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Original Article

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Psychometric Properties of the Persian Version of the Yale Food Addiction Scale 2.0 (P-YFAS 2.0) in an Iranian Clinical Sample

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Abstract

Background: The aim of this study was to assess the psychometric aspects of Persian version of Yale Food Addiction Scale 2.0 (YFAS 2.0) and the prevalence of Food Addiction (FA) among Iranian obese population seeking bariatric surgery.

Methods: In this cross-sectional study, psychometric aspects of the YFAS 2.0 including validity and reliability were assessed. Convergent and discriminant validity of the YFAS 2.0 was evaluated using Eating Disorder Inventory-3, Referral form (EDI-3 RF), Dutch Eating Behavior Questionnaire (DEBQ), Difficulties in Emotion Regulation Scale (DERS), and Barratt Impulsiveness Scale (BIS-15) and reliability of the scale was examined by test-retest analysis and internal consistency.

Results: Among 124 patients (48.6%) who met FA criteria, 2 patients (1.6%) received a mild, 12 (9.6%) a moderate, and 110 (88.7%) a severe FA diagnosis. FA was more prevalent and severe in females, unmarried individuals, unemployed patients, and those with higher Body Mass Index (BMI) or binge eating disorder/bulimia nervosa diagnoses. Reliability analysis showed high internal consistency (Cronbach's α = 0.89) and test-retest reliability (ICC = 0.88). Content validity was 0.8 or higher in terms of convergent validity. Except for one criterion, a one-factor structure was confirmed for the P-YFAS 2.0 (above 0.42). FA prevalence was higher in participants with BED or bulimia nervosa, and FA severity was correlated with scores on measures of impulsivity, emotion regulation difficulties, eating behaviors and psychopathology.

Conclusion: These findings support the reliability and validity of the P-YFAS 2.0 in assessing FA as defined by Diagnostic and Statistical Manual of Mental Disorders-fifth (DSM-5). The high rate of FA identified highlights the need for targeted interventions in this clinical population.

Keywords: Bariatric surgery, Feeding behavior, Food addiction, Iran, Obesity

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Introduction

Obesity is a worldwide health problem, and the main cause of several physical and psychiatric disorders (1). Overeating of energy-dense food is a major factor associated with obesity (2). There has been considerable debate on whether some forms of overeating may be conceptualized as an addictive process, commonly named "Food Addiction" (FA) (3-5). It is now recognized that palatable energy-dense food activates the meso-cortico-limbic reward circuits of the brain by the release of serotonin, dopamine, and endogenous opiates. Thus, the consumption of calorie-dense food can lead to addiction through neurobiological mechanisms that are similar to those of drugs of abuse (6). Furthermore, several behavioral features of drug addiction also seem to be common in disordered eating attitudes, such as inability to cut down or stop, use despite negative consequences, and failure in role obligation (3).

Binge Eating Disorder (BED) is described by the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) as recurrent episodes of binge eating and that is not associated with the regular use of inappropriate compensatory behavior and does not occur exclusively during the course of anorexia nervosa or bulimia nervosa (7).

Also, bulimia nervosa is introduced as an eating disorder by DSM-5 that is defined as recurrent episodes of binge eating along with inappropriate compensatory behaviors in order to prevent weight gain that that does not occur exclusively during episodes of anorexia nervosa (7).

Recent evidence suggests that the prevalence of FA ranges from 3% to 10% among general population (8,9) and might be as high as 50% in obese patients (10-12). The prevalence of FA is even higher in patients with morbid obesity seeking weight loss surgery (up to 53.7%) and in subjects with binge eating disorder (57-83.%) (13-15). It is proposed that obese patients with FA are usually less motivated and successful in non-surgical weight loss treatments and are more inclined to accept invasive weight loss procedures (16).

