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Dependence and Physical Exercise: Spanish Validation of the Exercise Dependence Scale-Revised (EDS-R)

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The purpose of this study was to validate the Spanish version of the Exercise Dependence Scale-Revised (EDS-R). To achieve this goal, a sample of 531 sport center users was used and the psychometric properties of the EDS-R were examined through different analyses. The results supported both the first-order seven-factor model and the higher-order model (seven first-order factors and one second-order factor). The structure of both models was invariant across age. Correlations among the subscales indicated a related factor model, supporting construct validity of the scale. Alpha values over .70 (except for Reduction in Other Activities) and suitable levels of temporal stability were obtained. Users practicing more than three days per week had higher scores in all subscales than the group practicing with a frequency of three days or fewer. The findings of this study provided reliability and validity for the EDS-R in a Spanish context.
Keywords: sport centers, physical activity, exercise dependence, validation.

El objetivo de este estudio fue validar la versión española de la Escala Revisada de Dependencia del Ejercicio (EDS-R). Para ello se utilizó una muestra de 531 usuarios de centros deportivos y se analizaron las propiedades psicométricas de la EDS-R a través de diferentes análisis. Los resultados ofrecieron apoyo tanto a la estructura de siete factores como al modelo de orden superior (siete factores de orden primario y un factor de orden secundario). La estructura de ambos modelos se mostró invariante por edad. Las correlaciones entre las subescalas indicaron un modelo de factores relacionados que apoya la validez de constructo de la escala. Se obtuvieron valores alfa de Cronbach superiores a .70 (salvo para la subescala Reducción de Otras Actividades), y niveles adecuados de estabilidad temporal. Los usuarios que informaron practicar más de tres días por semana obtuvieron puntuaciones más altas en todas las subescalas respecto al grupo que informó practicar con una frecuencia semanal de tres o menos días. Los resultados de este estudio proporcionan evidencias para la fiabilidad y validez de la EDS-R en el contexto español.
Palabras clave: centros deportivos, actividad física, dependencia del ejercicio, validación.

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Research has extensively shown that physical exercise produces positive physical and psychological benefits (Biddle & Fox, 1989; Glenister, 1996; Lubans, Foster, & Biddle, 2008). However, if practiced excessively, physical exercise can also have negative physical and psychological effects. In fact, recent investigations have indicated that people can become dependent on exercise, similarly to substances such as alcohol, tobacco, or other drugs (Davis, 2000).

Exercise dependence has also been called addictive, obligatory, or excessive exercise, addiction to exercise or commitment to exercise (Blumenthal, O'Toole, & Chang, 1984; Cohen, 1995; Farrell & Thompson, 1998; Kagan, 1987). In general, the terms describe a condition in which the practice of a moderate or intense exercise becomes a compulsive behavior. Specifically, exercise dependence manifests as a strong desire to perform physical practice in one's free time, which becomes an uncontrollable behavior and is expressed in the form of physiological symptoms (e.g., tolerance, abstinence) and/or psychological symptoms (e.g., anxiety, depression) (Hausenblas & Symons Downs, 2002a). Nevertheless, research on exercise dependence has been ambiguous, because as yet, the terminology of the constructs that surround this phenomenon, its definition, and the measures to assess it were not well developed. This is a challenge for basic and applied research because the factors that predominate, concur, and perpetuate exercise dependence are still unknown, making its prevention and treatment more difficult.

Until now, there have been several attempts to define, operationalize, and measure exercise dependence. The first questionnaires developed to measure this construct were one-dimensional measures (e.g., Commitment to Running Scale, Carmack & Martens, 1979; Negative Addiction Scale, Hailey & Bailey, 1982). These first measures operationalized exercise dependence either by the level of exercise (e.g., frequency, duration, intensity, history), biomedical symptoms (e.g., abstinence, tolerance), or psychological symptoms (e.g., giving priority to exercise instead of to occupational and social obligations). Nevertheless, it seems more reasonable to define exercise dependence, as with dependence on other substances, as a set of cognitive, behavioral, and psychological symptoms (Hausenblas & Symons Downs, 2002a, 2002b).

