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Psychometric examination and factorial validity of the Exercise Dependence Scale-Revised in Italian exercisers

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Background and aims: The purpose of this study was to verify the factorial structure, internal validity, reliability, and criterion validity of the 21-item Exercise Dependence Scale-Revised (EDS-R) in an Italian sample. *Methods:* Italian voluntary ($N = 519$) users of gyms who had a history of regular exercise for over a year completed the EDS-R and measures of exercise frequency. *Results and conclusions:* Confirmatory factor analyses demonstrated a good fit to the hypothesized 7-factor model, and adequate internal consistency for the scale was evidenced. Criterion validity was evidenced by significant correlations among all the subscale of the EDS and exercise frequency. Finally, individuals at risk for exercise dependence reported more exercise behavior compared to the nondependent–symptomatic and nondependent–asymptomatic groups. These results suggest that the seven subscales of the Italian version of the EDS are measuring the construct of exercise dependence as defined by the DSM-IV criteria for substance dependence and also confirm previous research using the EDS-R in other languages. More research is needed to examine the psychometric properties of the EDS-R in diverse populations with various research designs.

Keywords: exercise dependence, factorial validity, psychometric examination

INTRODUCTION

Current exercise guidelines identify the minimum amount of exercise needed to experience health benefits. The guidelines also recommend that an increased amount of exercise is associated with additional benefits (USDHHS, 2008). Although increased physical activity above the minimum guidelines is encouraged, no cut-off exists for "how much is too much". Distinguishing when regular exercise becomes too much and thus detrimental on an individual's physical and psychological health is often referred to as exercise dependence (Hausenblas & Symons Downs, 2002a). In general, exercise dependence is a condition in which the physical practice becomes a compulsive and uncontrollable behavior. Exercise dependence may be either an independent problem (i.e., primary dependence) or be secondary to an eating disorder (i.e., secondary dependence); and it is expressed in the form of physiological and psychological problems such as overuse injury, menstrual irregularity, anxiety, depression, illness, or exercising while injured or ill (de Coverley Veale, 1987; Hall, Kerr, Kozub & Finnie, 2007; Hausenblas & Symons Downs, 2002a; Veale, 1995).

Researchers have adapted the DSM-IV (American Psychiatric Association, 1994) criteria for substance dependence describing exercise dependence as a form of exercise that involves clinically significant distress (de Coverley Veale, 1987; Hausenblas & Symons Downs, 2002b). The dependence is manifested by three or more of the following seven criteria: (a) *tolerance* is the need to increase the exercise duration, frequency, and intensity to receive the desired benefits; (b) *withdrawal* is manifested by symptoms (e.g., anxiety, fatigue) in the absence of exercise, or exercise is continued to relieve or avoid these withdrawal symptoms; (c) *intended effect* refers to the duration or amount of exercise is greater than expected; (d) *loss of control* is the inability to reduce or manage the exercise, despite the desire to do so; (e) *time* refers to excessive time to perform or prepare for the exercise; (f) *reductions in other activities* refers to the elimination or reduction of social, occupational, or recreational activities because of the need to exercise; and (f) *continuity* is a persistence of exercise despite recurring physical or psychological problems caused by exercise.

Based on this conceptualization the Exercise Dependence Scale (EDS) was created to measure exercise dependence symptoms (Hausenblas & Symons Downs, 2002b). The EDS also differentiates between individuals at-risk for exercise dependence and nondependent individuals. Hausenblas and Symons Downs (2002b) found that individuals at-risk for exercise dependence reported more strenuous exercise, perfectionism, and self-efficacy compared to nondependent groups. Symons Downs, Hausenblas, and Nigg (2004) revised the factorial structure of this instrument, reducing the items to 21 (3 items for each of the 7 subscales). The EDS–REVISED [EDS-R] yields both interval and nominal data. Specifically, a mean score (i.e., interval data) as well as categorization (i.e., nominal data) are obtained. This latter solution is to differentiate among at-risk, nondependent–symptomatic, and nondependent–

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asymptomatic individuals. The categorization into one of the three groups are generated by a scoring manual that consists of flowchart decision rules, in which items or combination of items determine into which group the person is classified. On the EDS-R, 21-items are rated on a 6-point frequency scale ranging from 1 (never) to 6 (always). The higher the score, the higher is the risk for exercise dependence. The EDS-R has good psychometric properties, including good internal reliability, test-retest reliability, and concurrent validity. Another important aspect of the EDS-R is that operationalizing exercise dependence using the criteria established in the DMS-IV allows classifying individuals in the following groups: at risk for exercise (i.e., score of 5–6 on average on the Likert scale in at least three of the seven criteria), nondependent symptomatic (i.e., scores of 3–4 on average in at least three criteria, or scores of 5–6 on average combined with scores of 3–4 on average in three criteria, but failing to meet the criteria of at risk conditions), and nondependent asymptomatic (i.e., scores of 1–2 on average in at least three criteria).

