Cuadernos de Psicología del Deporte, vol. 22, 2, 85-98
Recibido: 17/11/2020
Aceptado: 05/10/2021

Murcia (España) ISSN edición impresa: 1578-8423
ISSN edición web (*http://revistas.um.es/cpd*): 1989-5879

Cita: Rica, R.; Solar, M.; Sepúlveda, A. R. (2022). Validation of the Spanish Compulsive Exercise Test Version in Male University Students: A Confirmatory Factor Analysis and invariance study. *Cuadernos de Psicología del Deporte,* 22(2), 85-98

Validación de la versión española del Test de Ejercicio Compulsivo en varones universitarios: Análisis Factorial Confirmatorio y un estudio de invarianza

Validation of the Spanish Compulsive Exercise Test Version in Male University Students: A Confirmatory Factor Analysis and invariance study

Validação da versão espahola do Teste de Exercício Compulsivo em estudantes universitários do sexo masculino: uma análise fatorial confirmatória e estudo da sua invariância

Rica, R.[1], Solar, M[1], & Sepúlveda, A.R.[1]

[1]*Autonomous University of Madrid, Madrid, Spain*

RESUMEN

Los varones son mas vulnerables a realizar conductas patológicas relacionadas con el ejercicio físico. El Cuestionario de Ejercicio Compulsivo (CET) es una de las medidas mas utilizadas sobre ejercicio patológico. Sin embargo, existen algunas inconsistencias con respecto a sus propiedades psicométricas, especialmente en muestras masculinas. El objetivo fue evaluar las propiedades psicométricas de la versión española del CET en una muestra representativa de varones. Un total de 750 estudiantes universitarios varones respondieron al CET junto con el Inventario Revisado de Obsesividad-Compulsividad, Inventario de Trastorno Dismórfico Muscular y Cuestionario Internacional de Actividad Física. Para evaluar la estructura interna, se probaron dos modelos mediante Análisis Factorial Confirmatorio. Se estudió la invarianza de la escala en función del nivel competitivo, la consistencia interna, la validez convergente y concurrente. Los resultados no replicaron la estructura original de cinco factores. Por el contrario, se apoyó una solución de tres factores, así como la invarianza de la escala. La validez convergente y concurrente fue confirmada por la correlación con la sintomatología de dismorfia muscular, la obsesividad y el ejercicio físico vigoroso. La escala muestra buena consistencia interna. La versión española del CET es un instrumento fiable y válido, aunque se requiere de mayor investigación que aborde las cogniciones y conductas patológicas relacionadas con el ejercicio compulsivo, que afectan mayoritariamente a los varones.

Palabras clave: CET; Trastornos de conducta alimentaria en varones; Dismorfia Muscular; Fiabilidad, invarianza de la medida.

ABSTRACT

Men are more vulnerable to engaging in pathological behaviors related to physical exercise. Compulsive Exercise Test (CET) is one of the most used measures of pathological exercise. However, there are some inconsistencies

Correspondence to: **Robin Rica.** Dirección Postal: C. Iván Pavlov, 6, 28049 Madrid.
Tel: 914 97 40 46. Email: rica.robin@gmail.com

regarding their psychometric properties, especially in male samples. The aim was to psychometrically evaluate the Spanish version of the CET in a representative sample of Spanish males. A total 750 male university students answered to the CET together with the Obsessive-Compulsive Inventory Revised, Muscle Dysmorphic Disorder Inventory and International Physical Activity Questionnaire. To assess the internal structure, two models of the CET were tested by confirmatory factor analysis. Measurement invariance by competitive level, internal consistency, convergent and concurrent validity was also studied. Results did not replicate the original five-factor. In contrast, the three-factor solution was supported, as well as the measurement invariance. Convergent and concurrent validity was confirmed by correlations with muscle dysmorphia symptomatology, obsessiveness, and vigorous physical activity. Adequate levels of internal consistency were shown for the scale. The Spanish CET is a reliable and valid instrument although further research is required addressing specific problematic cognitions and behaviors related to compulsive exercise, which affects mainly males.

Keywords: CET; males eating disorders; muscle dysmorphia; reliability; measurement invariance.

RESUMO

Os varões são mais vulneráveis a comportamentos patológicos relacionados com o exercício físico. O Teste de Exercício Compulsivo (Compulsive Exercise Test, CET, em Inglês) é uma das medidas de exercício patológico mais amplamente utilizadas. Contudo, existem algumas inconsistências no que diz respeito às suas propriedades psicométricas, especialmente em amostras masculinas. O objetivo era avaliar as propriedades psicométricas da versão espanhola do CET numa amostra representativa de homens. 750 estudantes universitários varões responderam ao CET juntamente com o Inventário Obsessivo-Compulsivo Revisado, Inventário de Desordens Dismórficas Musculares e o Questionário Internacional de Actividade Física. Para avaliar a estrutura interna, dois modelos foram testados por Análise Confirmativa de Fatores. A invariância da escala também foi estudada em função do nível competitivo, da consistência interna, e da validade da convergência e concorrente. Os resultados não reproduziram a estrutura original de cinco fatores. Mas em vez disso, foi mostrada a solução de três fatores, bem como a invariância da escala. A validade convergente e simultânea foi confirmada pela correlação com a sintomatologia da dismorfia muscular, obsessividade e exercício físico vigoroso. A escala mostra uma boa consistência interna. A versão espanhola do CET é um instrumento fiável e válido, embora seja necessária mais investigação para abordar os comportamentos cognitivos e patológicos relacionados com o exercício compulsivo, que afetam sobretudo aos homens.

Palavras chave: CET; transtornos alimentares masculinos; dismorfia muscular; confiabilidade; invariância da medição.

INTRODUCTION

Regular physical exercise has many well-known physical and psychological benefits (Nogueira et al., 2017; Reiner et al., 2013). However, exercise can also be detrimental when it reaches pathological or compulsive levels: individuals may train at higher intensity or frequency levels than recommended or continue training despite injury (Pope et al., 2000). Indeed, compulsive exercise is a frequent symptom of several disorders, such as eating disorders (ED) or muscle dysmorphia (MD), and has received several names, such as exercise dependence, exercise addiction or compulsive exercise (Cunningham et al., 2016; Melissa et al., 2020; Nogueira et al., 2017; Olave et al., 2021).