Recently, multidimensional approaches have been developed to measure the physiological and psychological symptoms of exercise dependence. For example, Ogden, Veale, and Summers (1997) developed the Exercise Dependence Questionnaire (EDQ) to measure the biomedical and psychological dimensions. In contrast to other instruments developed previously, the authors based their questionnaire on clinical criteria for substance dependence established in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV, American Psychiatric Association, 1994). This questionnaire was made up of 29 items with 8 subscales, but analysis of the psychometric properties revealed inadequate internal consistencies in some of them (Hall, Hill, Appleton, & Kozub, 2009; Kjelsas, Augestad, & Götestam, 2003; Ogden et al., 1997). In addition, as noted by Hausenblas and Symons Downs (2002a), only three of the eight subscales of the EDQ measure dependence criteria presented in the *DSM-IV* (i.e., interference with social and occupational life, withdrawal symptoms, and stereotyped behavior). In fact, some of the items from the other subscales assess attitudes and social aspects of exercise rather than symptoms that are characteristic of dependence (e.g., "After an exercise session I feel happier about life," "I exercise to meet other people," "I exercise to be healthy").

The Exercise Dependence Scale (EDS; Hausenblas & Symons Downs, 2002a, 2002c; Symons Downs, Hausenblas, & Nigg, 2004) is the first scale that conceptualizes and operationalizes exercise dependence totally based on the DSM guidelines. Using the DSM-IV criteria for substance dependence, Hausenblas and Symons Downs (2002a) operationalize exercise dependence as a maladaptive multidimensional pattern of exercise that leads to impairment or to clinically significant distress, manifested by the presence of at least three of the seven criteria of the *DSM-IV*: (a) Tolerance: defined either as a need to increase the amount of exercise to achieve the intention effect or to decrease the effect with continued use of the same amount of exercise; (b) Withdrawal: manifested by either the characteristic withdrawal symptoms for exercise (e.g., anxiety, exhaustion), or the same (or closely related) amount of exercise engaged in to relieve or avoid withdrawal symptoms; (c) Intention effects: exercise is often performed with a higher weight or more time than the person had planned; (d) Lack of control: a persistent desire or a fruitless effort to reduce or to control performing exercise; (e) Time: a large amount of time is employed in activities involving exercise; (f) Reduction in other activities: social or occupational activities, or recreational activities are dropped or reduced in order to exercise; (g) Continuance: the practice of exercise is continued despite awareness of a persistent psychological or physical problem, which was probably caused or worsened by performing exercise (e.g., to continue running despite an injury).

The original version of the EDS was developed by Hausenblas and Symons Downs (2002a) from the review of previous works on instruments that measured exercise dependence and interviews of practitioners of physical activity. The original EDS was later examined in a series of unpublished works in order to improve the comprehension of the items. The scale was revised and reduced to a total of 28 items, and scale scoring was changed to six points instead of five, in order to prevent an intermediate neutral score. Symons Downs et al. (2004) examined the psychometric properties and the factor structure of the revised scale (EDS-R) by means of two independent studies with a total

of 1263 university students. Through confirmatory factor analysis conducted in the first of the studies, the scale was reduced from 28 to 21 items: 3 items in each of the seven subscales. This factor model was supported in the second study. The results of Symons Downs et al. provide evidence of the reliability and validity of the EDS-R; however, they also suggest the need to examine this scale in a more varied population.

On the one hand, by operationalizing exercise dependence as a function of the seven criteria established in the *DMS-IV*, the EDS can provide information about the mean of each one of the symptoms or of the mean total score. Considering the first option, the EDS allows us to differentiate individuals in three groups: at risk of exercise dependence (i.e., scores of 5-6 on the Likert scale in at least three of the seven criteria), nondependent symptomatic (i.e., scores of 3-4 on the Likert scale in at least three criteria, or scores of 5-6 combined with scores of 3-4 in three criteria, but without meeting the at-risk conditions), and nondependent asymptomatic (i.e., scores of 1-2 on the Likert scale in at least three criteria, without meeting the conditions of the nondependent symptomatic). Nevertheless, prior studies (Edmunds, Ntoumanis, & Duda, 2006; Hausenblas & Symons Downs, 2002a; Symons Downs et al., 2004) have underlined the difficulty of finding a large number of individuals who can be classified as at risk of exercise dependence and, therefore, of comparing the diverse groups. Therefore, the mean total value of the seven subscales has sometimes been used to analyze the data (Hausenblas & Giacobbi, 2004). In this case, a lower score would reveal fewer symptoms of exercise dependence. Both possibilities suggest the need to test not only the factor structure of the seven correlated subscales, as was done by Hausenblas and colleagues, but also a model that includes a global factor of exercise dependence. In addition, the EDS is currently the only instrument on the international scene that follows the dependence criteria of the *DSM-IV* completely, so it can distinguish different types and degrees of exercise dependence. In future research, this instrument will allow us to examine exercise dependence in diverse Spanish populations and towards different forms of physical activity, in addition to analyzing possible antecedents and consequents.