In the international scene there are other scales that assess problematic exercise behavior (e.g., Exercise Addiction Inventory – EAI; Terry, Szabo & Griffiths, 2004; Exercise Dependence Questionnaire – EDQ; Ogden, Veale & Summers, 1997) but the EDS-R is currently the only instrument that uses all the dependence criteria of the DSM-IV and that can distinguish among types of exercise dependence degrees. Several studies have used the EDS-R to assess exercise dependence showing relevant findings (e.g., Cook & Hausenblas, 2011; Cook, Hausenblas, Tuccitto & Giacobbi, 2011). In addition, the EDS-R has been translated in different languages and has displayed good psychometric propriety in several countries such as Portugal (Lindwall & Palmeira, 2011), Spain (Sicilia & González-Cutre, 2011), Sweden (Lindwall & Palmeira, 2011), Hungary (Monok et al., in press), and France (Allegre & Therme, 2008; Kern, 2007). For these reasons the aim of our study was to start the validation process of the EDS-R in the Italian context. Specifically, the purpose of our study was to verify the factorial structure, reliability, internal and criterion validity of the EDS-R in an Italian sample. Consistent with other translated version of the EDS-R, we hypothesized that the Italian version of the EDS-R would display good psychometric properties (Hausenblas & Symons Downs, 2002a; Lindwall & Palmeira, 2011; Symons Downs, Nigg & Hausenblas, 2004).

METHODS

Sample

Participants were 262 male (age: M = 36.91; SD = 13.53; BMI: M = 24.97, SD = 2.96) and 257 female (age: M = 37.37; SD = 13.28; BMI: M = 22.94, SD = 3.60) voluntary users of gyms who had a history of regular exercise for over a year. The participants were Italian, and they were recruited in different gyms in Sicily and Calabria. Based on the EDS-R classification system participants were classified as at risk for exercise dependence (n = 34: male = 17, female = 17; as nondependent–symptomatic (n = 300: male = 163, female = 137), and as nondependent–asymptomatic (n = 184: male = 82, female = 103).

Procedure

The 523 participants were recruited from 37 fitness clubs in Sicily and Calabria (46 gyms were approached for recruitment, with 9 gyms not providing permission to collect data). After describing the study purpose, interested participants voluntarily completed the informed consent. Participants completed the questionnaire in a separate room of the gym under the assistance of a researcher either before or after their training sessions. The questionnaire took about 15 min to complete. Four subjects (3 men and 1 woman) failed to complete the entire questionnaire.

Measures

Socio-demographic and exercise frequency. Participants reported their age, gender, weight, and height. The height and weight information was used to compute their body mass index. For exercise frequency, the participants completed the following question: "Generally how many days a week do you train?".

Exercise Dependence Scale (EDS-R). Exercise dependence was assessed with the EDS (Hausenblas & Symons Downs, 2002a), a 21-item Likert-type scale that assesses the extent (1 = Never to 6 = Always) to which the respondent exhibits characteristics of exercise dependence. Higher scores indicate more symptoms of exercise dependence. The instrument has seven subscale (Tolerance, Withdrawal, Continuance, Lack of Control, Reduction in Other Activities, Time, and Intention Effects) based on the DSM-IV criteria for substance dependence and a total score.

The EDS was translated into Italian according to standard back-translation techniques. The translation phase of the questionnaire was carried out by two translators who produced two independent versions translated from English into Italian. Then a common version synthesized by the two previous versions was created. Finally, two other translators translated the Italian version into English to ensure equivalence with the original version.