The Yale Food Addiction Scale (YFAS) (17)" as there is currently a lack of psychometrically validated measurement tools in this area. The current study represents a preliminary exploration of the Yale Food Addiction Scale (YFAS was the original standardized self-assessment scale developed to evaluate signs of food addiction on the basis of the diagnostic criteria for substance use disorders in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, text revision (DSM-IV-TR) (18). A new version of this measure, referred to as the Yale Food Addiction Scale 2.0 (YFAS 2.0) (3) was recently developed to maintain consistency with Substance-Related and Addictive Disorders (SRAD) criteria in the DSM–5 (7). The YFAS 2.0 further included the following four diagnostic criteria: failure to fulfill major role obligations, craving, use in physically hazardous conditions, and use despite social or interpersonal problems. It also included a diagnostic continuum of severity. The YFAS 2.0 has been validated in various cultures and languages and has revealed desirable reliability, and validity (8,9,19,20) a new version of the YFAS has been developed based on the revised eleven diagnostic criteria for substance use disorder in DSM-5. This YFAS 2.0 was translated into German and used among other measures in a study with 455 university students (89%) female.

In Iran, similar to other developing countries, overweight and obesity are growing at an alarming rate, with a prevalence of 42.8 to 57.0% in individuals aged 15-65 years (21). So far, however, too little attention has been put on evaluating FA in Iranian overweight and obese people. To overcome this knowledge gap, a valid and practical measure is needed for assessing FA. As far as we know, there is currently no study evaluating the psychometric features of this instrument in Iranian obese population. Therefore, this study performed the psychometric aspects of a Persian translation of the YFAS 2.0 (P-YFAS 2.0) among a clinical sample of obese candidates for bariatric surgery. As a secondary aim, we investigated the prevalence of FA in this clinical sample using the P-YFAS 2.0.

Materials and Methods

Study Design

This cross-sectional research was conducted at Minimally Invasive Surgery and Obesity Clinic of Rasoul-e Akram Hospital, an affiliate of Iran University of Medical Sciences, located in Tehran, Iran, from October 2018 to February 2020.

Study participants

A total of 255 obese individuals presenting for bariatric surgery were included in this study. The included participants were: (1) aged between 18-65; (2) had a Body Mass Index (BMI) of ≥40 kg/m^2, or ≥35 kg/m^2 and at least one obesity-related co-morbidity including asthma, arthritis, type 2 diabetes, high blood pressure, heart disease, digestive disorders, sleep apnea, gallbladder disorders, fatty liver disease and urinary incontinence (1) few studies examined the impacts of this co-occurrence. The aim was to compare individuals with obesity and Mood Disorders (ObMD). Psychiatric evaluation was performed using a semi-structured clinical interview for major DSM-5 diagnoses. Patients were excluded if they had major psychiatric disorders (*e.g.*, bipolar and related disorders, depressive disorders, psychotic disorders, attention-deficit/hyperactivity disorder), organic mental disorders, neurodegenerative disorders, substance-related disorders, or intellectual disability. The individuals who agreed to participate in the study were asked to complete the questionnaires including YFAS 2.0, Eating Disorder Inventory-3, Referral form (EDI-3 RF), Dutch Eating Behavior Questionnaire (DEBQ), Difficulties in Emotion Regulation Scale (DERS), and Barratt Impulsiveness Scale (BIS-15). To assess test-retest reliability, the YFAS 2.0 was re-administered by 30 individuals 2 weeks later under conditions as similar as possible to those of the first session.

Measurements

Demographics questionnaire

Information about age, gender, marital status, educational level, and occupation was obtained.

The Structured Clinical Interview for DSM-5 (SCID-5)

A semi-structured clinical interview for major DSM-5 diagnoses (22), translated and adapted to Persian (23), was used by two experienced psychiatrists to assess current and previous diagnosis of BED and bulimia nervosa in the participants.

