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Original Article

Psychometric Properties of Persian Version of the Eating Disorders Screen for Athletes (EDSA)

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Abstract

Background: This study pursues two goals: first, presenting Persian translation and cultural adaptation of Eating Disorders Screen for Athletes (EDSA) by an international standard method, and second, studying factor structure and psychometric properties of EDSA.

Methods*:* 439 athletes aged 18 and older from various sports nationwide participated in this research. A confirmatory factor analysis was utilized to present the validation of the structure. Internal consistency was also examined using Cronbach's alpha coefficient. *Concurrent* validity was evaluated using the zero correlation between EDSA and the Eating Disorder Examination Questionnaire (EDE-Q). Receptor Operating Characteristic (ROC) curve analysis based on gender and distinct performance analysis was used to predict the grouping of athletes based on the EDSA cut-off point (3.33 as the optimal cut for men and women) from the benchmark test.

The Persian version of the EDE-Q in athletes has a similar factor structure to the English one. The questionnaire's reliability was obtained by Cronbach's alpha, which was 0.744. The correlation between the scores of this questionnaire and the EDE_Q was confirmed. Diagnostic validity for the classification of male and female athletes with low and high eating disorders has a significance level of P <0.001, and a cut-off score of 3.25 on EDSA presented an *optimal exchange* of sensitivity in *return* for sensitivity in genders. Therefore, a sensitivity of 0.100 and specificity of 0.94 was observed for men and a sensitivity of 1.100 and specificity of 935 for women.

Results*:* Data showed adequate fit to the original model: χ^2 (9) = 34.203, CFI = .938, TLI = .897, RMSEA = .095, 90% CI (.062, .129), PCFI = .563, CMIN / DF=3.8 SRMR=0.049. Based on the examination of modification índices, error terms for items Q2 and Q4 (χ2 = 18.9, expected parameter change = 0.316), showed relatively larger modification indices than others. Considering the correlation between the abovementioned error pairs, the measurement model was respecified. An improvement was found in the model fit of the respecified model: χ^2 (8) = 12.74, CFI = .988, TLI = .978, RMSEA = .044, 90% CI (.001, .086), PCFI = .573, CMIN / DF=1.59 and SRMR=0.029). Standardized factor loadings ranged between .43 and .81 at the significance level of p = 0.001.

Conclusions*:* The present research indicates the successful translation, development, and validation of Persian EDSA as a screening tool to identify male and female athletes at risk for eating disorders. The Persian version of EDSA can be confidently used in Persian language research and applied fields.

Keywords: Athletes; Eating Disorders; Psychometrics; Screen

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Introduction

The importance of developing an eating disorder screening tool for athletes

According to the criteria of the latest version of the Diagnostic and Statistical Manual of Mental Disorder (1), eating disorder is a serious mental disorder that affects young adult men and women by about 1% -3% and 6% -15% respectively. (2-4) Eating disorder is a mental health problem among adult men and women expressed as Anorexia Nervosa (AN) and Bulimia Nervosa (BN). Eating disorder symptoms usually appear within the puberty period (5). Eating disorders are related to several life *threatening* problems, such as congestive cardiac failure, renal failure, immunocompromisation, and other medical complications (6, 7). Despite more effective therapies available in comparison to the past, no significant reduction has been observed in the rate of eating disorders (7, 8).

Like full threshold eating disorder, threshold eating disorder has to do with psychosocial disorders and major medical complications (9-12) but is more common than it (13). All eating disorders expose individuals at the risk of physical, psychological, social and life-threatening complications by seriously intervening in the whole quality of life(14). Various biological, cultural, social, and psychological factors are involved in eating disorder risk and affect people in different ways(7).Cultural changes, such as the standards of beauty and slimming shift, affect eating disorders (7, 15, 16). Moreover, becoming muscular has increased the risk of eating disorders for both women and men (17-19).