RESULTS

Descriptive analyses

As shown in Tables 1 and 2, the EDS-R individual items and subscales had acceptable skewness ($< |2|$) and kurtosis ($< |1.5|$). The participants scored highest in the Tolerance subscale (M = 9.79), and lowest in the Reduction in Other Activities Subscale (M = 5.61). All the individual items were significantly correlated, with values ranging from .23 to .78. The correlations between each one of the factors and the global measure of dependence ranged between .55 and .79.

Confirmative factor analysis and reliability

Preliminary analysis revealed that the data departed significantly from multivariate normality (Mardia's coefficient = 73.32). Consequently, model fit was assessed using the Satorra-Bentler (1994) scaling correction to the maximum likelihood χ^2. Thus, the robust maximum likelihood methods was used for all indexes. Because there is no single accepted index of model fit, a combination of various fit indexes were reported using the robust root mean square error

of approximation (robust RMSEA = .038) and its 90% confidence interval (.03–.04), the comparative fit index (CFI = .97), the non-normed fit index (NNFI = .96), and the average absolute standardized residual (AASR = .03) were examined. These results for the model revealed adequate fit indexes and in line with the theoretical model all the items loadings exceeded .50 and ranged between .51 to .90 (see Table 1).

Internal consistency analyses were carried out for the Italian version of the EDS-21. All the subscale had good internal reliabilities (Table 1). The Reduction in Other Activities factor demonstrated the weakest reliability, with suboptimal AVE (Average Variance Extracted), and weighted omega coefficients.

Criterion validity

Pearson correlations between the EDS-R and exercise frequency was conducted to verify criterion validity (Table 2). Exercise frequency was positively related with all the EDS subscales. These results are confirmed by the differential analyses. In fact, the at-risk group had an exercise frequency

Table 1. Descriptive statistics for the Exercise Dependence Scale individual items and factor analysis

	M	*SD*	Ske	Kur	Factor loading	ε
Withdrawal (α = .79; AVE = .55; ω = .72)						
1. I exercise to avoid feeling irritable.	2.28	1.47	0.96	–0.10	.701	.713
8. I exercise to avoid feeling anxious.	2.25	1.53	1.08	0.05	.743	.670
15. I exercise to avoid feeling tense.	2.53	1.55	0.74	–0.56	.795	.607
Continuance (α = .74; AVE = .53; ω = .70)						
2. I exercise despite recurring physical problems.	2.57	1.74	0.74	–0.82	.783	.622
9. I exercise when injured.	1.83	1.44	1.58	1.09	.511	.860
16. I exercise despite persistent physical problems.	2.03	1.54	1.42	0.82	.853	.521
Tolerance (α = .87; AVE = .71; ω = .80)						
3. I continually increase my exercise intensity to achieve the desired effects/benefits.	3.65	1.69	–0.08	–1.21	.767	.641
10. I continually increase my exercise frequency to achieve the desired effects/benefits.	3.18	1.73	0.30	–1.20	.891	.453
17. I continually increase my exercise duration to achieve the desired effects/benefits.	2.96	1.67	0.45	–1.03	.855	.518
Lack of control (α = .87; AVE = .69; ω = .79)						
4. I am unable to reduce how long I exercise.	2.47	1.56	0.80	–0.46	.807	.591
11. I am unable to reduce how often I exercise.	2.29	1.50	1.00	–0.07	.868	.497
18. I am unable to reduce how intense I exercise.	2.20	1.49	1.13	0.26	.809	.588
Reduction in other activities (α = .70; AVE = .44; ω = .64)						
5. I would rather exercise than spend time with family/friends.	2.00	1.28	1.43	1.52	.722	.692
12. I think about exercise when I should be concentrating on school/work.	1.87	1.30	1.53	1.54	.619	.785
19. I choose to exercise so that I can get out of spending time with family/friends.	1.74	1.36	1.72	1.49	.643	.766
Time (α = .85; AVE = .67; ω = .78)						
6. I spend a lot of time exercising.	3.18	1.45	0.27	–0.72	.759	.652
13. I spend most of my free time exercising.	2.75	1.62	0.59	–0.84	.825	.566
20. A great deal of my time is spent exercising.	2.71	1.57	0.64	–0.63	.876	.483
Intention (α = .89; AVE = .73; ω = .81)						
7. I exercise longer than I intend.	2.46	1.49	0.74	–0.52	.865	.502
21. I exercise longer than I plan.	2.49	1.52	0.81	–0.36	.815	.579
14. I exercise longer than I expect.	2.46	1.52	0.82	–0.39	.901	.434

Note: N = 519 for all the items; M = Mean; SD = Standard Deviation; Ske = Skewness; Kur = Kurtosis; Factor loading = Standardized Factor Loadings; ε = Measurement Error; α = Cronbach's α; AVE = average variance extracted; ω = weighted omega.