Compulsive exercise is a repetitive and rigid behavior whose function is to relieve anxiety and avoid feared situations in response to obsessions (mostly related to body appearance), and which is difficult to stop practicing despite its consequences (Taranis et al., 2011). Compulsive exercise, both in non-clinical samples and in clinical samples of ED has been consistently associated with disordered eating to control body weight, mood dysregulation, compulsivity, perfectionism, and rigidity (Meyer et al., 2011; Trott et al., 2020). Compulsiveness has also been associated with excessive exercise in samples of community adolescents (Goodwin et al., 2011; Orrit, 2019), community exercisers (Gulker et al., 2001), ED patients (Naylor et al., 2011; Young et al., 2018) and males diagnosed with MD (Murray et al., 2012).

Despite this, the psychological relationship that the person maintains with exercise (e.g., anxiety about the possibility of not training) provides better information as a predictor of psychopathology than the amount of physical exercise performed (Scharmer et al., 2020).

Considering the negative effects and the disorders associated with compulsive exercise, it is important to have appropriate measurement instruments with which to assess it. The Compulsive Exercise Test (CET; Taranis et al., 2011) is one of the most widely used multidimensional measures of pathological or compulsive exercise. In the original validation carried out in a sample of 367 university female exercisers, the final scale comprised 24-item using 6-point Likert self-report response alternatives, and five factors were identified through an exploratory factor analysis: (1) Avoidance and rule-driven behavior (8 items), (2) Weight control exercise (5 items), (3) Mood improvement (5 items), (4) Lack of exercise enjoyment (3 items) and (5) Exercise rigidity (3 items). The CET showed good internal consistency (range: α = .71 to .81), and good convergent and concurrent validity with other measures of pathological exercise and eating psychopathology (Taranis et al., 2011).

The factorial structure of the CET has been explored in several samples with different results. The original five-factor structure has been supported in a sample of 356 women with ED and 360 healthy women aged 16 to 60 years (Meyer et al., 2016), in a sample of 104 adolescents with ED (7% males) (Formby et al., 2014) and in a community sample of 1012 adolescents aged 12 to 14 years (45.3% males) (Goodwin et al., 2011). However, Swenne (2016), in a clinical sample of 212 adolescents with ED, found a four-factor solution more appropriate. In contrast, a three-factor model was found to be more suitable in a sample of 689 competitive athletes of both sexes (37.4% males) (Plateau et al., 2014). Thus, the underlying structure of the scale appears to be a source of confusion as contradictory results emerge.

Sauchelli et al. (2016) carried out the first validation of the Spanish version of the CET in a mixed sample of 157 patients with an ED and 128 healthy university students, in which only 57 (20.3%) were men and 43 of them belonged to the control group. The CET showed good internal consistency, between .79 to .96 for the whole sample, its scores were associated with ED symptoms and general psychopathology measures, and the five-factor solution was supported through a confirmatory factor analysis. However, regarding the males in the sample, the validation used what can be considered as a small sample, thus there is reason to believe that the factor structure may not have been adequately confirmed for males.

Men tend to perform more physical exercise than women, both recreationally and competitively (Piercy et al., 2018), and may be more vulnerable to engaging in pathological behaviors related to physical exercise (Pope et al., 2000). These behaviors in many cases are oriented to modify body weight, increasing it (i.e., via muscle mass) or decreasing it. A recent study with more than a thousand male university students showed that more than 44% were not satisfied with their weight and would like to modify it in some way (Gorbeña et al., 2021). On the other hand, practicing sports, especially when competing, can generate stress and psychological demands that require personal coping resources (Almeida Pereira et al., 2020). Likewise, competitive sports may generate high anxiety, associated more with sports that require closed skills, such as athleticism or swimming, compared to other sports that require open skills (e.g., football) (Pons et al., 2020). In this vein, studies that have been carried out amongst competitive athletes have also shown high levels of body dissatisfaction, higher striving for perfection (Atienza et al., 2020), vulnerability to ED and substance use (Souter et al., 2018), including anabolic steroids (Pope et al., 2000). Surprisingly, recreational exercisers (non-competitive) have also reported a high weekly training frequency, such as in the study by Freire et al. (2021) who examined 159 running or crossfit practitioners, concluding that weekly training frequency appeared to be an intervening factor in the degree of compulsive exercise among recreational exercisers, explaining an unexpected 57 % of the variance. On the contrary, other studies that have been carried out in male athlete samples have not found differences between competitive athletes and recreational exercisers in the use of extreme weight control behaviors (Gorrell et al., 2019) and levels of exercise dependence (Menczel et al., 2017).

In summary, the CET is a multidimensional questionnaire that apparently presents adequate psychometric properties, albeit with inconsistencies, especially regarding its factor structure. Although CET has been studied in female and mixed samples, in

the latter the percentage of males has been limited (e.g., Goodwin et al., 2011; Plateau et al., 2014). To our knowledge, the psychometrics of the scale in a large and arguably adequate sample of males has not yet been examined in any country or language. Hence, this study has attempted to fill this apparent gap in compulsive exercising research. Thus, the main purpose of our study was to examine the psychometric properties of the CET in a sample of young males. The aims were: (a) to assess the factor structure of the scale, (b) to evaluate its measurement invariance as a function of the competitive level, (c) to evaluate its reliability, (d) to examine the concurrent validity with MD symptomatology and obsessive-compulsiveness, and (e) to examine the convergent validity with the amount of vigorous physical activity. We hypothesized that: (1) the original five-factor solution would be supported in the whole sample, (2) the scale would not be invariant for competitive and non-competitive exercisers, (3) the test would show good reliability and (4) greater levels of compulsive exercise would be associated with greater obsessive-compulsiveness and MD symptomatology, and with a greater amount of vigorous physical activity.

MATERIAL AND METHOD

Design

Instrumental research with a cross-sectional design based on an epidemiologic study of the prevalence of eating disorders (ED) and the prevalence of population at risk of muscle dysmorphia (MD) among male university students. To achieve a representative sample of the university campus by academic year and school, the sample design was proportionally stratified according to academic year and school, assuming a 95% confidence interval and 0.05 of sampling error. The survey was carried out in a sample of male students enrolled in the first and fourth academic year, between 2016-19 academic years. Of the 21 schools on campus, 5 schools with the highest number of male students enrolled were selected (i.e., over 70%). A total of 1634 students were targeted. A total of 1088 students were identified as the desired sample size. The final sample collected consisted of 850 Spanish male university students (i.e., 78,1% response rate).

Participants

After removing all non-Spanish students and incomplete responders (n = 100), the final sample consisted of 750 Spanish male university students from different degrees of Autonomous University of Madrid: (1) Physical Activity and Sports Sciences (*n = 246*), (2) Physics (*n = 85*), (3) Economics (*n = 153*), (4) Computer Engineering (*n = 105*) and (5) Business Administration and Management (*n = 161*). The mean age of the sample was 19.8 (*SD* = 2.8). 504 participants (67.2 %) practiced sports at a non-competitive level (recreational exercisers) and the remaining 246 (32.8 %) competed at a national or international level in some sport (e.g., football, swimming). The mean Body Mass Index (BMI) was 22.44 (*SD* = 2.85).

