugueses.

Palavras chave: feeling scale, felt arousal scale, validade constructo, tradução, validade convergente.

INTRODUCTION

Affective responses to physical exercise are variable and sensitive to individual, environment, and task constraints (Box et al., 2020; Ekkekakis & Brand, 2019). There is evidence that exercising in nature environments induces greater positive affect than exercising indoors (Focht, 2009; Niedermeier et al., 2017), listening to music while exercising may also lead to increased positive feelings, and high intensity exercise typically affects mood in a negative way (Andrade et al., 2011; Jones et al., 2014). Furthermore, arousal is an important aspect of performance in sport (Córdoba et al., 2020; Moreno-Fernández et al., 2019). In short, one individual may experience increases as well as decreases in affect and arousal during an exercise session (Ekkekakis et al., 2011). To measure such fluctuating affective states, sport and exercise psychologists have at their disposal a large number of valid questionnaires and scales which in many instances have similarities and distinctions between them (Boyle et al., 2015). Some examples are the Exercise-induced Feeling Inventory (Gauvin & Rejeski, 1993), the Profile of Mood States (McNair et al., 1971), and the Positive and Negative Affect Scale (Watson et al., 1988). Such questionnaires assess self-perceptions usually verbalized in a sheet of paper or simply as a question from someone else (i.e. researcher, health professional, coach), and thus, are highly sensitive to language. Notable examples of extensively used affective scales in exercise and physical activity research are Hardy & Rejeski's (1989) Feeling Scale (FS), and Svebak & Murgatroyd's (1985) Felt Arousal Scale (FAS) (Evmenenko & Teixeira, 2020). Despite this prominence in affect/hedonism research, the FS and FAS have not yet been translated to Portuguese (Portugal) and have not had their psychometric

properties tested in Portuguese participants, which limits their usage in this sociolinguistic context. During the process of creation and validation of self-reported instruments, questionnaires and scales are designed and shaped by the designer's language and related culture. Thus, to make these useful instruments available to more cultural and linguistic contexts, rigorous language adaptations are needed, if evidence-based theories and interventions are to be generalizable to how humans behave in sport and exercise (Badenes-Ribera et al., 2020; Tenenbaum et al., 2012).

There is ongoing discussion regarding the ability of such short scales as the FS and FAS to capture complex mental phenomena (Hoepfner et al., 2011; Sarstedt & Wilczynski, 2009). However, single-item scales have been endorsed in the literature because they show strong correlations to multiple-item questionnaires measuring the same constructs. The one-item Fatigue Scale showed convergent validity with other more complex screening instruments (Temel et al., 2006). The Rating of Perceived Exertion (Borg, 1998) is a single-item perceived exertion scale which consistently shows strong correlations to physiological exertion markers (Arney et al., 2019; Canário-Lemos et al., 2020). Svebak and Murgatroyd (1985) showed that arousal states from the FAS were correlated with physiologic arousal of the body of participants, and the FS showed strong correlations to the Multiple Affective Adjective Check List (Zuckerman & Lubin, 1985). During the development and validation of the FS, Hardy and Rejeski (1989) discussed that the bipolarization of affective states during exercise may be governed by the central aspect of the pleasure/displeasure emotion, thus, the single-

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item FS was able to measure positive and negative affect accurately.

Exercise psychologists, coaches, health professionals and researchers would benefit from theory-supported and practical questionnaires that are able to assess mental states accurately and repeatedly during exercise interventions, without language barriers. To this end, the Feeling Scale and the Felt Arousal Scale are single-item scales which are suited to be used across cultures to assess exercise-related affective states, benefiting from theoretical support and practicality, provided they are demonstrably capable of capturing the same constructs across language and cultural barriers (Evmenenko & Teixeira, 2020), since both the FS and FAS have been used extensively in sport and exercise psychology research (Lacharite-Lemieux et al., 2015; Turner & Stevinson, 2017; White et al., 2015).