The Yale Food Addiction Scale 2.0 (YFAS 2.0)

The YFAS 2.0 is a self-assessment measure created specifically for assessing addiction-like eating behaviors over the past 12 months. This scale consists of 35 items including the DSM-5 diagnostic criteria for SRAD and is rated on an eight-point Likert-type scale (from 0=never to 7=every day). There are two methods for scoring the YFAS 2.0: continuous and categorical. The continuous scoring adds up all the endorsed symptoms, yielding a total symptom count between 0 and 11. In the categorical scoring method, it is determined whether the individual meets the diagnostic threshold for FA or not (FA is present for participants with clinically significant impairment plus at least 2 symptoms during the previous 12 months, and absent for individuals without these criteria). The diagnosis can be further divided into mild (2 to 3 symptoms present), moderate (4 to 5 symptoms present), and severe FA (6 or more criteria present). The original validation of the YFAS 2.0 has shown high reliability (α=.90) and construct validity among a general population (3). The Persian YFAS 2.0 was used in the present study by permission of the authors (24) FA, binge eating, and objectively measured anthropometric indices were assessed. Internal consistency, convergent, and validity of the PYFAS 2.0 were examined. Also, the factor structure (confirmatory factor analysis following the 11 diagnostic indicators in addition to the significant distress. Additionally, we obtained permission from Dr. Ashley Gearhardt for the validation of the P-YFAS 2.0.

Barratt Impulsiveness Scale–short form (BIS-15)

The BIS-15 is a short form of the Barratt Impulsiveness Scale-11th revision (BIS-11) (25) that assesses three dimensions of trait impulsivity: motor, non-planning, and attentional impulsivity. Items are rated on a four-point scale (1=rarely/never, 2=occasionally, 3=often, 4=almost always/always). Higher scores indicate higher impulsivity (26). The Persian version of BIS-15 used in this study has been validated (27).

Eating Disorder Inventory-3, Referral form (EDI-3 RF)

The EDI-3 RF is a short form of Eating Disorder Inventory-3 (EDI-3) (28) to assess information in three areas: The Drive for Thinness (DT), Body Dissatisfaction (BD) and the Bulimia (B). The EDI-3

RF includes 25 items rated on a six-point Likert-type scale (0=never; 6=always). The total score is based on the sum of the subscale scores, and the higher score on each subscale indicates a more severe eating disorder (29). In the present study, a validated Persian version of the EDI-3 RF was used (30).

The Dutch Eating Behavior Questionnaire (DEBQ)

The DEBQ is a 33-item self-report questionnaire to determine eating styles: (1) emotional style, (2) external style or eating under environmental stimuli, and (3) restrained style. Responses are scored by using a 5-point Likert scale (1=never, 5=very often/always), with higher scores indicating greater endorsement of the eating behavior (31). The Persian version of the DEBQ has been proven to be valid and reliable (32) among all students are educated population Beheshti and Kharazmi University in Tehran (Mar-May 2016).

Difficulties in Emotion Regulation Scale (DERS)

The DERS is a 36-item self-report scale consisting of six areas of emotion dysregulation: non-acceptance, goal, impulse, awareness, strategy, clarity. Items are scored from 1 ["almost never (0-10%)"] to 5 ["almost always (91–100%)"]. Higher scores represent more emotion dysregulation. The Persian version of DERS has been found to be valid and reliable with a Cronbach's alpha coefficient of 0.90 (33).

Anthropometric parameters

Weight and height were measured, and BMI was calculated as weight/height^2 (kg/m^2).

