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Translation and Psychometric Evaluation of the Persian Yale Food Addiction Scale 2.0 (YFAS 2.0): A Cross-Sectional Study

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Abstract

Background and Objective: The emerging field of food addiction research highlights the necessity of a robust assessment instrument. This study undertook the translation and psychometric evaluation of the Yale Food Addiction Scale 2.0 (YFAS 2.0), recognizing its potential as a vital tool in this area.

Methods: This cross-sectional study was conducted on 398 employees in Ahvaz city in two phases: 1- Translation of the instrument and 2- Examination of the psychometric properties of the instrument, including face validity, content validity, construct validity (confirmatory factor analysis, convergent validity, and discriminant validity), criterion validity, reliability (including internal consistency, stability, standard error of measurement), and responsiveness to change. Data analysis was performed using SPSS version 26 and AMOS version 22.

Findings: The study demonstrated robust face and content validity through qualitative and quantitative evaluations. Assessment of construct validity revealed that a single-factor structural equation model adequately fit the data. Convergent validity was supported by the significant correlation observed with Garner's Eating Attitude Test, and discriminant validity was evident through significant BMI-related differences. Criterion validity was also confirmed. High internal consistency was indicated by a Cronbach's α of 0.95 for the entire scale. Moreover, all stability and standard error of measurement parameters were within acceptable limits. Finally, the instrument showed appropriate responsiveness to change, as indicated by an area under the ROC curve of 0.981.

Conclusion: The favorable psychometric characteristics of the Persian YFAS 2.0, in this study, strongly support its broad application for evaluating food addiction among Persian speakers.

Keywords*:* Food addiction, Psychometrics, YFAS 2.0

1. Introduction

Lifestyle modifications, particularly concerning dietary factors, significantly influence the prevalence and incidence of obesity (1). Obesity, a chronic disease, is shaped by a complex interplay of social, behavioral, cultural, physiological, and genetic influences (2). It commonly arises from overeating, lack of physical activity, and genetic vulnerability. Research has shown that addiction-like eating behaviors are among the factors that contribute to overeating and morbid obesity. Food addiction is essentially a form of psychological and physical dependence on certain high-fat, sugary, and nutritionally poor foods (1). The notable biochemical and behavioral similarities between compulsive overeating and dependence on psychoactive substances have led researchers to employ the term "food addiction" to delineate this form of excessive consumption. Repeated exposure to palatable and low-nutritional-value foods, similar to exposure to narcotics, disrupts the balance between motivational behavior circuits and response control circuits, resulting in an inability to overcome the urge to consume and eat (3). While commonly associated with eating disorders and obesity, food addiction is not exclusive to these groups and has been observed in individuals with normal weight as well. The prevalence rates highlight this difference: 27% in overweight or obese individuals versus 14% in those of normal weight (1). Studies show that eating disorders and substance dependence share common features. For example, both binge eating disorder and substance dependence involve a loss of control and an inability to stop consumption despite the desire to do so. This indicates a reciprocal relationship between substance dependence, food addiction, and eating disorders (4-6). Therefore, a correlation between the two instruments can suggest that they measure a similar construct. In fact, some psychometric studies on food addiction instruments have used the Garner Eating Attitudes Test (EAT), which measures eating disorders (7,8).

The increasing body of research on food addiction underscores the essential need for appropriate assessment tools (9). While the internationally recognized Yale Food Addiction Scale possesses established validity and robust psychometric properties confirmed by numerous studies, socio-cultural and economic variations across populations necessitate re-evaluation of its validity and reliability before application in specific contexts. Notably, only one domestic study has validated the Persian translation of the YFAS 2.0 (10), and it examined fewer psychometric aspects than the current investigation. Furthermore, the mentioned study's focus on a student population, a group susceptible to unique stressors like separation from home, academic pressure, sleep disturbances, and irregular eating habits, raises concerns about the generalizability of its findings to other demographics. Another study has examined and validated the psychometric properties of the initial version of the Food Addiction Scale in Iran, which was also conducted in a clinical population (2). In Zanbouri et al.'s study which examined the second version of the YFAS 2.0 (1), the study findings did not fully confirm the psychometric properties of YFAS 2.0. While international studies have assessed the psychometric properties of YFAS 2.0 within their respective populations, this underscores, rather than negates, the necessity for psychometric evaluation and localization of the questionnaire for the Iranian context. Although prior research has examined the Persian YFAS 2.0 (1-3,10), these studies were limited to specific populations with reduced diversity, such as overweight/obese individuals or Iranian students. Unlike previous studies, this research pioneers the validation of the YFAS 2.0 in a diverse working population encompassing governmental and non-governmental organizations and administrations.