This investigation had two goals. The first goal was to confirm the factor structure of the revised version of the Exercise Dependence Scale (EDS-R; Symons Downs et al., 2004) in the Spanish context, to analyze its construct validity by means of the correlations among the subscales, and its internal consistency, temporal stability, and factor invariance across age groups. As the EDS-R can be used to calculate the mean of each subscale and the total mean score (Hausenblas & Symons Downs, 2002c), the goal was to analyze both models. In the first model, we hypothesized that the seven first-order factors, which represent the seven dimensions of exercise dependence, would be correlated. In the second model, we proposed a structure with seven first-order factors and one second-order factor (Exercise dependence).

The second goal was to examine the criterion validity of the EDS-R based on the study of the differences in the symptoms of dependence according to users' practice frequency. Frequency and duration are the behavioral factors associated with exercise dependence. Investigators have found a linear relation between practice time and exercise dependence (Adams, Miller, & Kraus, 2003; Chapman & De Castro, 1990; Furst & Germone, 1993; Hailey & Bailey, 1982; Kjelsas et al., 2003; Pierce, McGowan, & Lynn, 1993). Nevertheless, these investigations have generally used one-dimensional measures of exercise dependence (e.g., the Negative Addiction Scale of Hailey & Bailey, 1982), despite acknowledging that dependence is a multidimensional construct (APA, 1994; Hausenblas & Symons Downs, 2002b). In this sense, investigation should clarify the relations between frequency of physical practice and the diverse symptoms of exercise dependence. On the basis of previous investigation, we hypothesized that users practicing more frequently would report higher scores in the seven symptoms of exercise dependence contemplated in the EDS-R.

Method

Participants

Participants for this study were 531 users of sports centers (271 men, 256 women, 4 dropouts), aged between 16 and 60 years (M = 29.62, SD = 8.97) from the capital of Almería (Spain). Specifically, 120 participants were between 16 and 21 years, 337 participants between 22 and 40, and 74 participants were over 40 years old.

Measures

Escala Revisada de Dependencia del Ejercicio (EDS-R). We used the Spanish version of the Exercise Dependence Scale-Revised (Symons Downs et al., 2004). This instrument has seven subscales: (a) Withdrawal (e.g., "I exercise to avoid feeling anxious"); (b) Continuance (e.g., "I exercise despite recurring physical problems"); (c) Tolerance (e.g., "I continually increase my exercise intensity to achieve the desired effect/benefits"); (d) Lack of control (e.g., "I am unable to reduce how long I exercise"); (e) Reduction in other activities (e.g., "I would rather exercise than spend time with family/friends"); (f) Time (e.g., "I spend most of my free time exercising"); and (g) and Intention effects (e.g., "I exercise longer than I intend"). Each subscale is represented by three items, and participants rate their response on a 6-point Likert scale, ranging from 1 (*never*) to 6 (*always*). Higher scores indicate more symptoms of exercise dependence.

Practice frequency. To collect information about practice frequency, the users answered the question of how many days did they practice physical exercise, considering three response options: *occasionally*, *2 or 3 days a week*, and *more than 3 days a week*.

Procedure

Specialists in psychology of physical activity and sports selected the EDS-R to use in the Spanish context. Taking into account the psychometric properties of the original version, it was considered a useful instrument to measure exercise dependence in Spain. Firstly, we translated the scale using the backward translation strategy (Hambleton, 1996). During this process, the original scale was translated to Spanish by a group of translators and subsequently, another group of translators translated it back to the original language. The accuracy of the translation was judged according to the degree of coincidence with the original version. The version obtained was analyzed by three experts (Lynn, 1986) in physical activity, so the items were guaranteed to be well designed to measure the constructs that were meant to be measured and to retain the original meaning. From the ensuing debate, only minor changes were carried out.

Once the scale had been translated, we contacted various sports centers to request their collaboration in this investigation. In addition, before administering the scale to the definite sample, we used a group of users of sports centers to confirm that they understood all the items.

The main investigators administered the scale, emphasizing that the responses were anonymous and there were no right or wrong responses. During the administration of the scale, any doubts arising during the process about the meaning of the items were clarified. Participation was voluntary, and the participants needed approximately 15 minutes to complete the scale.

Data Analysis

An initial analysis of the psychometric properties of the EDS-R was conducted to determine its validity and reliability in the Spanish context. For this purpose, we carried out descriptive analyses, correlational analysis of the factors (construct validity), confirmatory factor analysis for the seven-factor structure and for the structure with one higher-order dependence factor, analysis of factor invariance across age groups, and analysis of internal consistency with Cronbach's alpha coefficient. In addition, to assess the temporal stability of the scale, we performed test-retest analysis with a different sample of users. Lastly, we carried out an analysis of variance (ANOVA) to examine the relations between exercise dependence and user practice frequency. We used the SPSS 15.0 statistical packages and AMOS 7.0 to analyze the data.