Table 2. Descriptive statistics and correlations of the Exercise Dependence Scale Subscales and exercise frequency

	M	*SD*	Ske	Kur	1	2	3	4	5	6	7	8
1. Withdrawal	7.06	3.82	0.96	0.40	–							
2. Continuance	6.43	3.87	1.09	0.29	.369	–						
3. Tolerance	9.79	4.56	0.28	–0.97	.238	.290	–					
4. Lack of control	6.96	4.04	0.92	0.05	.303	.279	.437	–				
5. Reduction in other activities	5.61	3.12	1.37	1.21	.362	.443	.381	.447	–			
6. Time	8.65	4.08	0.59	–0.51	.369	.331	.594	.390	.606	–		
7. Intention	7.41	4.11	0.81	–0.21	.372	.280	.594	.497	.510	.787	–	
8. Total dependence	51.90	18.59	0.61	0.08	.557	.562	.709	.651	.633	.792	.783	α = .90
9. Exercise frequency	3.28	1.09	0.86	0.48	.123	.106	.257	.091	.180	.358	.263	.297

Note: All correlations are significant at least $p < .05$; N = 519; M = Mean; SD = Standard Deviation; Ske = Skewness; Kur = Kurtosis.

of 4.18 (*SD* = 1.31), the nondependent–symptomatic of 3.36 (*SD* = 1.06) and the nondependent–asymptomatic of 2.98 (*SD* = 1.00). The statistical analysis with Kruskal-Wallis showed significant differences among groups for exercise frequency, $\chi^2(2) = 35.61$, $p < .001$. These differences were confirmed by the Jonckheere-Terpstra test, J-T = –5.74, $p < .001$. Simple comparisons showed higher significant score of at-risk group than nondependent–symptomatic, U = 3321, Z = –3.58, $p <. 001$ and nondependent–asymptomatic, U = 1518, Z = –5.15, $p < .001$. The nondependent–asymptomatic group had the lowest scores when compared with the nondependent–symptomatic group, U = 21969, Z = –4.165, $p < .001$.

CONCLUSIONS

The aim of our study was to start the validation process of the EDS-R in the Italian context. We found that the Italian EDS-R had good psychometrics characteristic. Our study findings and limitations as well as future research directions are discussed below.

Consistent with our hypothesis, using confirmative factor analysis we found support for the 7-factor model and good internal reliability of the Italian EDS-R. Similar to other researchers, we found that the Reduction in Other Activities subscale had the lowest value (Allegre & Therme, 2008; Kern, 2007; Lindwall & Palmeira, 2011; Sicilia & González-Cutre, 2011; Symons Downs et al., 2004). Our results suggest that the seven subscales of the EDS-R are measuring the construct of exercise dependence as defined by the DSM-IV criteria for substance dependence. Criterion validity was evidenced by significant correlations between all the subscale of the EDS-R and exercise frequency. This finding is further confirmed by the differential analysis that showed that the at-risk individuals reported more exercise compared to the nondependent–asymptomatic and nondependent–asymptomatic participants. Our results confirm previous research and show similar results with the original English version as well as the translated forms of the EDS (Allegre & Therme, 2008; Symons Downs et al., 2004).

The prevalence of individuals at risk for exercise dependence (6.6% in our study) is comparable with the results of research conducting in other countries. For example, in an American sample the prevalence of exercise dependence risk was between 3.6 and 5% (Symons Downs et al., 2004). Similarily, Lindwall and Palmeira (2011) found the prevalence of exercise dependence to be 9.2% in a Swedish sample and 5.2% in a Portuguese sample. The consistent prevalence results of exercise dependence in several countries illustrates that it may be an international dependence, and establishing psychometrically valid versions of the EDS in other languages enables increased understanding of this type of dependence from a cross-country perspective. Because the validation of a questionnaire is an ongoing process, we encourage other researchers to continue to examine the psychometric properties of the Italian EDS-R. As well, we encourage researchers to conduct cross-country research with the EDS-R to examine if cultural differences exist with exercise dependence symptoms.