Statistical analysis

SPSS ver. 23 (Armonk, NY: IBM Corp) was used to perform the statistical analyses. Statistical analyses included descriptive statistics and examination of the psychometric properties of the scale (confirmatory factor analysis, construct validity, internal consistency, and test-retest reliability). Confirmatory Factor Analysis (CFA) (Table 1) was conducted to assess the one-factor structure for the YFAS 2.0 diagnostic criteria. The model fit was evaluated with the Root-Mean-Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Adjusted Goodness of Fit Index (AGFI), and Incremental Fit Index (IFI). Convergent and discriminant validity was examined with chi-square test, t-test, analysis of variance (ANOVA), and Spearman's rank correlation. The internal consistency was evaluated with Cronbach's

Table 1. Confirmatory factor analysis

	Criteria	Met criteria	Did not met criteria	Factor loading
1	Consumed more than intended	114 (44.7%)	141 (55.3%)	0.56
2	Unable to cut down or stop	178 (69.8%)	77 (30.2%)	0.56
3	Great deal of time spent	90 (35.3%)	165 (64.7%)	0.54
4	Important activities given up	154 (60.4%)	101 (39.6%)	0.52
5	Use despite physical/emotional consequences	152 (59.6%)	103 (40.4%)	0.67
6	Tolerance	109 (42.7%)	146 (57.3%)	0.43
7	Withdrawal	140 (54.9%)	115 (45.1%)	0.58
8	Use despite interpersonal/social problems	214 (83.9%)	41 (16.1%)	0.65
9	Failure in role obligation	108 (42.4%)	147 (57.7%)	0.46
10	Use in physically hazardous situations	140 (54.9%)	115 (45.1%)	0.35
11	Craving	114 (44.7%)	141 (55.3%)	0.60
12	Impairment/distress	127 (49.8%)	128 (50.2%)	0.56

alpha. A Cronbach's alpha value greater than 0.70 was considered acceptable. Test–retest reliability was assessed using the Intraclass Correlation Coefficients (ICC). The statistical significance was defined as $p< 0.05$.

Results

Participant characteristics

255 participants completed the questionnaires. The demographic and clinical characteristics and comparison of participants with different severity levels of FA are presented in table 2.

The results, as shown in table 2, indicated that among 124 patients (48.6%) who clinically met FA criteria, 2 patients (1.6%) received a mild, 12 (9.6%) a moderate, and 110 (88.7%) a severe FA diagnosis. Statistically significant relations were detected between sex, marital status and employment with the YFAS 2.0-diagnosed FA, *i.e.*, the prevalence of FA was lower in men (p=0.026), married (p=0.009), and employed participants (p=0.009). The prevalence of FA was higher in participants with BED (p<0.001) and bulimia nervosa (p=0.037). 65.3% of the patients with BED, and 75% of the patients with bulimia nervosa met the threshold for diagnosis of FA, and the majority of them (59.6% of BED patients and 62.5% of bulimia nervosa patients) suffered from severe FA. Furthermore, the mean scores for BMI varied significantly by FA severity levels. Particularly, BMI was higher in severe FA patients in comparison with no FA group (p-value<0.001).

The associations between the P-YFAS 2.0 symptom score and demographic and clinical characteristics of the sample are shown in table 3 The mean symptom

Table 2. Demographic and characteristics of the participants and comparison with different severity levels of FA