2. Objectives

The present study aims to comprehensively evaluate the psychometric properties of the Persian YFAS 2.0.

3. Methods

This was a cross-sectional study conducted on employees working in governmental and non-governmental organizations in Ahvaz, southwest of Iran. The inclusion criteria for the study were being employed in governmental and non-governmental organizations and administrations in Ahvaz city under official, contractual, or fixed-term employment conditions, providing informed consent to participate in the research, not being pregnant (for women), and not having any metabolic diseases. Incomplete questionnaire

completion and expressing unwillingness to cooperate in the project were considered exclusion criteria. Volunteer individuals were enrolled in the study after providing informed written consent. In this study, a demographic questionnaire, YFAS 2.0, and the 26-item Eating Attitude Test (EAT-26) were used to collect data. Body mass index was estimated using a Seca model 760 scale (Germany, 500g accuracy) and a Seca model 217 portable standing stadiometer (Germany, 1mm accuracy).

The YFAS 2.0 includes 35 items and 11 criteria for food addiction. The items of this questionnaire examine individuals' addictive-like eating behavior experiences over the past 12 months. The items in YFAS 2.0 have eight response options ranging from "Never" to "Every day." The threshold for these items varies from once a month to 4-6 times a week. To score the Yale scale, all questionnaire scores were converted to 0 and 1. In interpreting the questionnaire, a score of 0 on a criterion means that the criterion is not met, and a diagnostic criterion will be met if it receives a score of 1. The presence of at least two diagnostic criteria along with significant and noticeable clinical distress or impairment caused by the consumption of specific foods is necessary for the diagnosis of food addiction. The Garner Eating Attitude Test includes 26 items that measure attitudes and behaviors related to eating.

To translate the YFAS 2.0, the original version was provided to two translators who were proficient in both the source and target languages. Subsequently, a meeting was held under the supervision of the principal investigator to identify inappropriate phrases in the translation and examine any discrepancies between the original version and the translated versions. The resulting translations were synthesized, and finally, a unified version in the target language was prepared. Following this, back translation was performed. This stage was carried out by two translators proficient in both the source and target languages and independent of the first stage.

This study evaluated psychometric properties, including face validity, content validity, construct validity, criterion validity, reliability, and responsiveness to change. Face validity was assessed through both qualitative and quantitative methods. For the qualitative assessment, 10 individuals reviewed the questionnaire, providing feedback on the clarity, ambiguity, and comprehensibility of the items. Quantitative face validity was determined by calculating item impact scores, with a score above 1.5 deemed satisfactory (11).

To evaluate content validity, both qualitative and quantitative methods were employed. We used a group of experts in nutrition, health education, statistics, epidemiology, and clinical psychology to assess the qualitative content validity of the instrument. We asked them to review the instrument and provide written feedback on the appropriateness of its terms, expressions, and scoring system. Subsequent revisions were made based on their recommendations. The quantitative assessment of content validity involved calculating the content validity ratio (CVR) and content validity index (CVI). To determine the CVR, a panel of 10 experts rated each item as either essential, useful but not essential, or not necessary, and the resulting data were analyzed according to the Lawshe table (12, 13). The content validity index (CVI) was determined by providing the questionnaire to 10 experts who independently rated each item's relevance, simplicity, and clarity using a 4-point Likert scale.

To evaluate construct validity, confirmatory factor analysis (CFA), convergent validity, and known-groups validity were employed. Recognizing the critical role of sample size in CFA, we adhered to Costello's guideline (14) of recruiting 15 participants per questionnaire item. Based on the 35 items of the Yale Food Addiction Scale 2.0, a minimum sample size of 525 was calculated, which was then inflated to 618 to accommodate a projected 15% attrition rate. Convenience sampling was employed for participant recruitment. The final analysis included data from 398 participants. CFA was chosen over exploratory factor analysis to test and validate the instrument's factor structure (14). We used CFA with the maximum likelihood method on the covariance matrix. Before running the CFA, we performed Bartlett's test of sphericity. Next, we assessed the model's fit using CFA. We used absolute fit indices (GFI and AGFI), Comparative fit indices (NFI, CFI, and IFI), and parsimonious fit indices (RMSEA and CMIN).