In the cross-cultural adaptation of questionnaires, construct validity, sensitivity, and internal consistency is important (Andrade et al., 2013). In the case of single-item scales such as the FS and the FAS, internal structure is not applicable and factor analysis is not possible (Cid et al., 2022). Consequently, establishing convergent construct validity by correlating the scores of the scale with validated questionnaires is an appropriate approach to test construct integrity (Tenenbaum et al., 2012). Additionally, regression analysis is recommended to test if the scores of the scale that is to be translated and adapted to a new language can be predicted by the scores of a scale of reference already measuring the construct of interest (Boateng et al., 2018). In the past, validations following this method were performed for single-item scales (Konrath et al., 2018; Yohannes et al., 2011).

To adapt the new instruments, a reference instrument that can demonstrably capture the construct of interest must be selected. In this case, the Self-Assessment Manikin (SAM) (Bradley & Lang, 1994; Lang, 1980) is a suitable scale that can be used as a reference instrument to measure affect and arousal. The SAM is a distinct instrument because its three items are displayed as pictures (pleasure, arousal, and dominance), relative to an object or event. Assuming that the meaning of positive and negative pictures is common and shared among cultures (at least western cultures), then the SAM is not limited to a particular country or language, and can thus be applied in wider

contexts than language-based questionnaires and scales (Bynion & Feldner, 2017). Bradley and Lang (1994) conducted a tested the content validity of the SAM with participants that rated the SAM and the Semantic Differential Scale (Mehrabian & Russel, 1974), an affective scale of 18 bipolar adjectives dispersed in three dimensions (pleasure, arousal and dominance). By using principal components analysis, they reported that the three factors of pleasure, arousal and dominance accounted for 24%, 23% and 12% of the variation, respectively. Additionally, the SAM scores were strongly correlated to the adjectives in the Semantic Differential Scale (above 0.90 in the affective and arousal dimensions). Thus, the SAM is valid to be used in multiple cultural settings, including in Portuguese participants, as has been used before (Monteiro et al., 2011; Soares et al., 2015).

To increase the availability of the FS and FAS for research and field use by exercise and health psychologists and researchers in Portuguese contexts, the aim of this study was to translate and test the construct validity of these scales in Portuguese exercisers. The FS, FAS, and SAM protocols and forms are freely available in repositories easily accessible from an online search. Nonetheless, permission for using these instruments was requested from the original developers (Bradley & Lang, 1994; Hardy & Rejeski, 1989; Svebak & Murgatroyd, 1985), which was kindly granted by all.

METHODS

This research is a two-phase design. First, a translation of the FS and FAS was conducted, which is described in the procedure section, followed by a construct validation study. The translation occurred in January 2021, and the data collection for the validation was collected during the months of March and April of 2021. This study was not preregistered. Approval was received from the Ethics Committee of the University (Grant no. 30/2020), in accordance with the Declaration of Helsinki.

Participants

Participants were recruited from gyms and fitness academies in Leiria district, Portugal, and students from a University in Lisbon. They were approached by the researchers in the minutes before they entered their exercise session of choice and were asked if they

would like to enrol in this study. A total of 47 recreational exercisers enrolled (21 male and 26 female), mean age 24.7 ± 9.6 years. All adult participants provided informed consent, and all under-aged participants had the consent signed from their parents. The diverse activities the participants were practicing when tested were a basketball class (university students; $n = 12$), a theatrical dance class (university students; $n = 13$), a recreational run (recreational runners; $n = 2$), a kickboxing class (students from a Kickboxing school; $n = 9$), a circuit training gym class (gym clients; $n = 6$), and a gym cycling class (gym clients; $n = 5$).

Instruments

The FS is a scale to measure self-perceptions of pleasure/displeasure during exercise through a single item, to which the participants respond on a scale from -5 (very bad) to + 5 (very good). Hardy and Rejeski (1989) confirmed the face and content validity of the FS by showing that participants engaging in exercise consistently related good feelings in the FS with positive adjectives, and negative feelings with negative adjectives, in the Multiple Affective Adjective Check List.