		Overall sample (N=255)	No FA (N=131)	Mild FA (N=2)	Moderate FA (N=12)	Severe FA (N=110)	p-value
Age (years)	Mean±SD	37.70±9.91	38.66± 10.29	45.5± 17.68	38.42±7.83	36.35±9.46	0.208
Gender	Male	57 (22.4%)	37 (64.9%)	0	2 (3.5%)	18 (31.6%)	0.026*
	Female	198 (77.6%)	94 (47.5%)	2 (1%)	10 (5.1%)	92 (46.5%)	
Marital status	Single	68 (26.7%)	27 (39.7%)	1 (1.5%)	3 (4.4%)	37 (54.4%)	0.009*
	Married	178 (69.8%)	97 (54.5%)	1 (0.6%)	8 (4.5%)	72 (40.4%)	
	Divorced	9 (3.5%)	7 (77.8%)	0	1 (11.1%)	1 (11.1%)	
Education	School dropout	102 (40%)	46 (45.1%)	0	6 (5.9%)	50 (49%)	0.138
	High school degree	124 (48.6%)	69 (55.6%)	2 (1.6%)	4 (3.2%)	49 (39.5%)	
	Some university degree	29 (11.4%)	16 (55.2%)	0	2 (6.9%)	11 (37.9%)	
Employment	Unemployed	157 (61.1%)	70 (44.6%)	2 (1.3%)	9 (5.7%)	76 (48.4%)	0.009*
	Part time	42 (16.5%)	25 (59.5%)	0	0	17 (40.5%)	
	Full time	56 (22.0%)	36 (64.3%)	0	3 (5.4%)	17 (30.4%)	
BED	Yes	178 (69.8%)	62 (34.8%)	1 (0.6%)	9 (5.1%)	106 (59.6%)	<0.001*
	No	77 (30.2%)	69 (89.6%)	1 (1.3%)	3 (3.9%)	4 (5.2%)	
Bulimia nervosa	Yes	16 (6.3%)	4 (25%)	0	2 (12.5%)	10 (62.5%)	0.037*
	No	239 (93.7%)	127 (53.1%)	2 (0.8%)	10 (4.2%)	100 (41.8%)	
BMI	Mean±SD	46.10±7.04	43.01±5.86	48±9.33	46.09±5.95	49.36±8.16	<0.001*

FA: Food Addiction, BED: Binge Eating Disorder, BMI: Body Mass Index.

Table 3. Associations between the P-YFAS 2.0 symptom score and demographic and clinical characteristics of the sample

		Symptom count scoring/ mean (SD)	p-value
Gender	Male	5.11 (3.34)	0.051
	Female	6.17 (3.70)	
Marital status	Single	6.38 (3.41)	0.377
	Married	5.81 (3.79)	
	Divorced/separated	4.89 (1.9)	0.158
Education	School dropout	6.46 (3.79)	
	High school degree	5.66 (3.58)	
	Some university degree	5.28 (3.23)	
Employment	Unemployed	6.36 (3.74)	0.025*
	Part time	5.79 (3.73)	
	Full time	4.84 (3.09)	
BED	Yes	7.28 (3.23)	<0.001*
	No	2.83 (2.46)	
Bulimia nervosa	Yes	7.63 (2.73)	0.022*
	No	5.82 (3.67)	
Age		r=-0.12	0.054
BMI		r=0.48	<0.001*

BED: Binge Eating Disorder, BMI: Body Mass Index.

count was 6.36. There was a significant association between employment and symptom count score. The mean symptom count score was significantly higher in unemployed participants compared to employed subjects (p=0.025). Moreover, patients with BED (p<0.001) and bulimia nervosa (p<0.001) had significantly higher symptom count scores in comparison with patients without these disorders. A positive correlation was found between BMI and symptom count score (p<0.001).

Associations of BIS-15, DERS, DEBQ, and EDI-3 RF scale scores by the P-YFAS 2.0 diagnosis (absence/presence) and the P-YFAS 2.0 symptom count are presented in tables 4 and 5, respectively. As shown in table 4, the mean subscale and total scores of BIS-15, DERS, DEBQ, and EDI-3 RF scales differed significantly across FA severity classification groups, except for "Attentional" subscale of BIS-15 and "Aware" subscale of DERS. As can be seen from table 5, the P-YFAS 2.0 symptom score was significantly associated with the mean subscale and total scores of BIS-15, DERS, DEBQ, and EDI-3 RF scales, except for "Attentional" subscale of BIS-15, "Aware" subscale of DERS, and "Drive for thinness" subscale of EDI-3 RF.