Results

Descriptive Statistics and Analysis of Correlations among the Seven Factors

As shown in Table 1, the users scored highest in the Tolerance factor (M = 3.77), which indicates a need to increase the amount of exercise to achieve the intention effect. The Reduction in other activities factor (M = 2.03) obtained the lowest scores. The correlational analysis with Pearson's coefficient revealed positive correlations among all the factors, with values ranging from .24 to .67. The correlations between each one of the factors and the global measure of dependence ranged between .61 and .82.

Confirmatory Factor Analysis

Two confirmatory factor analyses were conducted to test the EDS-R in the Spanish context. As Mardia's coefficient

Table 1
Descriptive Statistics and Correlations of all the Factors of the EDS-R

Factors	*M*	*SD*	Skewness	Kurtosis	α	1	2	3	4	5	6	7	8
1. Tolerance	3.77	1.13	-.14	-.68	.73		.24**	.45**	.45**	.32**	.51**	.24**	.61**
2. Withdrawal	3.18	1.42	-.01	-1.10	.85			.31**	.48**	.40**	.42**	.42**	.66**
3. Intention effects	2.25	1.18	.89	.14	.83				.54**	.64**	.67**	45**	.78**
4. Lack of control	2.59	1.20	.49	-.45	.78					.58**	.61**	47**	.80**
5. Reduction in activities	2.03	1.07	1.11	.71	.68						.56**	.56**	.78**
6. Exercise time	2.86	1.28	.42	-.63	.84							47**	.82**
7. Continuance	2.29	1.30	.87	-.17	.81								.71**
8. Dependence	2.71	.90	.52	-.17	.92								