The FAS of the Telic State Measure (Svebak & Murgatroyd, 1985) is also a single-item scale to measure perceived arousal, ranging from 1 (low arousal) to 6 (high arousal). Arousal is a mental and physiologic state that may be felt in a multitude of ways. Low arousal may be expressed as relaxation, boredom, or calmness, and high arousal, expressed as excitement, anxiety, or anger (Svebak & Murgatroyd, 1985).

The SAM is scored from 1 to 9 in three items, representing low-to-high affect/arousal/dominance. The SAM is considered a practical and non-verbal method to quickly assess individual affective perceptions (Bradley & Lang, 1994; Lang et al., 1993).

Procedure

The translations of the FS and FAS into Portuguese were achieved by committee approach (Brislin, 1980). Four steps of the process were completed as follows: i) The original FS and FAS were translated from the English language to the Portuguese language by the authors. ii) Three exercise and sport psychology

academics experienced in psychometrics analysed the preliminary versions of first translations, resulting in revised versions of the scales. iii) The revised versions were shown to three more specialists in the psychology and exercise research fields, who suggested further changes that were promptly discussed by the authors. iv) A pilot study was then conducted with the latest versions. The FS and FAS were scored by 16 bilingual college students, who were recreational exercisers, to test English-Portuguese syntax and comprehension. There was 100% correspondence between the ratings in the Portuguese and English versions of the FS and FAS in the 16 students. The researchers and the specialist panels straightforwardly achieved consensus during the four steps of the translation process. Since the FS and the FAS are single-item scales, the fifth and final step of Brislin's methodology was not carried out.

For the FS and FAS construct validation phase, gyms and fitness academies were visited by the researchers to recruit participants. Once the sample of 47 recreational exercisers was recruited, they were assessed for affect and arousal previously, and after an exercise session, via FS, FAS, and SAM. The exercise sessions were 45-60 minutes long, they addressed different types of exercise, and although the exercise intensity was not monitored by the researchers, they were standard classes which according to ACSM (2018) amount to moderate-to-vigorous intensity (64-94% maximal heart rate). Five minutes before exercise, the researchers handed a sheet of paper comprised the FS, the FAS, and the SAM, which included a brief description explaining each scale to the participants. A new sheet was handed to the participants for the post-exercise assessment. The researchers offered a brief description to the participants about the scores of the scales, as described in Bradley and Lang (1994). For example, in the FS, to score the positive end of the scale meant they were 'happy, pleased, satisfied, contented, hopeful, or relaxed', and to score the negative end means they were 'unhappy, annoyed, unsatisfied, melancholic, despairing, or bored'.

Data analysis

Using SPSS and Excel, linear regressions were conducted, with SAM as the independent variable, and FS and FAS as the dependent variables. The pre- and post-assessment data were analysed independently

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(FS-SAM pre-exercise, FS-SAM post-exercise, FAS-SAM pre-exercise, FAS-SAM post-exercise). The data from the FS was converted from the original scoring to all positive numbers (from 1 to 11), to eliminate the negative and zero values which might confound the analysis. The FAS and SAM values were input as the original scoring. Probability-probability and residuals plots were drawn for the dependent variables, to check heteroscedasticity of the data. The coefficient of determination (R^2) was used to calculate the amount of variance (in percentage) that is explained in the FS and FAS by the SAM (i.e. how much movement in the FS and FAS is explained by movement in the SAM affect and arousal items). The values of the FS and the FAS were predicted based on the slope and intercept values.

RESULTS

One participant was excluded from the FS analyses due to incorrect filling of the scales. The linear regression scatter plots for the pre-exercise (Figure 1) and post-exercise (Figure 2) assessments, and the respective regression equations are presented below. Pearson Correlations, slopes, and intercept values are shown in table 1, including the 95% confidence intervals. The predictions of the FS and FAS based on correspondence with the SAM reference is displayed in table 2.