Research studies have shown that 84% of biological characteristics associated with eating disorders are related to the genetic factors(20, 21). For instance, immediate families who are diagnosed with eating disorders, are more at risk(DSM-5 Selections; American Psychiatric Association 2015). Moreover, there are psychological factors which influence people's eating behaviors, suggesting that eating disorders can be a way to cope with painful emotions. These studies show that people who emotionally eat are at risk of eating disorders (22-24) and those with anxiety disorders are also at the same risk (25). Studies show that most people experience changes in response to emotional stress and appetite while eating with an average increase of 30% and a decrease of 48%, respectively. Additionally, epidemiological data reveals that stress-related eating is associated with weight gain (26).

Cultural influences, not surprisingly, should be taken into account when eating disorders are examined. Post-industrialized, high-come cultures experience the highest rates of eating disorders and more intense fears of weight gain (25).

Eating disorders have been considered historically. Though case descriptions of eating disorders refer to the female patients(27), the implication of many parts is that men do not catch disease at all or catch rarely(10).

Although these cases eventually led to the claim that approximately one out of ten men is diagnosed with an eating disorder as well, current evidence suggest that people catch irregularity in eating at about one out of four. Also, empirical evidence has shown for the first time that eating disorders in men increase more rapidly in comparison with women in the society. Moreover, the correlation of eating disorder symptoms in people is as strong as reports in women(28).

Eating disorders are also widespread among those who exercise (29, 30). Rates of eating disorders in athletes seem to be increasing with rates varying from 6–45% in female athletes and 0–19% in male athletes (31, 32).

On the other hand, many studies published recently reveal a higher prevalence of eating disorders in athletes compared to the public (33). Some researches illustrate that female athletes are more likely to catch eating disorders than their male counterparts (30, 33). Nevertheless, recent studies have shown that the gap between male and female athletes with eating disorders is smaller compared to the previous thoughts(34, 35). Athletes and elite athletes, who compete in sport competitions, are more at risk for eating disorders due to the expectations from them for training, as well as sports that they work with different weight groups for a long time(33, 36-39).

Athletes with a range of risk factors for eating disorders associated with sports participation, especially athletes who participate in slimming sports are more at risk of eating disorders (33, 40, 41), indicating that people whose weight loss is a factor in improving their performance, such as those who cycle and are also judged aesthetically, such as gymnasts, and those in weight classes, such as wrestlers are more at risk of eating disorders rather than athletes in non-weight sports, such as basketball players. The risk of eating disorder varies based on the level of competition as well(42, 43).

Personality traits with the expectations of the team, coach, family and fans are dangerous factors for causing eating disorders, and athletes who do sports which require speed, power, agility and lightness are more likely to catch eating disorder than those who need muscle mass(44).

It is significant to note that cognitive impairments of eating disorders are strongly

associated with decreased athletic performance(45, 46) and increased risk for sport-related injuries(47), this reinforces the importance of diagnosis and intervention in groups of athletes.

The Development of EDSA screening tool

The EDSA was developed through a research-practice collaboration that started at first with 20 items from the *Female Athlete Screening Tool* (*FAST*) (48) and the Female Athlete Triad Screening Questionnaire (49). While both of the above mentioned tools were designed to be used for female athletes, the 20 items were also selected to find the potential relevance among male athletes. However, Gallagher and colleagues (2019) found significant gender bias in some ítems. It means that items focused on thinness and weight were more likely to be endorsed by female athletes than their male counterparts even after adjusting for overall eating disorder risk. Item modification was thus done to focus on more gender-neutral body ideals (50) to lower gender bias. For example, the FAST item, "Do you worry that you will gain weight if you cannot exercise?" (48) was changed to "Do you worry that your weight, shape, or body composition will change if you cannot exercise?" (51)

In response to the Eating Disorder Challenge, Hazard and colleagues developed and approved a sports questionnaire for male and female athletes based on evidence from the sports field. EDSA has been shown to be an effective and reliable tool for identifying athletes at risk of ED(51). The importance of early detection of eating disorder behavior and the development of clinical identification tools has been studied and researched for many years (52).