In conclusion, our study revealed that the Italian version of the EDS-R has good psychometric characteristic. Because scale development is an ongoing process future studies should also examine the psychometric properties of the EDS-R in diverse populations (e.g., varying physical activities, ages, ethnicities) using various research designs (e.g., experimental, prospective). Continued cross-country research into exercise dependence using psychometrically valid measures will increase our understanding of this psychological issue.

REFERENCES

Allegre, B. & Therme, P. (2008). Étude confirmative de l'échelle de dépendance à l'activité physique Exercise Dependence Scale-Revised pour une population francophone. *L'Encéphale, 34,* 490–495.

American Psychiatric Association (APA) (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington DC: Author.

Bowker, A. (2006). The relationship between sports participation and self-esteem during early adolescence. *Canadian Journal of Behavioural Science, 38,* 214–229.

Cook, B. J. & Hausenblas, H. A. (2011). Eating disorder specific health-related quality of life and exercise in college females. *Quality of Life Research, 20,* 1385–1390.

Cook, B. J., Hausenblas, H. A., Tuccitto, D. & Giacobbi, P. (2011). Eating disorders and exercise: A structural equation modeling analysis of a conceptual model. *European Eating Disorders Review, 19,* 216–225.

de Coverley Veale, D. M. (1987). Exercise dependence. *British Journal of Addiction, 82,* 735–740.

Donaldson, S. & Ronan, K. (2006). The effects of sports participation on young adolescents' emotional well-being. *Adolescence, 41,* 369–389.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C. & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods, 4,* 272–299.

Hall, H. K., Kerr, A. W., Kozub, S. A. & Finnie, S. B. (2007). Motivational antecedents of obligatory exercise: The influence of achievement goals and multidimensional perfectionism. *Psychology of Sport and Exercise, 8,* 297–316.

Hausenblas, H. A. & Symons Downs, D. (2002a). Exercise dependence: A systematic review. *Psychology of Sport and Exercise, 3,* 89–123.

Hausenblas, H. A. & Symons Downs, D. (2002b). How much is too much? The development and validation of the Exercise Dependence Scale. *Psychology and Health, 17,* 387–404.

Kern, L. (2007). Validation de l'adaptation française de l'échelle de dépendance à l'exercice physique: l'EDS-R. *Pratiques psychologiques, 13,* 425–441.

Lindwall, M. & Palmeira, A. (2011). Factorial validity and invariance testing of the Exercise Dependence Scale-Revised in Swedish and Portuguese exercisers. *Measurement in Physical Education and Exercise Science, 13,* 166–179.

Monok, K., Berczik, K., Urban, R., Szabo, A., Griffiths, M. D., Farkas, J., Magi, A., Eisinger, A., Kurimay, T., Kokonyei, G., Kun, B., Paksi, B. & Demetrovics, Z. (in press). Psychometric properties and concurrent validity of two exercise addiction measures: A population wide study. *Psychology of Sport and Exercise*.

Ogden, J., Veale, D. & Summers, Z. (1997). The development and validation of the Exercise Dependence Questionnaire. *Addiction Research, 5,* 343–356.

Pett, M. A. (1997). *Nonparametric statistics for health care research. Statistics for small samples and unusual distributions.* Thousand Oaks, CA: Sage.

Sicilia, A. & González-Cutre, D. (2011). Dependence and physical exercise: Spanish validation of the Exercise Dependence Scale-Revised (EDS-R). *The Spanish Journal of Psychology, 14,* 421–431.

Symons Downs, D. S., Hausenblas, H. A. & Nigg, C. R. (2004). Factorial validity and psychometric examination of the Exercise Dependence Scale-Revised. *Measurement in Physical Education and Exercise Science, 8,* 183–201.

Terry, A., Szabo, A. & Griffiths, M. (2004). The exercise addiction inventory: A new brief screening tool. *Addiction Research and Theory, 12,* 489–499.

USDHHS (2008). 2008 Physical activity guidelines for Americans. www.health.gov/paguidelines/guidelines/default.aspx

Veale, D. (1995). Does primary exercise dependence really exist? In: J. Annett, B. Cripps & H. Steinberg (Eds.), *Exercise addiction: Motivation for participation in sport and exercise* (pp. 1–5). Leicester, UK: British Psychological Society.