Internal consistency and test-retest reliability

The Cronbach's alpha for the entire P-YFAS 2.0 was 0.89. The test-retest reliability by 30 individuals over a 2-week period was adequate (ICC=0.88, p=0.012). In the present study, internal consistencies of the BIS-15 were: α = 0.60 (non-planning), α = 0.66 (motor), α = 0.72 (attentional), and α = 0.67 (total scale). Internal consistencies of the EDI-3 RF were: α = 0.72 (DT), α = 0.76 (BD), α = 0.82 (B), and α = 0.77 (total scale). The internal consistency of the DEBQ was excellent for the emotional eating (α= 0.94) and external eating subscales (α=0.91) and good for restrained eating subscale (α=0.83). The Cronbach's alpha coefficient for DERS was 0.87 in the current study.

Convergent validity of the P-YFAS 2.0 (Diagnostic version)

Female participants with FA diagnosis of the P-YFAS 2.0 were more frequent and the BMI mean was higher in those in comparison with not FA participants (Table 2). Also, the percent of patients with BED and bulimia nervosa were higher in FA participants (Table 2). They also had higher eating pathology (Table 4).

Convergent validity of the P-YFAS 2.0 (Symptom count version)

The P-YFAS 2.0 symptom scores were associated with higher BMI and being unemployed but not with gender, marital status, education, or age (Table 3). Also, they were associated with diagnosis of bulimia nervosa, diagnosis of binge eating disorder (Table 3), and higher eating pathology (Table 5).

Discriminant Validity of the YFAS 2.0 (Diagnostic and Symptom Count Versions)

Statistically significant differences were found between participants with different severity levels of FA in particular, between 'No FA' and 'Severe FA' in almost all the eating disorder measures and also in BMI (Tables 2 and 4). There was not any significant relation between symptom count and FA diagnosis by "attentional impulsivity" and "lack of emotional awareness" (Tables 4 and 5). Moreover, YFAS 2.0 scores were not associated with "Drive for Thinness" (Table 5).

Table 4. Associations of BIS-15, DERS, DEBQ, EDI-3 RF scale scores by the P-YFAS 2.0-diagnosis (absence/presence)

		No FA	Mild FA	Moderate FA	Severe FA	p-value
BIS-15	Motor	8.17 (2.41)	10 (1.41)	9.42 (2.39)	10.4 (2.88)	<0.001*
	Attentional	12.48 (1.71)	9 (1.41)	11.75 (1.76)	12.46 (1.7)	0.051
	Non-planning	11.71 (1.77)	9 (1.41)	12.33 (1.83)	12.33 (1.63)	0.003*
	Total BIS	32.37 (4.01)	28 (4.24)	33.5 (3.5)	35.19 (3.78)	<0.001*
DERS	Awareness	16.45 (4.42)	19.5 (2.12)	18.83 (4.32)	15.81 (4.04)	0.074
	Non-acceptance	11.08 (5.17)	16 (2.83)	12.68 (6.42)	13.06 (6.04)	0.036*
	Goals	11.81 (3.98)	12.5 (0.71)	12.08 (4.36)	15.55 (4.6)	<0.001*
	Impulse	12.22 (4.68)	14.5 (0.71)	12.75 (5.01)	15.56 (5.76)	<0.001*
	Strategies	14.93 (5.53)	19.5 (0.71)	15.83 (6.86)	19.95 (7.12)	<0.001*
	Clarity	10.56 (3.42)	14 (2.83)	10.25 (3.08)	12.39 (3.17)	<0.001*
	Total DERS	77.05 (18.6)	96 (1.41)	82.42 (21.30)	92.32 (21.34)	<0.001*
DEBQ	Emotional eating	25.36 (10.44)	36 (11.31)	28.33 (11.13)	40.38 (11.94)	<0.001*
	External eating	27.06 (8.34)	30.5 (3.54)	28.25 (5.69)	37.92 (7.16)	<0.001*
	Restrained eating	31.56 (6.81)	30 (0)	29.08 (8.40)	33.8 (6.98)	0.027*
	Total DEBQ	83.98 (18.82)	96.5 (14.85)	85.67 (14.19)	112.1 (17.82)	<0.001*
EDI-3 RF	Body Dissatisfaction	23.92 (7.44)	30.5 (4.95)	27.42 (4.33)	29.59 (7.83)	<0.001*
	Bulimia	4.45 (4.93)	10.5 (3.54)	6.67 (5.30)	13.35 (6.13)	<0.001*
	Drive for Thinness	16.687 (5.86)	21.5 (3.54)	20.25 (7.29)	18.5 (5.22)	0.023*
	Total EDI-3 RF	45.05 (11.45)	62.5 (4.95)	54.33 (13.48)	61.44 (12.85)	<0.001*