Pre-exercise assessment

The FS showed a strong correlation with the SAM affect item ($r = .697$, $p < 0.001$). The SAM affect item explained 49% of the variance in FS scores ($R^2 = .486$). The lower, middle, and higher ends of the SAM affect item (1, 5, and 9 values) corresponded

respectively to -1.6, +1.6, and +4.8 in the FS. The FAS showed a strong correlation with the SAM arousal item ($r = .651$, $p < 0.001$). The SAM arousal item explained 42% of the variance in FAS scores ($R^2 = .424$). The lower and higher ends of the SAM arousal item (1 and 9 values) corresponded respectively to 2.3 and 5.5 in the FAS.

Post-exercise assessment

The FS showed a moderate correlation with the SAM affect item ($r = .556$, $p < 0.001$). The SAM affect item explained 31% of the variance in FS scores ($R^2 = .309$). The lower, middle, and higher ends of the SAM affect item corresponded respectively to -1.3, +1.6, and +4.5 in the FS. The FAS showed a high correlation with the SAM arousal item ($r = .719$, $p < 0.001$). The SAM arousal item explained 52% of the variance in FS scores ($R^2 = .517$). The lower and higher ends of the SAM arousal item corresponded respectively to 2.6 and 5.7 in the FAS.

DISCUSSION

The aim of this study was to translate and test the construct validity of the Portuguese versions of the FS and FAS, using the SAM as the reference instrument, in Portuguese recreational exercisers. Correlations and linear regressions were conducted and predictions of the FS and FAS ratings according to the reference scale were calculated. The hypothesis of this study was that the FS and the affect item of the SAM would measure the same constructs, thus, it was expected that the same individual would score these homologous scales identically, regardless of the value range of the

Table 1. Linear Regression data from the FS-SAM and FAS-SAM time-point analyses.

	n	Pearson	R^2	intercept	95% CI	slope	95% CI	mean
		Correlation			(intercept)		(slope)	residual
FS pre-exercise	46	0.697*	0.486	3.647*	1.179, 5.503	0.790*	0.543, 1.036	0
FS post-exercise	46	0.556*	0.309	4.022*	1.439, 6.605	0.717*	0.392, 1.043	0
FAS pre-exercise	47	0.651*	0.424	1.854*	1.070, 2.637	0.404*	0.263, 0.546	0
FAS post-exercise	47	0.719*	0.517	2.195*	1.459, 2.932	0.391*	0.278, 0.505	0

Note: FS – Feeling Scale, FAS – Felt Arousal Scale, n – Number of participants, CI – Confidence Intervals, * $p < 0.01$