**p < .01.

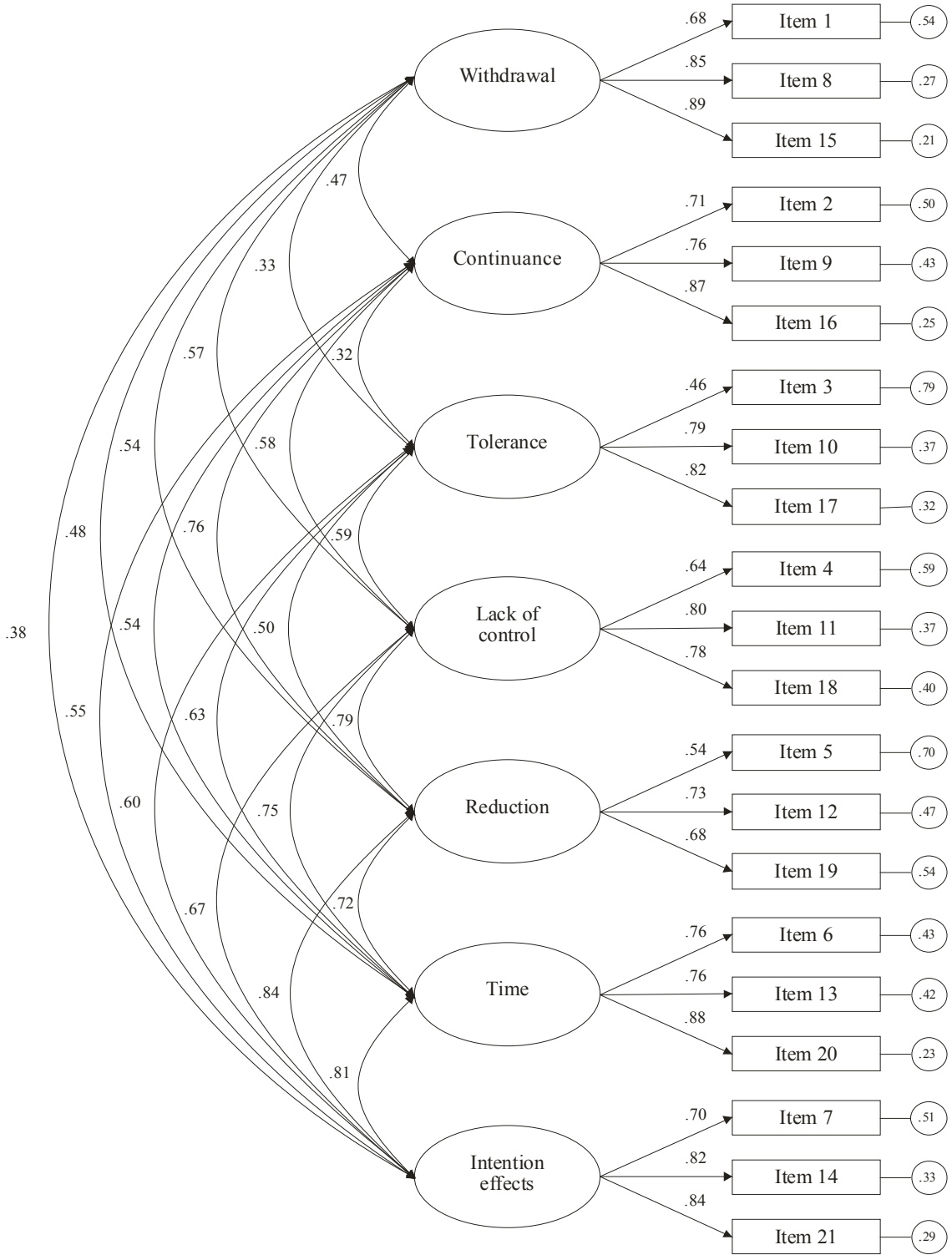

Figure 1. Confirmatory Factor Analysis of the EDS-R. The ellipses represent the factors and the rectangles represent the diverse items. The residual variances are in the small circles.

was high (121.35), the maximum likelihood method was used with the bootstrapping procedure. The estimators were not affected by the lack of normality and, consequently, they were considered sufficiently robust (Byrne, 2001).

In order to accept or reject the models, we used a combination of various fit indexes: the chi-square/degrees of freedom ratio (χ^2/df), the comparative fit index (CFI), the incremental fit index (IFI), the root mean square error of approximation (RMSEA) and its 90% confidence interval, and the standardized root mean square residual (SRMR). As chi-square is very sensitive to sample size (Jöreskog & Sörbom, 1993), we used the chi-square/degrees of freedom ratio, which is considered acceptable with values lower than 3 (Schermelleh-Engel, Moosbrugger, & Müller, 2003). Incremental indexes (CFI and IFI) show good fit with values of .90 or higher (Schumacker & Lomax, 1996), whereas the error indexes are considered acceptable with values equal to or lower than .06 for RMSEA and .08 for SRMR (Hu & Bentler, 1999).

The results of the first-order seven-factor model (Figure 1) revealed acceptable fit indexes: χ^2 (168, N = 531) = 489.98, p = .001, χ^2/df = 2.91, CFI = .94, IFI = .94, RMSEA = .060 (90% CI = .054 - .066), SRMR = .045. The standardized regression weights of the items ranged between .46 and .89, and were statistically significant ($p < .001$), and satisfactory error variance was obtained. The correlations among the seven factors ranged between .32 and .84.

The fit indexes for the higher-order factor model (7 first-order factors and 1 second-order factor) were slightly worse, although they were, in general, acceptable: χ^2 (182, N = 531) = 615.99, p = .001, χ^2/df = 3.38, CFI = .92, IFI = .92, RMSEA = .067 (90% CI = .061-.073), SRMR = .057. In this model, all the standardized regression weights were significant ($p < .001$): .57 for Withdrawal, .68 for Continuance, .65 for Tolerance, .85 for Lack of control, .92 for Reduction in other activities, .87 for Time, and .87 for Intention effects.

Invariance Analysis

As the age range was broad, we carried out a multi-group analysis to verify whether the structure of the confirmatory factor analysis performed for both models was invariant across age. The median (28 years of age) was used to establish two age groups and to analyze whether the model was invariant in these two groups. The decision to use the median as the cut-off point was based on methodological reasons. The ideal situation would have been to test the invariance across the different age groups taking into account a theoretical division that considered different life stages: adolescents, young adults, and older adults. However, the reduced number of participants in some of these stages and the disproportion among each of them limited conducting an analysis of invariance of these three groups. Therefore, we chose two homogeneous age groups in the sample.

The first group was made up of 252 users aged between 16 and 27 years (M = 22.13, SD = 3.18). The second group included 279 users aged between 28 and 60 years (M = 36.39, SD = 6.90). In Table 2 are shown the diverse fit indexes for the four models compared within the first structure analyzed (7 first-order factors). No significant differences were found between the unconstrained model (Model 1) and the model with invariant measurement weights (Model 2). There were significant differences between Model 1 and Models 3 (invariant structural covariances) and 4 (invariant measurement residuals). The lack of significant differences between Model 1 and Model 2 entails a minimal criterion in order to accept the existence of invariance of the model across age (Byrne, Shavelson, & Muthén, 1989; Marsh, 1993).

In Table 2 are also shown the diverse fit indexes for the six models compared within the structure of one higher-order factor. No significant differences were found between the unconstrained model (Model 1) and the models with invariant measurement weights (Model 2) and invariant structural weights (Model 3). There were significant differences between Model 1 and the models with invariant structural covariances (Model 4), invariant structural residuals (Model 5), and invariant measurement residuals (Model 6). Therefore, the results showed that the higher-order factor model was also invariant across age.