BIS-15: Barratt Impulsiveness Scale–short form, DERS: Difficulties in Emotion Regulation Scale, DEBQ: The Dutch Eating Behavior Questionnaire, EDI-3 RF: Eating Disorder Inventory-3, Referral form.

Table 5. Associations of BIS-15, DERS, DEBQ, and EDI-3 RF scale scores by the P-YFAS 2.0-diagnosed FA symptom count

		r	p-value
BIS-15	Motor	0.444	<0.001*
	Attentional	0.072	0.249
	Non-planning	0.14	0.026*
	Total BIS	0.392	<0.001*
DERS	Awareness	-0.033	0.600
	Non-acceptance	0.169	0.007*
	Goals	0.442	<0.001*
	Impulse	0.347	<0.001*
	Strategies	0.398	<0.001*
	Clarity	0.315	<0.001*
	Total DERS	0.401	<0.001*
DEBQ	Emotional eating	0.591	<0.001*
	External eating	0.675	<0.001*
	Restrained eating	0.232	<0.001*
	Total DEBQ	0.693	<0.001*
EDI-3 RF	Body Dissatisfaction	0.303	<0.001*
	Bulimia	0.704	<0.001*
	Drive for Thinness	0.083	0.188
	Total EDI-3 RF	0.538	<0.001*

BIS-15: Barratt Impulsiveness Scale–short form, DERS: Difficulties in Emotion Regulation Scale, DEBQ: The Dutch Eating Behavior Questionnaire, EDI-3 RF: Eating Disorder Inventory-3, Referral form

The RMSEA, CFI, AGFI, and IFI were 0.08, 0.89, 0.87, and 0.83, respectively. One diagnostic criterion (use in physically hazardous situations) indicated a factor loading of 0.35. The other diagnostic criteria had factor loading of >0.42.

Discussion

This study investigated the psychometric aspects of the P-YFAS 2.0 in a sample of obese patients undergoing evaluation for bariatric surgery. Additionally, we set out to assess the relationship between demographic and clinical characteristics and P-YFAS 2.0-diagnosed FA in these patients.

A one-factor structure was confirmed for the P-YFAS 2.0. Although the factor loading of one criterion (use in physically hazardous situations) was relatively low (0.35), the total internal consistency of the measure was acceptable (α=0.89). The weak factor loading for the mentioned criterion could be due to inappropriate translation or lack of clarity of "hazardous situations" for the participants. Test–retest reliability analysis revealed acceptable results over a 2-week period (ICC = 0.88). Adequate reliability has been demonstrated in most research testing the psychometric features of the YFAS 2.0 (34). Consistent with previous validation studies, the P-YFAS 2.0 had high convergent validity with scales of BMI, eating pathology, and with bulimia nervosa and diagnosis of BED (34,35). The strongest correlations were found with the DEBQ total score (r=0.693), its subscales (external eating, r=0.675;

emotional eating, r=0.591), and the bulimia subscale of EDI-3 RF (r=0.704). These correlations demonstrate a strong association between FA and eating disorders. The results further supported discriminant validity of the YFAS 2.0, showing that the scale does not merely measure an impulsive eating behavior, but rather a distinct construct. It was also found that P-YFAS 2.0 had an adequate ability to discriminate between subjects with and without eating disorders.