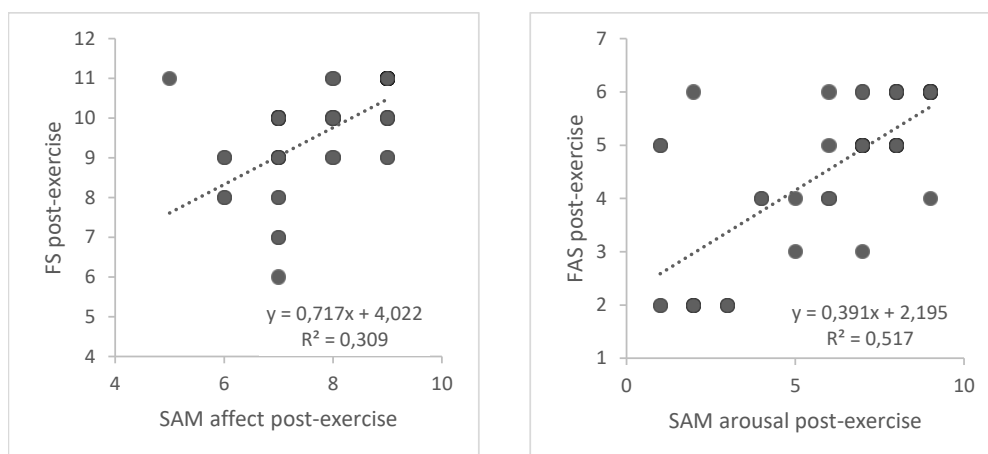


Figure 2. Post-exercise scatter plots with slope and intercept values. FS – Feeling Scale; FAS – Felt Arousal Scale; FS increases 0.7 and FAS increases 0.4 for each point increase in the homologous items of the SAM

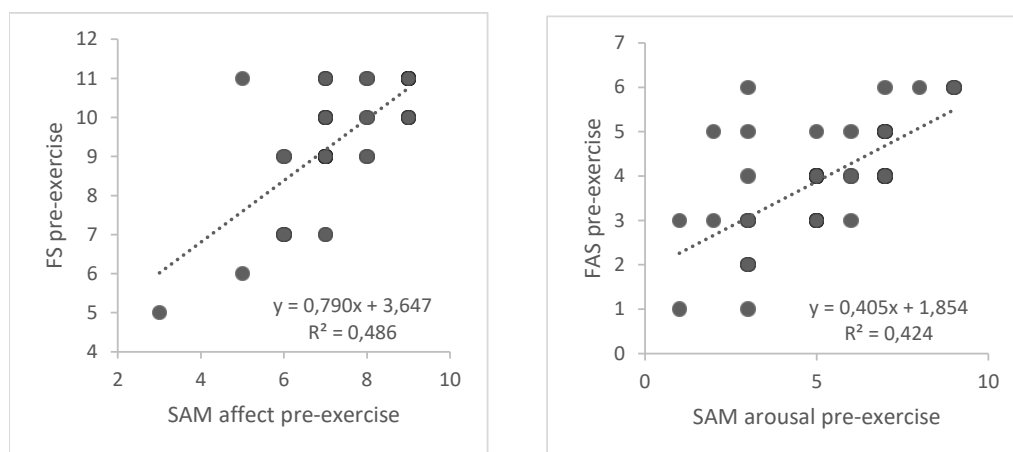


Figure 1. Pre-exercise scatter plots with slope and intercept values. FS – Feeling Scale; FAS – Felt Arousal Scale; FS increases 0.8 and FAS increases 0.4 for each point increase in the homologous items of the SAM.

scales. The same was hypothesized to be true about the FAS and the arousal scale of the SAM.

The FS and FAS are two important scales in the study of affective valence during exercise that have been widely used in international exercise psychology studies (Evmenenko & Teixeira, 2020). The translation and validation of these instruments and others into multiple cultural settings allows their dissemination and contributes to an increasing body of knowledge on the topic of affective response in the exercise context (Batista et al., 2019; Rodrigues et al., 2020). This study used a method similar to that of other authors who translated and validated the

contents of FS and FAS to the German language by correlation with the SAM, which, similarly to this study, showed moderate-to-strong correlations ($r = 0.72$ to 0.73 for FS and SAM, and $r = 0.50$ to 0.62 for FAS and SAM) (Maibach et al., 2020). In that study, the authors employed the scales at various time-points during exercise, whereas in this study only the assessments before and after the exercise were recorded. Despite this difference in design between the two studies, the results here do not suffer from not screening the subjects during exercise, as the aim of this study was not to measure affective valence, but to test the construct validity of the FS and FAS as opposed to a homologous scale of reference.

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Table 2. Linear regression prediction of FS and FAS ratings by correspondence to reference SAM ratings.