Measures

In addition to the CET., participants completed the following questionnaires:

a) Demographic and personal data. Students answered a set of questions regarding their age, nationality and whether they exercised. Students that exercised were also asked whether they partook in organized sporting competitions. In addition, participants reported their height and their weight, allowing us to calculate the Body Mass Index (BMI; kg/m^2).

b) Muscle Dysmorphic Disorder Inventory (MDDI; Hildebrandt et al., 2004): Questionnaire of 13 items with a response range from 1 (*never*) to 5 (*always*) that evaluates body dissatisfaction from a male perspective related to muscle development. Likewise, the MDDI is divided into three subscales: drive for size (DFS), appearance intolerance (AI) and functional impairment (FI). The original version showed adequate reliability indexes (range: α = .77-.85), as well as the Spanish version (range: α = .73-.85) (Sepúlveda et al., 2019). The internal consistency in the current sample for the MDDI total score was omega = .83.

c) Obsessive-Compulsive Inventory Revised (OCI-R; Foa et al., 2002): 18-item questionnaire that assesses the distress associated with obsessive-compulsive disorder (OCD) symptoms. Participants rate the degree of distress experienced in the last month in the situations described by the items using a 5-point Likert

scale from 0 (*not at all*) to 4 (*extremely*). The total score is the sum of all items, with higher scores indicating greater OCD symptomatology. The Spanish version showed good internal consistency (α = .86) and adequate validity (Fullana et al., 2005). The internal consistency in the current sample for the OCI-R total score was omega = .85.

d) International Physical Activity Questionnaire-Short Form (IPAQ-S; IPAQ Research Committee, 2005): 7-item questionnaire that assesses the dimensions of physical activity in adult populations in several domains (leisure time, housework, work-related activity and transportation), with six items measuring the frequency and duration in the last seven days of three types of physical activity (walking, moderate-intensity and vigorous-intensity activity). The scores were computed by multiplying the minutes per week of walking, moderate activity and vigorous activity by the intensity of a metabolically equivalent task (MET). The IPAQ-S has shown modest convergent validity with objective measures of exercise in international (Craig et al., 2003) and Spanish adult samples (Román-Viñas et al., 2010).

Procedure

The tests were collectively administered and completed individually after obtaining informed consent, emphasizing voluntary participation, confidentiality and anonymity of responses. Participants responded at the classroom at the same time and could choose between electronic or paper format. The battery could be completed in 45 to 60 minutes. Permission to conduct the study was granted by the deans of the university and the participants' professors.

The translation into Spanish was conducted using a back-translation procedure (Brislin, 1970; Muñiz & Bartram, 2007). First, two psychologists translated the English items into Spanish. Second, Spanish items were back translated into English by another bilingual psychologist independently. Third, the three psychologists discussed the adequacy of the items: if the back-translated and the original items were identical, these items were retained; but if there were any discrepancies between them, their content was discussed to determine the definitive version.

Since the CET Spanish validation study conducted by Sauchelli et al. (2016) was published after we started our investigation (November 2016), we used our translated version (September 2016). Our items were compared to Sauchelli's to check any differences and we concluded that both versions were equivalent in their general meaning, so results are comparable.

Statistical Analysis

Statistical analyses were carried out using SPSS 25.0, Mplus 7.11 and RStudio, employing the MNV package (Korkmaz et al., 2014), and the psych package (Revelle, 2020). Descriptive statistics (mean ± standard deviation) were calculated for the total CET and its subscales, the total OCI-R, the MDDI and the IPAQ-S vigorous-exercise subscale. The Mardia's test revealed that the CET did not follow a multivariate normal distribution (skewness = 7253.04, p <.001; kurtosis = 43.60, p <.001). Moreover, Kolmogorov-Smirnov tests showed that all scale scores were not normally distributed.

In order to assess the internal structure of the CET, confirmatory factor analyses (CFA) were carried out. Three models were tested: (1) the original five-factor solution (Taranis et al., 2011), (2) a four-factor solution where Mood improvement factor includes its original items and Lack of exercise enjoyment items, and (3) the alternative three-factor model (Plateau et al., 2014), which includes 15 items regarding Avoidance of negative affect (6 items), Weight control exercise (4 items) and Mood improvement (5 items). Additionally, the five-factor solution was also tested using the Exploratory Structural Equation Modeling (ESEM) approach with Target rotation (Asparouhov & Muthén, 2009). Since data were ordinal with more than five categories and non-normal, all analyses were carried out using Robust Maximum Likelihood (MLR) with robust (Hubert-White) standard errors. Several fit indexes were considered: The Root Mean Square Error of Approximation (RMSEA) and its 90% confidence interval, the Tucker Lewis index (TLI), the Comparative Fit Index (CFI) and the Standardized Root Mean Square Residual (SRMR). It is considered that the model has good fit when RMSEA and SRMR values are below .06, although RMSEA values ≤ .08 are deemed as reasonable fit (Browne & Cudeck, 1993), and CFI and TLI values are above .95 (Hu & Bentler, 1999).

The measurement invariance (i.e., the equivalence between non-competitive and competitive exercisers in terms of the factor structure, factor loadings and factor intercepts of the model) of the retained CET factor model (see Figure 1) was tested using multigroup CFA (MG-CFA) and the alignment method (Asparouhov & Muthén, 2014) with MLR estimation. We tested three levels of invariance: (1) configural invariance (i.e., the factor structure is the same in both groups), (2) metric invariance (i.e., factor loadings are equal in both subsamples) and (3) scalar invariance (i.e., item intercepts are equal in both groups) (Horn & McArdle, 1992; Meredith, 1993). In MG-CFA analyses, we considered RMSEA, CFI and TLI indexes to assess the fit of each invariance model, and we used ΔCFI and ΔRMSEA to examine the plausibility of both metric and scalar invariance. With two groups, it is considered that ΔCFI smaller in magnitude than -.010 and ΔRMSEA ≤ .015 support metric and scalar invariance (Chen, 2007).

The internal consistency for the CET-S and its subscales was evaluated using omega coefficient (McDonald, 1999). In addition, their convergent and concurrent validity were assessed by Spearman correlations with the OCI-R, MDDI and IPAQ-S vigorous-exercise scores.

Data availability

Data associated with the paper is not publicly available but is available from the corresponding author on reasonable request.

Compliance with ethical standards

All procedures in the current study were in accordance with the ethical standards of the institutional research committee (Ethics Committee of the Autonomous University of Madrid, CEI-75-1368) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study, highlighting the voluntary participation, confidentiality and anonymity of the responses.