Using the validated P-YFAS 2.0, 48.6% of obese participants met criteria for the presence of FA. This result accords with the findings of other studies conducted in Turkey (36), Germany (19) a new version of the YFAS has been developed based on the revised eleven diagnostic criteria for substance use disorder in DSM-5. This YFAS 2.0 was translated into German and used among other measures in a study with 455 university students (89% female, Malaysia (12), and Italy (11), in which 30-57% of the obese participants met the diagnostic threshold of FA. However, this finding is higher than the reported prevalence of FA in a sample of obese Iranians using previous version of YFAS (48.6 *vs.* 26.2%) (37) and food addiction (FA. It is also encouraging to compare this figure with the prevalence rates of FA reported in the general population (3-10%) (8,9)Fourth Edition, Text Revision. Following recent updating of addiction criteria, a new DSM-5 version (YFAS 2.0. The overall higher rates of individuals meeting YFAS 2.0 criteria for FA in the current study may be explained by the fact that our sample consisted only of patients with morbid obesity which were more likely to endorse symptoms of FA. Also, the YFAS 2.0, has identified a higher percentage (5.8%) of individuals who meet the criteria for food addiction. given that the original YFAS captured only symptoms of dependence (not abuse), and that the revised version of the YFAS captures the full range of symptoms comprising SRADs in the DSM–5, YFAS 2.0 has a lower threshold corresponding to DSM–5 and will identify individuals with less severe symptoms. This may contribute to higher prevalence rates according to YFAS 2.0 *vs.* YFAS (3).

Additionally, consistent with previous findings, the results indicated that female, divorced/separated and unemployed participants had greater risk of being diagnosed with severe FA (3,11). Personality traits, emotional influences on the desire to overeat, and hormonal changes related to menstruation may contribute to the gender differences in FA rates (38,39). Another possible explanation for this gender difference might be that men have less insight into their problematic eating behaviors and are less likely looking for treatment (40). Another important finding was that a significant proportion of obese participants suffered from BED (69.8%), the majority of whom met the diagnostic threshold for severe FA (59.6%). This finding reflects the findings of previous research which showed that 57-83% of the patients with BED are food addicted (13,15,41). Several features of FA, such as loss of control and continuous use despite negative consequences, are common in BED, which can explain the higher prevalence rate of FA in these patients (42).

Finally, a number of important limitations need to be considered. First, the associations found in the current study had a cross-sectional design. Thus, the causality cannot be concluded. Future studies using longitudinal or case–control designs are, therefore, warranted to further explore the potential causal relationships. Second, several variables were assessed using self-administered scales. This self-reported data could be influenced by social desirability and recall biases. Third, this project used a clinical sample, thus the findings might not be transferable to non-clinical population. Notwithstanding these limitations, this study is based on a relatively large sample. Additionally, the diagnosis of eating disorders was based on standardized semi-structured interviews by expert psychiatrists.

Conclusion

This study demonstrated that P-YFAS 2.0 is a valid instrument to evaluate FA under the DSM-5 Substance-Related and Addictive Disorders (SRAD) criterion in obese population seeking bariatric surgery and it can also be used in the research of FA in this clinical population. Furthermore, it was shown that FA is highly prevalent among Iranian obese patients. This finding highlights the need for expanding effective harm reduction strategies or even public health politics. Further work is required to establish the psychometric features of P-YFAS 2.0 in non-clinical and other clinical samples.

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Ethics Statement
Ethical approval was obtained based on the principles of the World Medical Association Declaration of Helsinki. This study was approved by the institutional review board of Iran University of Medical Sciences (Ref No: IR.IUMS.REC.1398.769).

Consent
All the patients signed informed consent statements.

Availability of data and materials
The data that support the findings of this study are available from Rasoul-e Akram Hospital, but restrictions apply to the availability of these data, which were used under license for the current study, and so they are not publicly available. However, data are available from the authors upon reasonable request and with permission of Rasoul-e Akram Hospital.

Conflict of Interest
The authors did not have any conflict of interest.

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