Various measurements have been performed to estimate the risk of eating disorders among female athletes. These measurement tools include the Athletic Milieu Questionnaire (53), Female Athlete Screening Tool (48), Physiological Screening Test (54) and Athlete Eating Disorders Questionnaire (44). In addition, the Compulsory Exercise Test - Athlete Prescription (55, 56) has been developed to evaluate successful exercise between female athletes with and without a high risk of eating disorder(57). Nevertheless, each of these assessment tools has been validated only to be used for female athletes. Therefore, these tools are limited to identify eating pathology in men, which shows female athletes' body ideals and different eating patterns (58). Moreover, except for BEDA-Q, these tools are relatively lengthy and limit the ease of publication as a screening tool(51).

A six-item, single-factor structure was supported for EDSA in both genders. The internal consistency was good for both men and women. According to ROC curve analysis, EDSA could accurately predict the risk of eating disorder and scored as a favorable value for men (sensitivity =.96, specificity =.80) and female athletes (sensitivity = 96 / 0, attribute = .64). In addition, the results supported the lack of robust change in measurements for EDSA based on gender, competition level (one group vs. club group) and type of exercise (lean vs. lean)(51).

The Need for a Persian version EDSA

In Iran, as far as the authors and experts of sports psychology are aware, there is no specific valid and reliable questionnaire in the field of eating disorders in male and female athletes, and if there is a questionnaire, it is dedicated to a specific gender and has different drawbacks and does not have an approved application in the field of the psychometrics of athletes. Therefore, a screening tool has been designed for eating disorders in athletes to be used in Iran to evaluate the psychometric properties of eating disorders in various sports groups regardless of gender. Considering that something has been done for the development and validation of age, the adaptation of an internationally recognized, valid, and reliable tool such as EDSA was assessed as appropriate and efficient.

This study pursues two goals: Persian translation and cultural adaptation of EDSA based on an international standard method, and investigating factor structure and psychometric properties of EDSA.

Materials and Methods

Procedure

Suggested methods to translate the questionnaire for socio-cultural adaptation were localization, including forward and backward translation, as well as cognitive interview(59, 60).

Step 1: At first, two native Iranian translators with university degrees and knowledge on the field of study forward translated the questionnaire and prepared a translation of the main items, instructions, options, and answers independently. The translators then discussed both translations and came to an agreement on a single combined version in order to produce a conceptually and semantically equivalent and easy to understand translation of the original tool (61).

According to the above, this process allows the change in the original version, where words with translatable meanings or words and terms have a special meaning and create a different meaning culturally.

Step 2: The Persian EDSA was backward translated into English by another professional translator and compared with the original version to determine any misunderstanding or inaccuracy in the translation process.

Step 3: Cognitive interview: In the last stage, the translated questionnaire was used for a sample of respondents to determine if the translation was acceptable and if it was easy to understand to assess the tool's clarity. The cognitive interview was held virtually with 10 participants due to the health restrictions at the time of the outbreak of Covid19 virus.

The interviews included the following:

A) Assessing easy understanding of each question using clear and understandable dual options and difficult to understand

B) Assessing easy comprehension of each item using a 0 to 5 numerical rating scale (from highly comprehensible to incomprehensible)

C) In order to get a better result from the items in the questionnaire, the interviewees were asked to express the understood meaning of each item in their own words and then reiterate each item to confirm their understanding.

Instruments

The EDSA as an eating disorder screening tool was developed to screen eating psychopathology in male and female athletes. The 6-item EDSA, scored on a 5-point Likert scale, was developed in 2020 (Hazzard et al., 2020). This scale could consistently and accurately predict eating disorder risk status among both female and male athletes (Hazzard et al., 2020). Additionally, the EDSA has shown strong measurement across the competition level (Division I versus club), type of sport (lean versus non-lean sports), and gender (male versus female) (Hazzardet al., 2020).