RESULTS

Confirmatory factor analysis and exploratory structural equation model

Fit statistics for each model are presented in Table 1. The five-factor model structure proposed by Taranis et al. (2011) showed poor fit to our data, as our fit indexes were far from recommended cut-off points. Furthermore, this model showed convergence problems, indicating that this model was not adequate. A more thorough investigation showed that two items were problematic: Item 8 ("*I do not exercise to be slim"*) and item 21 ("*I do not enjoy exercising*"). Both items had low inter-item correlations (below .30) and low corrected item-rest correlations (r_{8X}^{c} = .03; r_{21X}^{c} = -.06). These items have shown poor performance in other CET validations (e.g., Formby et al., 2014; Plateau et al., 2014; Sauchelli et al., 2016). Thus, they were removed from further analyses.

A five-factor model with 22 items was then tested. This new model was also problematic, with a non-positive definite latent variable covariance matrix. Several factor correlations were extremely large, above .90 or even 1.00 (the standardized correlation between Lack of exercise enjoyment and Mood improvement was 1.43). Thus, this model was not adequate for our data. Then, we tested the same model using the ESEM approach with Target rotation (Asparouhov & Muthén, 2009), but fit was not adequate. Furthermore, there were several significant zero-target cross-loadings.

Given the previous results for the five-factor model and considering that several modification indexes suggested an overlap between Lack of exercise enjoyment and Mood improvement factors, a four-factor solution (Avoidance of negative affect, Weight control exercise, Mood improvement and Exercise rigidity) with 22 items was tested, where Mood improvement included 7 items (5 from Mood improvement plus 2 from Lack of exercise enjoyment). However, this model showed also poor fit to our data

Therefore, we tested the three-factor model (Avoidance of negative affect, Weight control exercise and Mood improvement) proposed by Plateau et al. (2014). This model showed the best fit to our data (see Table 1), which could be considered adequate. Thus, this last three-factor model was retained (see Figure 1).

Models	χ^2 *(g.l.)*	*RMSEA [C.I.; 90%]*	*CFI*	*TLI*	*SRMR*
Five-factor model (Taranis *et al.*, 2011; 24-items)	1204.52 (242)	.073 [.069; .077]	.866	.847	.099
Five-factor model (22-items)			Not positive definite matrix		
Five-factor ESEM model (22-items)	298.75 (63)	.074 [.068; .079]	.921	.861	.020
Four-factor model (22-items)	1073.80 (203)	.076 [.071; .080]	.872	.854	.086
Three factor model (Plateau *et al.*, 2014; 15-items)	391.04 (87)	.068 [.061; .075]	.934	.920	.059

Table 1. Fit index values for the tested models (*n = 750*).

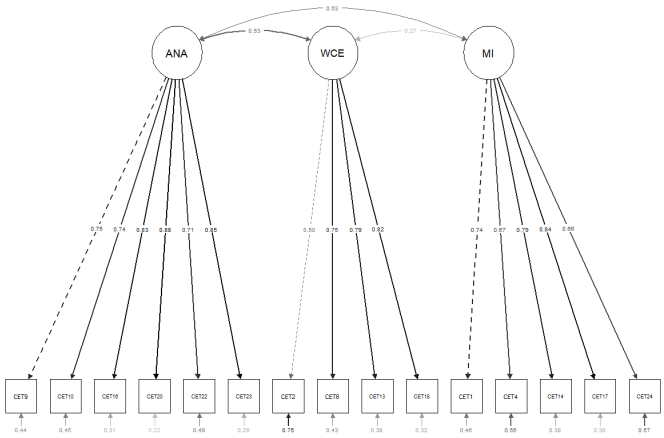

Figure 1. Retained factor model (three-factor 15-item) for the Compulsive Exercise Test (CET) in Spanish males (*n = 750*).

Measurement invariance

Although the three-factor model of 15-items appeared to be adequate for the total sample, Plateau et al. (2014) proposed this model only for competitive athlete populations. Since our sample included both non-competitive and competitive exercisers, we first tested independently the internal structure of the CET in the two subsamples, to examine if the same factor structure was supported for both groups. Only the three-factor model with 15 items was tested (see Table 2).

Subsample	χ^2 *(g.l.)*	*RMSEA [C.I.; 90%]*	*CFI*	*TLI*	*SRMR*
Non-competitive exercisers (*n = 504*)	332.81 (87)	.075 [.066; .083]	.922	.906	.068
Competitive exercisers (*n = 246*)	178.85 (87)	.066 [.052; .079]	.936	.923	.063

Table 2. Fit index values for the three-factor model of CET.

The reduced three-factor model showed an acceptable fit in both non-competitive and competitive exercisers. Thus, we next examined the measurement invariance of this model using MG-CFA and testing configural, metric, and scalar invariance (see Table 3). The configural invariance model showed adequate fit to our data, supporting the configural invariance of the three-factor 15-item CET. The fit of the metric and scalar invariance models was also adequate. Furthermore, the ΔCFI and ΔRMSEA values were below the recommended cut-off points in both cases. Thus, scalar invariance for the CET retained model was supported for the male university sample.

Level of measurement invariance	χ^2 *(g.l.)*	*RMSEA*	*CFI*	*TLI*	*ΔCFI*	*ΔRMSEA*
Configural invariance	521.79 (174)	.072	.926	.911	-	-
Metric invariance	548.07 (186)	.072	.923	.913	-.003	-
Scalar invariance	597.69 (198)	.073	.915	.910	-.007	.001

Table 3. Fit indexes for measurement invariance models of CET with 15-items.

Additionally, we carried out the alignment method to examine if there were some loadings or intercepts of particular items that were non-invariant between both groups. We initially used a FREE approach, but this analysis provided a standard error warning, so we used a FIXED approach (Asparouhov & Muthén, 2014), with the non-competitive exercisers as the reference group. Results from this analysis showed that only the intercept of item 2 (*I exercise to improve my appearance*) was non-invariant, which had the higher absolute fit function contribution. All remaining parameters (loadings and intercepts) were deemed as invariant, further supporting the measurement invariance of the CET in our sample.

Descriptive statistics, internal consistency, convergent, and concurrent validity

Means, standard deviations and internal consistency for all measures, as well as correlations among all evaluated variables, are presented in Table 4. The CET-S and its subscales showed good to excellent internal consistency, with omega coefficient values above .80.

Regarding the convergent validity, the total CET-S score showed moderate significant correlations with the vigorous physical activity scale of the IPAQ-S. This was also the case for the ANA and the MI subscale. The WCE subscale showed significant but low correlations with those scores.