Analysis of Internal Consistency

The analysis of internal consistency revealed Cronbach alpha values of .85 for Withdrawal, .81 for Continuance, .73 for Tolerance, .78 for Lack of control, .68 for Reduction in other activities, .84 for Time, and .83 for Intention effects. Consistency for the global value of exercise dependence was .92.

Analysis of Temporal Stability

To analyze temporal stability of the scale, we used an independent sample of 81 users of sports centers, aged between 16 and 53 years (M = 29.26, SD = 8.23). We administered the EDS-R twice, with a 4-week interval between the first and second data collection. We calculated the intra-class correlation coefficient (ICC) for each of the seven factors of the EDS-R to estimate temporal stability. The means of the subscale of Withdrawal were 2.67 (SD = 1.29) and 2.58 (SD = 1.37) with an ICC of .85. For Continuance, the means were 1.76 (SD = 1.13) and 1.72 (SD = 1.10) with an ICC of .88. For the subscale of Tolerance, the values of the means were 3.52 (SD = 1.25) and 3.41 (SD = 1.18) with an ICC of .74. For the subscale Lack of control, the means ranged between 2.26 (SD = 1.07) and 2.22 (SD = 1.17) with an ICC of .75. For Reduction in activities, we obtained means of 1.61 (SD = 0.74) and 1.51 (SD = .68) with an ICC of .70. For the subscale Time, the

means obtained were 2.54 (*SD* = 1.25) and 2.64 (*SD* = 1.28) with an ICC of .90. Lastly, for Intention effects, the means were 1.86 (*SD* = 1.11) and 1.89 (*SD* = .89) with an ICC of .81. Therefore, we obtained high levels of temporal stability in all the subscales that make up the EDS-R, with the lowest score in the subscale Reduction in other activities.

Analysis of Criterion Validity

As very few people reported practicing physical exercise occasionally (n = 25), we decided to group the first two questionnaire categories of practice frequency. Thus, to analyze possible differences of the EDS-R as a function of physical practice frequency, we used two groups, considering 3 days per week as the threshold frequency recommended for going from a low-medium level of physical practice to an advanced level (Haskell et al., 2007). The first group was made up of 259 users who reported practicing physical exercise with a frequency of 3 days or less per week, whereas the second group, made up of 270 users, stated they practiced exercise more than 3 days per week. Two of the practitioners did not indicate their practice frequency and were therefore eliminated from the analysis.

The ANOVA by practice frequency (see Table 3) revealed significant differences in all the factors of the EDS-R, as

Table 2
Multi-Group Invariance Analysis across Age

First-Order Seven-Factor Model									
Models	χ^2	*df*	χ^2/df	$\Delta\chi^2$	Δdf	CFI	IFI	SRMR	RMSEA (90% CI)
Model 1	694.05	336	2.06	-	-	.94	.94	.052	.045 (.040- .050)
Model 2	714.76	350	2.04	20.71	14	.94	.94	.049	.044 (.040- .049)
Model 3	754.45	378	1.99	60.41*	42	.93	.93	.056	.043 (.039- .048)
Model 4	949.53	399	2.38	255.48*	63	.90	.90	.054	.051 (.047- .055)
Higher-Order Factor Model									
Models	χ^2	*df*	χ^2/df	$\Delta\chi^2$	Δdf	CFI	IFI	SRMR	RMSEA (90% CI)
Model 1	850.24	364	2.33	-	-	.91	.91	.070	.050 (.046-.055)
Model 2	869.75	378	2.30	19.50	14	.91	.91	.068	.050 (.045-.054)
Model 3	881.10	384	2.29	30.85	20	.91	.91	.067	.049 (.045-.054)
Model 4	885.08	385	2.29	34.83*	21	.91	.91	.071	.050 (.045-.054)
Model 5	896.21	392	2.28	45.96*	28	.91	.91	.071	.049 (.045-.054)
Model 6	1076.48	413	2.60	226.24*	49	.88	.88	.069	.055 (.051-.059)

*$p < .05$.