To evaluate convergent validity, the Garner Eating Attitude Test (EAT-26) was used, and the correlation coefficient between the YFAS 2.0 and EAT-26 was measured. Discriminant validity was examined through known-groups comparison based on body mass index.

The reliability of the instrument was investigated through measures of internal consistency, stability, standard error of measurement, and agreement. Internal consistency was determined using Cronbach's alpha coefficient, while stability was evaluated using the test-retest procedure. The time interval between the test and retest was two weeks. After collecting data at both time points, the intraclass correlation coefficient (ICC) was calculated for each food addiction criterion and the overall scale. The standard error of measurement (SEM) was subsequently determined using the formula $SEM=SD\times\sqrt{(1-ICC)}$, with SD denoting the standard deviation of the pooled test and retest scores. Alongside other parameters, instrument agreement was measured using Cohen's kappa coefficient. The Kappa coefficient and its corresponding statistical analysis are represented by a numerical value between -1 and +1, where a value closer to +1 indicates a direct and proportionate agreement (15). For interpreting the Kappa values, we referred to the Mohammadbeigi et al.'s article and considered values greater or equal to 0.7 as acceptable (11).

In addition to evaluating the validity and reliability of the YFAS 2.0, its responsiveness to change, encompassing both sensitivity and specificity,
was examined by calculating the area under the receiver operating characteristic (ROC) curve. We used the Youden's J statistic to calculate the cut-off point on the ROC curve for examining the sensitivity and specificity of the instrument. This statistic represents the point on the ROC curve with
the highest combined sensitivity and specificity (16). In addition, in interpreting the Area Under the ROC Curve (AUC), we used a conventional classification system based on the study by Safari and Baratloo (16): 0.90 - 1.00 = Excellent, 0.80 - 0.90 = Good, 0.70 - 0.80 = Fair, 0.60 - 0.70 = Poor, 0.50 - 0.60 = Useless.

Data analysis for the entire study was performed using SPSS version 26 and AMOS version 22 software, and a statistical significance threshold of $P < 0.05$ was applied for all tests.

4. Results

Fifty-one percent (203 individuals) of the sample were men, and 49% (195 individuals) were women. The average age of participants was 41.17±17.56 years, and their average body mass index was reported as 20.84±3.25.

For qualitative face validity, minor adjustments were made to the instrument. In the assessment of quantitative face validity, the impact score of each item was confirmed.

Regarding qualitative content validity, corrective feedback from several experts was incorporated into the instrument. For quantitative content validity, the instrument's CVR was 0.85, and its CVI was 0.89 for relevance, 0.91 for simplicity, and 0.91 for clarity.

The results of the Kaiser-Meyer-Olkin (KMO) test for sampling adequacy (0.932) and Bartlett's test (Bartlett's coefficient = 10231.25, df = 595, and $p < 0.0001$) indicated that our sample size was sufficient and the factor analysis model was appropriate. Factor structure diagram and standardized factor loadings of the CFA is shown in Figure 1. Also, Table 1 presents the model fit indices in the CFA.

In determining convergent validity, the correlation coefficient between the YFAS 2.0 and EAT-26 instruments was 0.734, with a significance level of $P<0.001$. Findings related to the validity of known groups, based on the body mass index variable, indicated a significant difference in food addiction among subgroups related to body mass index ($P<0.01$).

For criterion validity, the correlation coefficient between the YFAS 2.0 and EAT-26 instruments was 0.734, calculated at a significance level of less than 0.05 ($P<0.001$).

The overall Cronbach's alpha coefficient for the YFAS 2.0 was 0.958. For stability, based on the test-retest method, the ICC of the YFAS 2.0 scale was 0.841, indicating a good level of reliability. The agreement rate across the two test phases was 87.1% with a Kappa coefficient of 0.67 and a significance level of $P<0.01$, which was evaluated as desirable.