Regarding the concurrent validity, there was a positive low significant correlation between the OCI-R and the CET-S scores. On the other hand, the MDDI total score showed positive low to moderate significant correlation with the CET-S and its subscales. There were also positive moderate to high correlations between the MDDI-FI subscale and the CET-S, especially with the ANA subscale and the total CET-S score. There was also a moderate positive correlation between the WCE subscale and the MDDI-AI subscale. The MDDI-DFS subscale showed low significant correlations with the CET-S.

Table 4. Means (standard deviations), internal consistency and correlations among variables of CET-S with 15-items.

	Mean (SD)	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**
1. CET-S: ANA	1.49 (1.24)	**.91**	.50**	.49**	.89**	.26**	.12**	.63**	.48**	.25**	.42**	.16**
2. CET-S: WCE	1.81 (1.26)		**.82**	.25**	.70**	.18**	.43**	.33**	.38**	.25**	.16**	.37**
3. CET-S: MI	3.54 (1.14)			**.85**	.71**	.11**	-.01	.43**	.26**	.13**	.36**	.15**
4. CET-S total	2.26 (0.96)				**.89**	.24**	.21**	.62**	.49**	.28**	.40**	.26**
5. MDDI-DFS	9.73 (4.13)					**.86**	.21**	.33**	.81**	.30**	.14**	-.14**
6. MDDI-AI	5.77 (2.66)						**.82**	.13**	.47**	.27**	-.12**	.33**
7. MDDI-FI	6.47 (3.43)							**.85**	.68**	.24**	.44**	.17**
8. MDDI total	21.97 (7.31)								**.83**	.38**	.24**	.09*
9. OCI-R	14.16 (9.00)									**.85**	.01	-.01
10. IPAQ-S: VA	2510.82 (4452.57)										**N.A.**	.10**
11. BMI	22.44 (2.85)											**N.A.**

Notes: Omega coefficients are presented along the diagonal in bold. CET=Compulsive Exercise Test; ANA=Avoidance of Negative Affect; WCE=Weight Control Exercise; MI=Mood Improvement; MDDI = Muscle Dysmorphia Disorder Inventory; DFS = Drive for Size; AI = Appearance Intolerance; FI = Functional Impairment; OCI-R = Obsessive Compulsive Inventory Revised; IPAQ-S = International Physical Activity Questionnaire-Short Form; VA = Vigorous physical activity; BMI = Body Max Index. N.A.= Not Applied. *p<.05 **p<.01.

DISCUSSION

Our study aimed to examine the psychometric properties of the CET in a sample of Spanish male university students. To do so, we assessed its factor structure, measurement invariance, reliability and convergent and concurrent validity with obsessive-compulsiveness, MD symptomatology and exercise frequency and duration. We hypothesized that the original five-factor solution would be supported, the scale would not be invariant, and that the CET would show good reliability and convergent and concurrent validity.

Regarding the CET factor structure, CFA performed in our sample did not support the original five-factor model proposed by Taranis et al. (2011) and supported by Sauchelli et al. (2016) in Spain. On the contrary, the data showed adequate fit for the three-factor model suggested by Plateau et al. (2014), indicating the multidimensional nature of physical exercise. Although the development and validation study by Taranis et al. (2011) was carried out in a community sample of physically active women, the conceptualization of the test was carried out with specialists and ED patients, as well as in the majority of the sample (men = 57, 20.3%) used by Sauchelli et al. (2016). Therefore, the theoretical development of CET from a female-centered viewpoint of ED may cause discrepancies when applied to men, as has happened in body dissatisfaction questionnaires (Compte & Sepúlveda, 2014). In men, rule-driven behavior, exercise rigidity and lack of exercise enjoyment components are not aspects that influence the maintenance of compulsive exercise, unlike the avoidance of negative affect, weight loss control exercise and mood improvement. Unlike women, men show the so-called "feeling and talking taboo", particularly if they are related to their body image, and being more likely to use potentially risk behaviors as an emotional regulation strategy (Pope et al., 2000). Male body dissatisfaction is mainly oriented to increasing muscle mass and leads to risky behaviors related to diet and physical exercise (Murray et al., 2012; Orrit, 2019), a central feature of MD and absent in ED of female predominance.

The invariance analysis performed did not support our initial hypothesis. The three-factor model of Plateau et al. (2014) was proposed for competing athletes. However, in our sample, the CET shows invariance, both from a traditional approach (MGCFA) and from the recent alignment optimization approach (Asparouhov & Muthén, 2014), between the groups of competing and non-competing students. The fact that both techniques pointed in the same direction supports the robustness of the CET-S items and structure in males. Sauchelli et al. (2016) also performed an invariance analysis between men and women; however, its subsample of 57 men was very scarce to carry out this type of analysis, which affects the stability of the results.

To date, psychometric properties of the CET have not been assessed in such a large sample of males in any country or language. These results support the use of the CET in a generalized way in the population of adult males regardless of their sports level, extending the use of the short version proposed by Plateau et al. (2014). Nevertheless, differences in the factorial structure of the CET between men and women reflect the sensitivity of the scale to gender bias, suggesting a flexible application with a reduced 15-item version for men and the original 24-item for women.

The omega coefficient better fits the nature of our data, so the comparison with Cronbach's alpha reliability indices from previous studies is limited. In any case, for our sample of university male students, the internal consistency of the CET-S was good, making it a reliable instrument (range: ω = .82 to .91).

Even though the CET-S implicitly carries a dimension of compulsivity, its relationship with the obsessive dimension in our sample, although significant, is limited. On the contrary, in line with the research hypothesis, an intense relationship is observed between the level of compulsive exercise and the symptoms of MD. The amount of compulsive exercise and its use to avoid negative emotional states generates higher levels of functional impairment in the person's life and increases the risk of developing serious disorders such as MD.

On the other hand, the relationship between CET-S and drive for size is limited despite its statistical significance. The search for greater muscle volume is obtained through the continuous practice of strength exercise, but, above all, through dietary alterations (e.g., increased amount of proteins) or supplement use. In this sense, the link between compulsive exercise and dietary alterations has been accredited in the

literature, to the point that the development of CET occurs in the context of ED (Taranis et al., 2011). However, its association with the dimensions of MD is limited, since the weight-oriented CET items refer to the fear of gaining weight and/or becoming thinner, without reference to bulking. Although MD is currently within the obsessive-compulsive disorder spectrum, this classification is not without criticism within the scientific community, which claims for its inclusion within the spectrum of an ED (Compte et al., 2019; Compte et al., 2018; Compte & Sepúlveda, 2014; Murray et al., 2012). Data on the high relationship between CET-S and MD symptoms, on the one hand, and the low relationship with the obsessive spectrum, on the other, support this view.