Eating Disorder Examination Questionnaire (EDE- Q 6.0) (22) was developed to evaluate cognitive and behavioral properties of eating disorders with emphasis on the last 28 days. EDE-Q provides behavioral data, a global score, and four subscales, including restraint, shape concern, weight concern, and eating concern. Using seven ítems focusing on the number of episodes within the past 28 days in which the behaviors occurred, the

frequency of pathological eating behaviors, such as binge eating and laxative misuse is assessed. Several studies have psychometrically evaluated EDE-Q.

Participants

Participants were 439 athletes (213(48.5%) male, 226(51.5%) female, mean age of 30.34 years) who completed questionnaires. Using self-reported height and weight, the mean body mass index (BMI) of athletes was obtained to be 24.48 kg/m^2 (*SD* = 9.61). (For details, see Table 1).

Table 1. Participant characteristics

	f	%		Mean	SD
Gender			Age	30.54	10.13
Male	213	48.5	weight	71.34	15.44
Female	226	51.5	height	174.28	50.39
Number of sport disciplines	30		Age of onset of exercise	13.98	7.19
Competitive Level:	f	%	BMI	24.48	9.61
Recreational	137	31.2	Experience	f	%
Club	169	38.5	1-5 years	113	25.7
National	90	20.5	5-10 years	125	28.5
International	43	9.8	More than 10	201	45.8

Statistical Analysis

Confirmatory Factor Analysis: Structural equation modeling (SEM) using AMOS software was used to evaluate the validity of the questionnaire. For factorial validity evaluation, comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), parsimonious comparative fit index(PCFI) , normed chi-square (CMIN / DF) and standardized root mean square residual (SRMR) were utilized. Considering the cut-off values of CFI and TLI, an index value of over .90 indicates adequate fit and an index value of over .95 represents good fit (62)). For RMSEA and SRMR a cut-off value below .08 and .06 signifies adequate and good fit, respectively, Considering the PCFI cut-off values, an index value above .50 represents adequate fit and cut-off values of normed chi-square value of lower 5 shows adequate fit (62).

Internal Consistency: The questionnaire reliability was examined using Cronbach's alpha coefficient. The α values of .70 represent adequate reliability (63).

Concurrent validity: The zero-order correlations between EDSA and EDE-Q were computed in simple to evaluate concurrent validity.

Criterion validity: ROC curve analysis by gender and discriminant function analysis were used to predict the grouping of athletes based on the EDSA cut-off point (3.33 as the optimal cut for men and women) from the benchmark test.(51). Data were analyzed using SPSS software version 25.

Results

Confirmatory Factor Analysis

Data revealed adequate fit to the original model: χ^2 (9) = 34.203, CFI = .938, TLI = .897, RMSEA = .095, 90% CI (.062, .129), PCFI = .563 , CMIN / DF=3.8 SRMR=0.049 . Based on the modification indices, error terms for items Q2 and Q4 (χ2 = 18.9, expected parameter change = 0.316) had relatively larger modification indices than the rest. The model of measurement was thus respecified by considering the correlation between the abovementioned pairs of error terms. Improvement of the model fit of the respecified model was observed: χ^2 (8) = 12.74, CFI = .988, TLI = .978, RMSEA = .044, 90% CI (.001, .086), PCFI = .573, CMIN / DF=1.59 and SRMR=0.029). (Fig. 1). Standardized factor loadings ranging from .43 to .81, were significant at the p = 0.001 level (Table 2).

Internal Consistency

The EDSA showed a good internal consistency for both male athletes (α = .702), female athletes (α = .782) and whole sample (α =.744).

Concurrent validity

Zero-order correlations between EDSA and EDEQ have been calculated to evaluate the Concurrent validity (Table 2). The zero-order factor correlations were positive (r = .385–.615).