The SEM was estimated to be 12.58. No significant difference was observed when comparing the mean and the score difference before and after the YFAS 2.0 scale based on Kendall's coefficient ($p=0.51$).

Based on findings from the ROC curve, at a cutoff point of 3.5, the sensitivity and specificity of the YFAS 2.0 instrument were reported as 0.716 and 0.99, respectively. An analysis of the ROC curve yielded an area of 0.981, placing the model's performance in the excellent range.

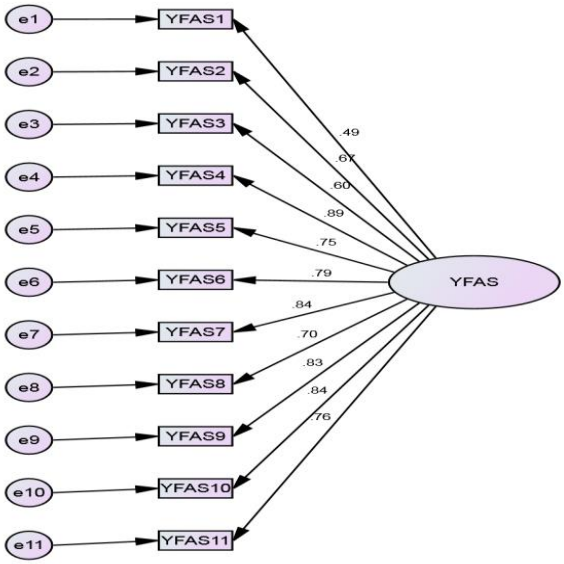

Figure 1: Factor Structure Diagram and Standardized Factor Loadings of the Confirmatory Factor Analysis

Table 1. Examination of Model Fit Indices

Fit Indices	Acceptable Value and Range	Value
Goodness-of-Fit Index (GFI)	GFI ≥ 0.9	0.979
Adjusted Goodness-of-Fit Index (AGFI)	AGFI ≥ 0.9	0.968
Normed Fit Index (NFI)	NFI ≥ 0.9	0.978
Comparative Fit Index (CFI)	CFI ≥ 0.9	0.988
Incremental Fit Index (IFI)	IFI ≥ 0.9	0.989
Root Mean Square Error of Approximation (RMSEA)	RMSEA ≤ 0.08	0.01
Normed Chi-Square (CMIN/DF)	1 ≤ CMIN/DF ≤ 3	1.05

5. Discussion

The primary objective of this study was to translate and assess the psychometric properties of the Persian-translated Yale Food Addiction Scale 2.0, thereby enabling its use in Iran. After the translation and preparation of the final Persian YFAS 2.0, face validity was established through a comprehensive psychometric evaluation employing both quantitative and qualitative approaches. The content validity of the instrument was also reported as favorable in both qualitative and quantitative assessments. All questionnaire items were retained at this stage of psychometric evaluation, and no items were removed.

Considering the values of the model fit indices, it can be stated that the single-factor model of structural equation modeling provided a good fit to the data, and the correlations in the model were found to be acceptable. In other words, the factor structure of the food addiction scale demonstrated a suitable fit, which indicates that the items on this scale align with the construct of food addiction. This finding is consistent with the studies of Panahi et al. (2) and Ghanbari et al. (10), in which the construct validity of the food addiction instrument was also confirmed. However, in Zanbouri et al., the construct validity of the instrument was not confirmed (1). Other studies inconsistent with the present research include the evaluations of the Italian and Malay versions of the YFAS, where the construct validity of the instrument was not confirmed (17, 18).

Convergent validity showed a direct and statistically significant relationship at the $p < 0.05$ threshold. Arefi et al. also obtained the concurrent validity of the questionnaire by correlating it with EAT-26 in a sample of 50 individuals, at a significance level of $P<0.001$. However, due to the small sample size, the findings of the aforementioned study cannot be definitively cited or generalized to the entire population (1). In known-groups validity, when individual food addiction criteria were compared between the two BMI groups, significant differences emerged only for withdrawal symptoms ($P = 0.045$), obligations ($P = 0.021$), and problems ($P = 0.042$). The effort criterion showed a trend towards significance ($P = 0.051$). Supporting our results, previous research by Panahi et al. and Zanbouri et al. also established

the discriminant validity of the Yale Food Addiction Scale (1, 2).