In line with the research hypothesis, there is a relationship between the CET-S and its different subscales, and the amount of vigorous physical activity done by the male students, mainly with those subscales that explore the positive and negative emotional reinforcement of physical activity. In contrast, the relationship between the amount of vigorous physical activity with the weight control exercise subscale of the CET has a lower effect size. As mentioned above, the content of the CET was designed on the area of ED with mostly female populations in which the drive for thinness is a central aspect. However, the results suggest that in males, aspects related to emotional regulation play a more important role in intense physical activity than weight control in the terms referred to in the CET. In particular, the guilt or discomfort at the possibility of not complying with the exercise routine.

BMI is also found to be positively related to the different subscales of the CET. However, it is the weight control exercise subscale that shows a larger effect size. BMI is a parameter related to dimensions of body dissatisfaction such as compulsive exercise, ED, or MD. However, it is sometimes only reported as a description of participants and no analyses are performed on the validation studies (Taranis et al., 2011; Sauchelli et al., 2016). Males also present a dislike of body fat and overweight, although they may want to obtain pathological levels of weight associated with muscle volume (Compte et al., 2018; Gorbeña et al., 2021). The CET as an instrument would be limited in capturing these muscle-seeking aspects, which are frequent in the male population.

Limitations and future research

This study has several limitations. First, the measures included in the study are self-report questionnaires and they could be influenced by bias such as social desirability and recall bias, amongst others (Paulhus & Vazire, 2007). Specifically, it has been noted that IPAQ respondents could report greater amounts of exercise or mistake different intensity levels of physical activity (Román-Viñas et al., 2010). Thus, future research should include objective measures of exercise, such as accelerometers, to examine if the results are replicated. Second, CET was developed to be used in the context of ED, where women are more affected than men. It is known that women are more preoccupied with weight-loss, whereas men are more preoccupied with muscle gain (Murray et al., 2012). Thus, weight control exercise items are not related to muscle gain, but that desire to lose weight. Considering that all participants were male students, this fact could have affected our results, and it should be considered in future research to explore MD symptoms related to eating behavior or use of ergogenic substances. Fourth, our sample was composed of university students, which limits the generalizability of the results. Investigations in middle-aged men, men with ED will be useful in the future. Finally, this study was cross-sectional, so we cannot establish causality. Longitudinal studies should be carried out in the future to elucidate these causal relationships.

CONCLUSIONS

In summary, the Spanish three-factor-15-item version of the CET validated in male university students has good psychometric properties in male populations, as it is a valid and reliable compulsive exercise self-report questionnaire. Thus, the CET-S could be used as a screening measure of compulsive exercise, and it could help examine its prevalence and maintenance factors in male populations. However, more research is necessary to support the findings from this study and to understand the development and maintenance factors of excessive exercise in male populations.

IMPLICATIONS FOR PRACTICE

Re-examining the psychometric properties of measures designed and used mostly in female populations is relevant for both research and clinical treatment in order to avoid possible gender biases when applied to males. The original factorial structure of the questionnaire does not fit the reality of men and may underestimate the presence of compulsive exercise in this population when using the 24 items, five-factor version of the CET as a screening instrument. The proposal of a generalized use of the short three-factor version of the CET with only 15 items, regardless of sport level, provides to clinical professionals and researchers a tool that can be easily applied to explore compulsive exercise in Spanish-speaking men. Compulsive exercise is strongly related to the symptomatology of serious pathologies such as Muscle Dysmorphia, more prevalent in men. The use of CET as a screening instrument can be useful, along with other instruments, to detect symptoms of Muscle Dysmorphia among male populations, including sportsmen.

Funding
This research did not receive any specific grant from funding public or private agencies.

Conflicts of interest
The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Authors contribution
Robin Rica: Investigation, Visualization, Project administration, Writing-Original Draft.
María Solar: Formal analysis, Results Writing original Draft.
Ana R. Sepúlveda: Conceptualization, Methodology, Supervision, Writing-Review & Editing
All authors read and approved the final version of the manuscript and they have agreed to authorship in the indicated order.

Acknowledgements
We express our gratitude to the Vice-Rector of Students, Dean and Vice-Dean of Students of each School at the Autonomous University of Madrid during 2016 to 2018. We would also like to thank the Vide-Dean of Students (P. Benito) of the School of Sciences for Physical Activity and Sport (INEF) and his Technical Assistant (J. Butragueño) from the Polytechnic University of Madrid; and also, the teachers of each School who collaborated with the recruitment as well as the students who participated in this study. Finally, we would like to acknowledge, D. Schaarschmidt for her help with the back translation, and S. Foguet and A. Moreno for their involvement in the recruitment and data collection process.

REFERENCES

1. Almeida Pereira, F. S., Passos, M. A., Pesca, A. D., & Cruz, R. M. (2020). Coping Measurement in the Sports Context: A Systematic Review. *Revista de Psicología del Deporte(Journal of Sport Psychology)*, *29*, 2, 35-46. https://www.rpd-online.com/index.php/rpd/article/view/21
2. Asparouhov, T., & Muthén, B. (2009). Exploratory structural equation modeling. *Structural Equation Modeling: A Multidisciplinary Journal,* 16(3), 397-438. https://doi.org/10.1080/10705510903008204
3. Asparouhov, T., & Muthén, B. (2014). Multiple-group factor analysis alignment. *Structural Equation Modeling: A Multidisciplinary Journal,* 21, 495-508. https://doi.org/10.1080/10705511.2014.919210.
4. Atienza, F., Appleton, P., Hall, H. K., Castillo Fernández, I., & Balaguer Solá, I. (2020). Validation of the Spanish version of multidimensional inventory of perfectionism in young athletes: Validation of the Spanish MIPS. Cuadernos de Psicología del Deporte, 20(1), 118-129. https://doi.org/10.6018/cpd.397951
5. Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology,* 1, 185-216. https://doi.org/10.1177/135910457000100301.
6. Browne, M. W. & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.). *Testing structural equation models* (pp. 136- 162). Newbury Park, CA: Sage.
7. Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal,* 14, 464-504. https://doi.org/10.1080/10705510701301834.
8. Compte, E.J., & Sepúlveda, A.R. (2014). Muscle dysmorphia: Historical review and updates in its diagnostic, assessment and treatment. *Behavioral Psychology/Psicologia Conductual,* 22, 307-326.