Table 3
Analysis of Variance of Exercise Dependence by Practice Frequency

	3 days or less		More than 3 days		*F* (1-527)	Partial η^2
	M	*SD*	*M*	*SD*		
Tolerance	3.45	1.13	4.07	1.05	42.19**	.07
Withdrawal	2.96	1.34	3.38	1.48	11.55*	.02
Intention effects	2.03	1.00	2.46	1.30	17.94*	.03
Lack of control	2.29	1.08	2.86	1.24	30.82**	.06
Reduction in activities	1.89	.95	2.16	1.16	8.17*	.02
Exercise time	2.45	1.11	3.25	1.31	57.21**	.10
Continuance	2.09	1.15	2.48	1.41	12.50**	.02
Dependence	2.45	.76	2.95	.96	43.55**	.08

*$p < .01$. **$p < .001$

well as in the global factor of exercise dependence. The users in the group of higher physical practice frequency obtained higher scores both on the seven factors and on the global value of exercise dependence, compared to the group of lower practice frequency.

Discussion

The goals of this study were to examine the factor validity, internal consistency, temporal stability, and criterion validity of the EDS-R. The results support the EDS-R as a valid and reliable instrument to assess exercise dependence and indicate the need for a multidimensional measure to assess this construct (Hausenblas & Symons Downs, 2002b; Ogden et al., 1997). Nevertheless, the results of the study suggest various issues that should be addressed in future works.

Firstly, internal consistency and temporal stability were adequate with the exception of the subscale Reduction in other activities, which obtained an alpha value below .70 (Nunnally, 1978). As the factor is made up of only three items, the internal validity observed could be marginally accepted (Hair, Anderson, Tatham, & Black, 1998; Nunnally & Bernstein, 1994). This factor also obtained a low alpha value in the review of the scale carried out by Symons Downs et al. (2004), which indicates that the items that form this subscale should probably be reviewed. Future studies should examine this subscale and the conceptual relevance of its items. For example, future research could explore whether the items of this subscale adequately represent the reduction in other activities as a result of current exercise habits.

Secondly, the results of this study provide support for the factor validity of the seven subscales that make up the Spanish version of the EDS-R. The results of the correlational analysis are in accordance with the theory of exercise dependence, supporting the construct validity of the scale. All the factors correlated positively with each other, and there were no very high values among the subscales, which indicates the absence of problems of discriminant validity. The confirmatory factor analysis confirms the structure of a seven-factor model and suggests that the 7 subscales with a total of 21 items are measuring the construct exercise dependence, according to the criteria established by the DSM-IV (Hausenblas & Symons Downs, 2002c). The confirmatory factor analyses revealed minimally acceptable fit indexes both for the first-order seven-factor model and for the higher-order factor model. In addition, the scale showed factor invariance across two samples comprising different age groups. Recent investigations (Allegre, Therme, & Griffiths, 2007; Hausenblas & Giacobbi, 2004) have been using the total mean value of the EDS to analyze its relation with other variables, despite the fact that Symons Downs et al. (2004) only tested the seven-factor structure and not a model with a higher-order dependence factor. Therefore, future investigations should also replicate this last factor structure of the scale.

Thirdly, we found support for the criterion validity of the scale. The ANOVA showed that the users who reported performing physical exercise with higher frequency during the week scored higher both in the global value of exercise dependence and in each one of the seven subscales of the EDS-R. These results are in accordance with previous studies that have revealed a relation between exercise dependence and commitment (in frequency and duration) to exercise (Adams et al., 2003; Chapman & De Castro, 1990; Furst & Germone, 1993; Hailey & Bailey, 1982; Kjelsas et al., 2003; Pierce et al., 1993). Using the EDS-R, Symons Downs et al. (2004) found that all the symptoms of exercise dependence were positively related to the values of frequency and intensity of practice in university students. Nevertheless, the authors found that, although the three types of intensity (low, medium, and high) were significantly correlated with the symptoms of exercise dependence, the lowest coefficient found was for low intensity. This suggests that the symptoms of exercise dependence may be more relevant with moderate and intense exercise. Recently, Allegre et al. (2007) also found a positive relation between the EDS-R and practice frequency in ultra-marathoners. However, the authors note that research should analyze the relation of practice intensity and frequency, because an individual who only trains 6 hours per week could display more exercise dependence than an individual who trains 10 or more hours per week, if the former's intensity were higher. Future research should examine the factors associated with the form and habits of physical practice and the symptoms of exercise dependence.

Although the results of this investigation provide psychometric support for the EDS-R, some limitations must be acknowledged. Firstly, one of the subscales obtained an internal consistency value that is only marginally acceptable. Secondly, although acceptable fit indexes were obtained in the confirmatory factor analyses, Hu and Bentler (1999) recommend CFI and IFI values higher than .95 for good fit. Thirdly, invariance across age was only partial, because significant differences were found between the unconstrained model and some invariant models. Fourthly, the participants in this study were recruited randomly, although only those who finally agreed to complete the questionnaire participated in the study (i.e., approximately 80% of those requested). It would have been interesting to collect data about age and sex of the people who refused to participate in the study in order to interpret the results correctly. Participants with a high level of exercise dependence could be those who refused to participate, with the intention of not reducing their training time (Szabo, 1995). Fifthly, physical activities in sports centers are limited in number and do not include the entire practice.