Table2. Factor loads of questionnaire items, descriptive statistics and correlations among EDSA and EDEQ (n = 439)

Item	**Factor loads**	Mean	SD	Correlation
1. Does your weight, shape, or body composition affect the way you feel about yourself?	.427***	3.9	1.2	.412***
2. Are you dissatisfied with your weight, shape, or body composition?	.43***	5.5	1.1	.425***
3. Do you worry that your weight, shape, or body composition will change if you cannot exercise?	.637***	3.7	1.3	.380***

4. Do you want to be leaner even if others may think you are already lean?	.611***	2.7	1.5	.528***
5. Do you worry about losing control over your eating because of how it may affect your weight, shape, or body composition?	.813**	3.1	1.4	.552**
6. Do you try to avoid certain foods to influence your weight, shape, or body composition?	.545***	3.2	1.3	.385***
Total	-	3.2	.88	.615**

*** p < .001

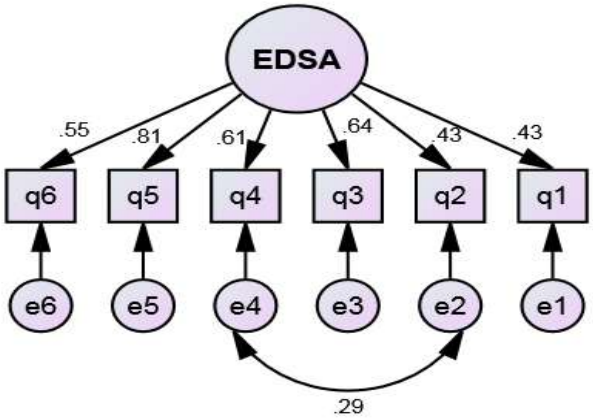

Fig1. The hierarchical structure of EDSA, confirmatory factor analysis with standardized coefficients

Criterion validity

We found a significant discriminant function of the EDSA for males (Wilks Lambda = 0.340, $\chi 2$= 227.07, p < 0.001), with a canonical correlation of 0.812 and for females (Wilks Lambda = 0.367, $\chi 2$= 223.76, p < 0.001), with a canonical correlation of 0.795.

The EDSA could accurately predict the "no disorder" group members in males (93.4%, 113 out of 121) and the "with disorder" group members in females (100%, 92 out of 92) and the "no disorder" group members in females (115 out of 126) and the "with disorder" group members in (100%, 100 out of 100) in males.

As can be observed in Figure 2, EDSA scores could accurately predict the eating disorder risk status for both male athletes (area under the curve [AUC]= .993, 95% CI: .98-.100) and female athletes (AUC = .997, 95% CI: .99-.100). A cut-off score of 3.25 on the EDSA provided an optimal trade-off between sensitivity and sensitivity across genders. Therefore, a sensitivity of 0.100 and specificity of 0.94 was observed for men and a sensitivity of 1.100 and specificity of 935 for women.