Pre-exercise assessment									
SAM (affect)	1	2	3	4	5	6	7	8	9
FS	-2.44	-1.23	0.02	0.81	1.6	2.39	3.18	3.97	4.76
SAM (arousal)	1	2	3	4	5	6	7	8	9
FAS	2.25	2.65	3.05	3.45	3.85	4.25	4.65	5.05	5.45
Post-exercise assessment									
SAM (affect)	1	2	3	4	5	6	7	8	9
FS	-2.74	-1.46	0.18	0.90	1.62	2.34	3.06	3.78	4.50
SAM (arousal)	1	2	3	4	5	6	7	8	9
FAS	2.59	2.98	3.37	3.76	4.15	4.54	4.93	5.32	5.71

Note: SAM – Self-Assessment Manikin; FS – Feeling Scale (min = -5, max = +5); FAS – Felt Arousal Scale (min = 1, max = 6).

Furthermore, in this study, the correlation values between the FS/FAS and SAM remained strong in two distinct moments in terms of physical exertion (i.e. before and after exercise). Furthermore, the SAM scales revealed a substantial predictive power over the FS and FAS, suggesting that the scales share the same constructs.

In spite of the potential utility of these instruments, there is some discussion that their single-item structure prevents the identification of factors that may influence the exercisers' affective valence. Engaging in physical activity may also cause negative experiences such as fear, breathlessness, and pain, despite it being widely associated to greater wellbeing (Ekkekakis et al., 2011). However, they offer a general measure of pleasure/displeasure and arousal that are the result of a set of positive and negative feelings related to engaging in physical activities and exercise. Most researchers of affective phenomena include at least the two dimensions of affective valence and arousal in their models (Mehrabian and Russel, 1974; Thayer, 1989) and according to Ekkekakis and Petruzzello (2002), "different affective states are considered combinations of varying degrees of these two constituent dimensions" (p. 38). Thus, these instruments gain other advantages in comparison to more complex affective scales and questionnaires, since they are quicker to rate, are able to capture affective state, and thus are easier to employ during

exercise, as opposed to complex, time-consuming questionnaires which may impact the exercise interventions.

Another particular advantage of having the FS and FAS as available instruments for research and field use, is that the scores of both scales in an individual may be plotted as an affect-arousal (x,y) 'affective space', which is known as the circumplex model, which has been applied in several contexts, including physical exercise (Evmenenko & Teixeira, 2020; Niedermeier et al., 2017). Thus, increasing the availability of practical and valid instruments like the FS and FAS will allow for the application of the circumplex model more widely.

As limitations in this study, the SAM did not predict the lower ends of the FS and FAS accurately. This is probably because there were no observations of extremely low affect or arousal in the sample, since the participants were probably engaging in their favourite past-time activities. It is inferred that if there had been more negative scorings in the scales it would have helped the linear prediction even further, since the predictions were positive, nonetheless. Another limitation were the successive lockdowns during the Covid-19 pandemic, which imposed limitations on the researchers, ultimately denying reliability analyses (test-retest). However, one could infer that if construct validity has been obtained in correspondence to the

original English versions of the scales, then reliability of the newly translated version ought to be similar to the original versions as well, although it is acknowledged that reliability testing is needed to reach definitive validation.

Further validation of these scales is warranted and should focus on recruiting other samples, such as the elderly or sedentary individuals, as well as designing trials where the scales are scored during high intensity activities to produce more negative scorings in the scales. Alternatively, researchers can manipulate the participants towards negative affect and arousal prior to engaging in exercise, to improve the predictive power of the SAM over the FS and the FAS. Also, reliability tests should be conducted by replicating the exercise with the same participants, although these scales capture extremely variable behavior, i.e. affect is known to rise and fall substantially within individuals in short periods of time (Brose et al., 2020).

CONCLUSION

This study shows that the Portuguese translated versions of FS and FAS capture the constructs of affect and arousal and may be used to assess these psychological states in Portuguese recreational exercisers. The translated forms are available as supplemental material.

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DISCLOSURE STATEMENT

The authors report there are no competing interests to declare.

DATA AVAILABILITY STATEMENT

Data and materials from this study are available as supplemental material, or by contacting the main author.

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