9. Compte, E.J., Nagata, J.M., Sepúlveda, A.R., Rivas, A., Sbdar, L.S., Menga, S., Rica, R., Torrente, F., Murray, S.B. (2019). Assessment and validation of a Spanish version of the Muscle Dysmorphia Disorder Inventory in Argentinian men who exercise: Inventario de Dismorfia Muscular. *Body Image,* 31, 24-34.
10. Compte, E.J., Sepúlveda, A.R., & Torrente, F. (2018). Approximations to an integrated model of eating disorders and muscle dysmorphia among university male students in Argentina. *Men and Masculinities,* 1097184X17753039. http://dx.doi.org/10.1177/1097184X17753039.
11. Craig, C. L., Marshall, A. L., Sjorstrom, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., Pratt, M., Ekelund, U., Yngve, A., Sallis, J. F., & Oja, P., (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine & Science in Sports & Exercise*, 35 (8), 1381-1395. https://doi.org/10.1249/01.MSS.0000078924.61453.FB.
12. Cunningham, H. E., Pearman III, S., & Brewerton, T. D. (2016). Conceptualizing primary and secondary pathological exercise using available measures of excessive exercise. *International Journal of Eating Disorders,* 49, 778-792. https://doi.org/10.1002/eat.22551.
13. Formby, P., Watson, H. J., Hilyard, A., Martin, K., & Egan, S. J. (2014). Psychometric properties of the Compulsive Exercise Test in an adolescent eating disorder population. *Eating Behaviors Journal,* 15, 555-557. https://doi.org/10.1016/j.eatbeh.2014.08.013.
14. Freire, G. L. M., Fortes, L. de S., Moreira, J. A. G. L. F., Alves, J. F. N., Souza, M. F., & Nascimento Junior, J. R. A. (2021). La frecuencia de entrenamiento semanal como factor asociado a la dependencia del ejercicio en atletas recreativos. *Cuadernos de Psicología del Deporte,* 21, 2, 1-12. https://doi.org/10.6018/cpd.427221
15. Fullana, M. A., Tortella-Feliu, M., Caseras, X., Andión, Ó., Torrubia, R., & Mataix-Cols, D. (2005). Psychometric properties of the Spanish version of the Obsessive–Compulsive Inventory-Revised in a non-clinical sample. *Journal of Anxiety Disorders,* 19, 893-903. https://doi.org/10.1016/j.janxdis.2004.10.004.
16. Goodwin, H., Haycraft, E., Taranis, L., & Meyer, C. (2011). Psychometric evaluation of the compulsive exercise test (CET) in an adolescent population: links with eating psychopathology. *European Eating Disorders Review,* 19, 269-279. https://doi.org/10.1002/erv.1109.
17. Gorbeña, S., Govillard, L., & Iraurgi, I. (2021). A taxonomy of groups at risk based on reported and desired body mass index and its relationships with health. *Psychology, Health & Medicine*, 26, 49-61. https://doi.org/10.1080/13548506.2021.1966699.
18. Gorrell, S., Nagata, J. M., Hill, K. B., Carlson, J. L., Shain, A. F., Wilson, J., Timko, C. A., Lock, J., & Peebles, R. (2019). Eating behavior and reasons for exercise among competitive collegiate male athletes. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity,* 1-9. https://doi.org/10.1007/s40519-019-00819-0.
19. Gulker, M. G., Laskis, T. A., & Kuba, S. A. (2001). Do excessive exercisers have a higher rate of obsessive-compulsive symptomatology? *Psychology, Health & Medicine,* 6(4), 387-398. https://doi.org/10.1080/13548500126535.
20. Hildebrandt, T., Langenbucher, J., & Schlundt, D. G. (2004). Muscularity concerns among men: Development of attitudinal and perceptual measures. *Body Image*, *1*(2), 169-181. https://doi.org/10.1016/j.bodyim.2004.01.001
21. Horn, J. L. & McArdle, J. J. (1992). A practical and theoretical guide to measurement invariance in aging research. *Experimental Aging Research: An International Journal Devoted to the Scientific Study of the Aging Process,* 18, 117-144. https://doi.org/ 10.1080/03610739208253916.
22. Hu, L. & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modelling,* 6, 1-55. http://dx.doi.org/10.1080/10705519909540118.
23. IPAQ Research Committee. (2005). Guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ)–short and long forms.
24. Korkmaz, S., Goksuluk, D., & Zararsiz G.M.V.N. (2014). An R Package for Assessing Multivariate Normality. *The R Journal,* 6,151-162.
25. Lee, P. H., Macfarlane, D. J., Lam, T. H., & Stewart, S. M. (2011). Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic review. *International Journal of Behavioral Nutrition and Physical Activity,* 8(1), 115. https://doi.org/10.1186/1479-5868-8-115.