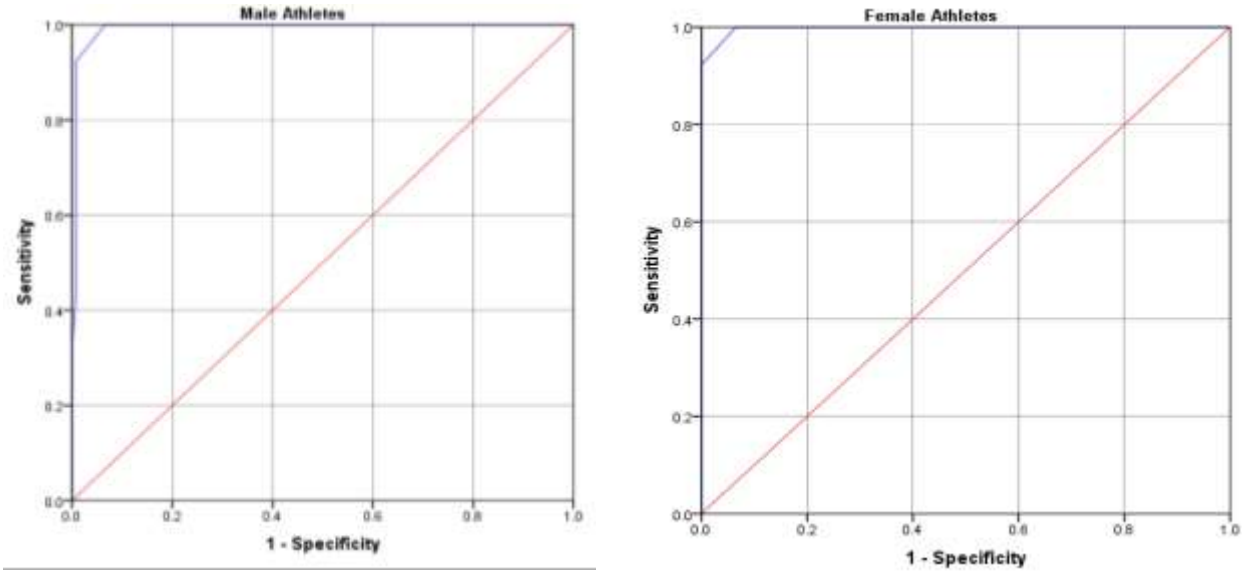

Figure 2. ROC curves for male and female athletes. Area under the curve = .993 for male athletes and .997 for female athletes.

Discussion

Preventing eating disorders from happening in the first place is the most effective way for reducing the occurrence of eating disorders in athletes. Therefore, a valid screening tool capable of predicting new cases of eating disorders among young athletes may be an important step in prevention of eating disorders, because no therapy and recovery may occur unless these disorders are identified(39). To facilitate early identification and treatment, we propose in this research a concise and easy to administer screening tool as a first step for identification of athletes with an eating disorder and in need of further medical and psychological examination. EDSAcan be used as an important tool by professionals working with athletes to make easier the identification of athletes in need of further examination. The aim of this study was to compare the appropriateness of EDSA scores among different groups of athletes by measuring immutability based on gender, competition level, and type of sport. The results support the immutability of strong EDSA measurements at the level of competition (first vs. club) and type of sport (lean vs. lean) as well as partial measurement.Firstly, EDSA showed a high ability to diagnose athletes with and without eating disorders. In addition, a decrease of 3.25 in EDSA causes a favorable change between sensitivity and sensitivity between the genders, leading to a sensitivity of 0.100 and a specificity of 0.93 for male athletes and a sensitivity of 0.100, and a specificity of 935 for

female athletes, respectively.Secondly, EDSA internal compatibility was calculated to be good for both gender groups. Moreover, an optimal balance was found between sensitivity and specificity invariance across genders (male versus female), indicating that EDSA scores can be meaningfully compared across these groups. Our results prove that the EDSA is a valid measure to determine eating disorder behavior. Though the basic validity and accuracy of each of the psychological tests and measures have been examined prior to being adopted by professionals, there is still scant research on whether these tests work well with real-world datasets. Additionally, the medical area is considered quite subjective as each expert decides on the resources to be used in a patient diagnosis process. An expert may simply choose not to use specific diagnostic instruments, even when they may render the best results. Moreover, a professional may be unaware of the availability of a better diagnostic instrument than the previous one. It is thus essential that researchers begin to test the efficacy of these instruments in real-world contexts. The analysis in the present research focuses on EDSA.

Conclusions

This study presents the successful translation, development and validation of the Persian EDSA as a screening instrument for identification of male and female athletes at risk for eating disorders and can be confidently used in Persian language research and applied fields.

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Conflict of Interests:

The authors declare no conflict of interests with any internal or external entity in conducting this research.

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Appendix

Eating Disorders Screen for Athletes (EDSA)

Please read each question carefully and select the appropriate response. Please note that "weight"

refers to numbers on a scale, "shape" refers to amount and distribution of body fat and muscle, "body composition" refers to ratio of body fat to muscle, and "leanness" refers to low body fat-to-muscle ratio.