Also, the physical practice profile of the user of sports centers is usually multivariate (i.e., various modalities). Future research should take into account other populations and other practitioners of different sports modalities (e.g., racing, canoeing, bicycling). Moreover, in this study, we did not measure the physical activity practiced by users inside the sports center, and future research could analyze the way that symptoms of exercise dependence may vary as a function of the modality of physical practice (e.g., weight-lifting, choreographic activities, etc.). Lastly, in this study, we analyzed the relation between exercise dependence and practice frequency. Although this relation has been sufficiently confirmed in research, recent studies have emphasized that the intensity of the physical activity may be more important than the amount or frequency of practice (Allegre et al., 2007; Hausenblas & Symons Downs, 2002a). Therefore, intensity, combined with frequency and exercise time, seems to be an interesting factor to take into account in order to understand exercise dependence.

Summing up, the EDS-R is revealed as a valid and reliable multidimensional measure to assess exercise dependence in the Spanish context. To date, there was no multidimensional instrument that could measure exercise dependence in our country. Investigators attempted to measure exercise dependence using items separately and one-dimensional scales. The EDS-R seems to be a more robust psychometric instrument and, therefore, more adequate to measure exercise dependence. Both the scores obtained in the diverse subscales and the global value of the EDS-R can be used as indicators of dependence. However, we note that, whereas it is possible to classify individuals into three groups by combining the mean value of each subscale, the mean global value of the scale does not allow us to differentiate individuals who are at risk of exercise dependence but instead, in this case, a continuum is established on which higher values indicate more symptoms of dependence. Therefore, it would be interesting for future research to study in detail the possibility of creating a general index of exercise dependence that takes into account the different factor loadings of each one of the subscales and that could be used instead of the mean global score of the EDS. Likewise, it would be useful to establish a threshold for this general index of dependence to differentiate dependent individuals from those who are not dependent. In any event, as noted in other studies (Symons Downs et al., 2004), the EDS-R should not be considered a diagnostic instrument by itself, but rather a screening instrument and, therefore, it should be used together with clinical interviews and/or medical examinations to detect dependent individuals. The development of a scale is an ongoing process and, therefore, future studies should also examine the psychometric properties of the EDS-R in diverse populations and activities within our context, including clinical populations.

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APPENDIX

EXERCISE DEPENDENCE SCALE-REVISED (EDS-R).

Withdrawal (Abstinencia)

1. **Practico ejercicio físico para evitar sentirme de mal humor**
8. **Practico ejercicio físico para evitar sentirme ansioso**
15. **Practico ejercicio físico para evitar sentirme tenso**

Continuance (Continuación)

2. **Practico ejercicio físico a pesar de reiterados problemas físicos**
9. **Practico ejercicio físico cuando estoy lesionado**
16. **Practico ejercicio físico a pesar de problemas físicos persistentes**

Tolerance (Tolerancia)

3. **Constantemente incremento la intensidad de mi práctica física para lograr los beneficios o efectos deseados**
10. **Constantemente incremento la frecuencia de mi práctica física para lograr los beneficios o efectos deseados**
17. **Constantemente incremento la duración de mi práctica física para lograr los beneficios o efectos deseados**

Lack of control (Falta de control)

4. **Soy incapaz de reducir el tiempo total que practico ejercicio físico**
11. **Soy incapaz de reducir la frecuencia con la que practico ejercicio físico**
18. **Soy incapaz de reducir la intensidad con la que practico ejercicio físico**

Reduction in other activities (Reducción de otras actividades)

5. **Me gustaría practicar más ejercicio físico que estar con mi familia y amigos**
12. **Pienso en hacer ejercicio físico cuando debería estar concentrándome en el trabajo o en la clase**
19. **Elijo practicar ejercicio físico para poder librarme de estar con mis amigos y familia**

Time (Tiempo)

6. **Dedico un montón de tiempo a la práctica física**
13. **Dedico la mayoría de mi tiempo libre a hacer ejercicio físico**
20. **Dedico mucho tiempo a practicar ejercicio físico**

Intention effects (Efectos deseados)

7. **Practico ejercicio físico durante más tiempo de lo que generalmente quiero**
14. **Practico ejercicio físico durante más tiempo de lo que generalmente espero**
21. **Practico ejercicio físico durante más tiempo de lo que generalmente planeo**

Translator's note: The scale items have not been translated, as this is the Spanish version of a scale that was originally published in English