Reliability analysis revealed strong internal consistency for the YFAS 2.0. This finding aligns with previous Iranian studies reporting acceptable to good internal consistency for food addiction measures, such as Panahi et al. ($\alpha = 0.87$) (2), Zanbouri et al. ($\alpha = 0.72$) (1), and Ghanbari et al. ($\alpha = 0.93$) (10). Foreign studies also indicate the reliability of the YFAS in various communities (9, 17, 19).

Test-retest reliability analysis revealed that the YFAS 2.0 demonstrates stability in measuring food addiction across different assessment points within a Persian-speaking population. This is consistent with Ghanbari et al.'s study (10), which reported an ICC of 0.85 over a two-week interval. In the studies of Tajik et al. and Chen et al., the reliability of the instrument in the test-retest was reported to be appropriate with an intraclass coefficient of 0.71 to 0.88, which indicates the stability of the instrument over time (20, 21).

The agreement in the two test stages was obtained with a kappa coefficient of 0.67 and a significance level of 0.0001. This kappa coefficient was deemed good and desirable (6). The findings indicate that the instrument's systematic error and its responsiveness to favorable changes were assessed. The standard error of measurement indicates how much an individual's observed score might differ from their true score. This parameter has an inverse relationship with the instrument's reliability. This means that the smaller the SEM, the greater the instrument's reliability, and the closer the observed scores are to the true score. A high SEM can have significant clinical consequences for patients. It suggests that the questionnaire's results are likely influenced by irrelevant factors and may not accurately reflect the individual's true condition. This could lead to incorrect decisions regarding diagnosis, treatment, or the evaluation of a patient's progress. Furthermore, if a questionnaire has a high Cronbach's alpha but an inadequate SEM (due to reasons such as random error in responses, a lack of clarity in understanding the questions, or insufficient differentiation between options), it means that while the questionnaire items are generally consistent with each other (good internal reliability), this consistency does not guarantee an accurate and reliable measurement of the intended variable. In other words, the questionnaire might not be able to correctly differentiate between individuals with different levels of the variable. In such cases, it is recommended to use other methods, such as factor analysis or convergent validity, in addition to Cronbach's alpha. Alongside all these measures, the questionnaire results should be interpreted cautiously, and attention should be paid to the instrument's SEM. In the present study, not only was Cronbach's alpha examined, but the instrument's confirmatory factor analysis and convergent validity were also evaluated and confirmed.

While prior research has explored the psychometric properties of the Persian YFAS 2.0, these studies have often focused on populations with limited diversity, such as individuals with overweight or obesity, or students. In contrast, this study marks the first validation of YFAS 2.0 in a more heterogeneous sample comprising employees from both governmental and non-governmental organizations. Moreover, our psychometric evaluation extends beyond previous work by examining less frequently investigated properties, including the instrument's standard error and its responsiveness to change. However, the relatively uniform working hours and sleep patterns among organizational employees might influence their dietary habits and eating behaviors, potentially limiting the generalizability of our findings to the broader population. Consequently, future research should investigate the psychometric properties of the YFAS 2.0 across more diverse populations and compare the results. This would contribute to a more robust psychometric profile of the instrument, particularly within the context of individuals seeking weight loss.

Given the robust psychometric properties demonstrated by the Persian YFAS 2.0 in this study, we can conclude its broad applicability for measuring food addiction. Furthermore, researchers and clinicians can employ this scale extensively in various research domains and clinical psychology practices.

Footnotes

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Conflict of Interests Statement

The authors declare that they have no conflicts of interest related to the present research.

Data Availability

All data generated or analyzed in this study are available from the corresponding author upon reasonable request.

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There was no financial sponsor for the present study

Ethical Approval

All stages of the present study were approved by the Ethics Committee for Research at the Avicenna Research Institute of Academic Center for Education, Culture, and Research (ACECR) - Jahad Daneshgahi (Ref ID: IR.ACECR.AVICENNA.REC.1400.017).

Authors' Contribution

M.T. was responsible for the study design, execution, and article drafting. Q.Sh. and Z.B. collaborated on the study design. A.Z. contributed to the article drafting. M.T. and A.M. collaborated on the statistical analysis of the study findings.

Informed Consent

Written informed consent was obtained from all volunteers participating in the study before their enrollment.

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