26. McDonald, R. P. (1999). Test theory: A unified treatment. L. Erlbaum Associates.
27. Melissa, R., Lama, M., Laurence, K., Sylvie, B., Jeanne, D., Odile, V., & Nathalie, G. (2020). Physical Activity in Eating Disorders: A Systematic Review. *Nutrients,* 12, 183. https://doi.org/10.3390/nu12010183.
28. Menczel, Z., Griffiths, M.D., Vingender, I., Eisinger, A., Farkas, J., Magi, A., Mervó, B., Kökönyei, G., & Demetrovics, Z. (2017). Exercise dependence in amateur competitors and non-competitor recreational exercisers. *International Journal of Mental Health and Addiction,* 15, 580-587. https://doi.org/10.1007/s11469-016-9661-7.
29. Meredith, W. (1993). Measurement invariance, factor analysis and factorial invariance. *Psychometrika*, 58(4), 525-543. https://doi.org/10.1007/BF02294825.
30. Meyer, C., Plateau, C. R., Taranis, L., Brewin, N., Wales, J., & Arcelus, J. (2016). The Compulsive Exercise Test: confirmatory factor analysis and links with eating psychopathology among women with clinical eating disorders. *Journal of Eating Disorders,* 4(1), 22. https://doi.org/10.1186/s40337-016-0113-3.
31. Meyer, C., Taranis, L., Goodwin, H., & Haycraft, E. (2011). Compulsive exercise and eating disorders. *European Eating Disorders Review,* 19(3), 174-189. https://doi.org/10.1002/erv.1122.
32. Muñiz, J., & Bartram, D. (2007). Improving international tests and testing. *European Psychol.* 12, 206-219. https://doi.org/10.1027/1016-9040.12.3.206.
33. Murray, S. B., Rieger, E., Hildebrandt, T., Karlov, L., Russell, J., Boon, E., ... & Touyz, S. W. (2012). A comparison of eating, exercise, shape, and weight related symptomatology in males with muscle dysmorphia and anorexia nervosa. *Body Image,* 9, 193-200. https://doi.org/10.1016/j.bodyim.2012.01.008.
34. Naylor, H., Mountford, V., & Brown, G. (2011). Beliefs about excessive exercise in eating disorders: the role of obsessions and compulsions. *European Eating Disorders Review,* 19(3), 226-236. https://doi.org/10.1002/erv.1110.
35. Nogueira A., Salguero del Valle, A. & Márquez, S. (2017). Adicción a correr: una revisión desde sus inicios hasta la actualidad. *Revista de Psicología Aplicada al Deporte y al Ejercicio Físico*, 1, e6, 1-22. https://doi.org/10.5093/rpadef2017a1
36. Nunnally, J. (1978). Psychometric Theory (2nd ed.). New York, NY: McGraw-Hill.
37. Olave, L., Estévez, A., Momeñe, J., Muñoz-Navarro, R., Gómez-Romero, M. J., Boticario, M. J., & Iruarrizaga, I. (2021). Exercise addiction and muscle dysmorphia: the role of emotional dependence and attachment. *Frontiers in Psychology,* 12, 681808. https://doi.org/10.3389/fpsyg.2021.681808
38. Orrit, G. (2019). Muscle Dysmorphia: Predictive and protective factors in adolescents. *Cuadernos de Psicología del Deporte*, *19*, 3, 1-11. https://doi.org/10.6018/cpd.347981
39. Paulhus, D. L., & Vazire, S. (2007). The self-report method. In Robins, R. W., Fraley, R. C., & Krueger, R. F. (Eds.). Handbook of research methods in personality psychology (pp. 224-239). New York: Guilford.
40. Piercy K. L., Troiano R. P., Ballard R. M., Carlson, S. A., Fulton, J. E., Galuska, D. A., George, S. M., & Olson, R. D. (2018). The Physical Activity Guidelines for Americans. Journal of American Medical Association, 320(19), 2020-2028.https://doi.org/10.1001/jama.2018.14854.
41. Plateau, C. R., Shanmugam, V., Duckham, R. L., Goodwin, H., Jowett, S., Brooke-Wavell, K. S., Laybourne, A., Arcelus, J. & Meyer, C. (2014). Use of the Compulsive Exercise Test with athletes: norms and links with eating psychopathology. *Journal of Applied Sport Psychology,* 26(3), 287-301. https://doi.org/10.1080/10413200.2013.867911.
42. Pons, J., Ramis, Y., Viladrich, C., & Checa, I. (2020). Anxiety Levels and Coping Styles Depending On the Perceptual-Motor Skills of the Sport. *Revista De Psicología Del Deporte (Journal of Sport Psychology)*, *29*(2), 105-115. https://www.rpd-online.com/index.php/rpd/article/view/19
43. Pope, H., Phillips, K. A., & Olivardia, R. (2000). The Adonis complex: The secret crisis of male body obsession. New York: Simon and Schuster.
44. Reiner, M., Niermann, C., Jekauc, D., & Woll, A. (2013). Long-term health benefits of physical activity – a systematic review of longitudinal studies. *BMC Public Health,* 13(1), 813. https://doi.org/10.1186/1471-2458-13-813.
45. Revelle, W. (2020). psych: Procedures for Psychological, Psychometric, and Personality Research. Northwestern University, Evanston,

Illinois. R package version 2.0.8, https://CRAN.R-project.org/package=psych.
46. Román-Viñas, B., Serra-Majem, L., Hagströmer, M., Ribas-Barba, L., Sjöström, M., & Segura-Cardona, R. (2010). International physical activity questionnaire: reliability and validity in a Spanish population. *European Journal of Sport Science,* 10(5), 297-304. https://doi.org/10.1080/17461390903426667.
47. Scharmer, C., Gorrell, S., Schaumberg, K., & Anderson, D. (2020). Compulsive exercise or exercise dependence? Clarifying conceptualizations of exercise in the context of eating disorder pathology. *Psychology of Sport and Exercise*, 46, 101586. https://doi.org/10.1016/j.psychsport.2019.101586.
48. Sauchelli, S., Arcelus, J., Granero, R., Jiménez-Murcia, S., Agüera, Z., Del Pino-Gutiérrez, A., & Fernandez-Aranda, F. (2016). Dimensions of compulsive exercise across eating disorder diagnostic subtypes and the validation of the Spanish version of the compulsive exercise test. *Frontiers in Psychology,* 7, 1852. https://doi.org/10.3389/fpsyg.2016.01852.
49. Sepúlveda, A. R., Carrobles, J. A., & Gandarillas, A. M. (2008). Gender, school and academic year differences among Spanish university students at high-risk for developing an eating disorder: an epidemiologic study. *BMC Public Health,* 8, 102. https://doi.org/10.1186/1471-2458-8-102.
50. Sepúlveda, A. R., Rica, R., Moreno, A., Román, F. J., & Compte, E. J. (2019). Assessing the male body image: Spanish validation of two instruments. *Psychiatry Research,* 272, 483-490. https://doi.org/10.1016/j.psychres.2018.12.125.
51. Souter, G., Lewis, R. & Serrant, L. Men, Mental Health and Elite Sport: a Narrative Review. *Sports Medicine-Open*, 4, 57 (2018). https://doi.org/10.1186/s40798-018-0175-7.
52. Steenkamp, J. B. E. & Baumgartner, H. (1998). Assessing measurement invariance in cross-national consumer research. *Journal of Consumer Research,* 25, 78-90. https://doi.org/10.1086/209528.
53. Swenne, I. (2016). Evaluation of the compulsive exercise test (CET) in adolescents with eating disorders: factor structure and relation to eating disordered psychopathology. *European Eating Disorders Review,* 24(4), 334-340. https://doi.org/10.1002/erv.2439.
54. Taranis, L., Touyz, S., & Meyer, C. (2011). Disordered eating and exercise: Development and preliminary validation of the Compulsive Exercise Test (CET). *European Eating Disorders Review,* 19(3), 256-268. https://doi.org/10.1002/erv.1108.
55. Trott, M., Yang, L., Jackson, S. E., Firth, J., Gillvray, C., Stubbs, B., & Smith, L. (2020). Prevalence and Correlates of Exercise Addiction in the Presence vs. Absence of Indicated Eating Disorders. *Frontiers in Sports and Active Living,* 2, 84. https://doi.org/10.3389/fspor.2020.00084
56. Young, S., Touyz, S., Meyer, C., Arcelus, J., Rhodes, P., Madden, S., Pike, K., Attia, E., Crosby, R. D., & Hay, P. (2018). Relationships between compulsive exercise, quality of life, psychological distress and motivation to change in adults with anorexia nervosa. *Journal of Eating Disorders,* 6, 2. https://doi.org/10.1186/s40337-018-0188-0.