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ORIGINAL CONTRIBUTIONS

Brazilian Version of the Yale Food Addiction Scale for Individuals with Severe Obesity

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Abstract

Purpose Adapting and validating the Portuguese version of Br-YFAS 2.0-Obes to allow it to be used by the Brazilian candidates for bariatric surgery.

Materials and Methods This study included 329 individuals with body mass indexes (BMI) ≥ 30 kg/m^2, candidates for bariatric surgery at a reference hospital in Brazil. They were given a questionnaire that identified sociodemographic data, and the YFAS 2.0 scale, Portuguese version (BR-YFAS2.0-Obes), was applied to assess their food dependence levels. The Food Craving Questionnaire – Trait: The FCQ-T-reduced was subsequently used for a correlation analysis.

Results The patients' average BMI was 41.6 ± 8.8 kg/m^2. Br-YFAS2.0-Obes presented an average of 4.9 ± 3.1 for the FA diagnostic criteria. The resulting values of the Comparative Fit Index, Tucker Lewis Index, and Standardized Root Mean Square Residual were 0.990, 0.986, and 0.074, respectively. The internal consistency analysis of the 11 domains presented a Kuder–Richardson α of 0.82. The convergent validity, obtained through an analysis of the Pearson correlation coefficient, was $r = 0.43$ ($p < 0.001$). It was found that an increase in the number of Br-YFAS 2.0-Obes symptoms is associated with an increase in the FCQ-T-r mean.

Conclusion Much like the YFAS 2.0 in other languages, the BR-YFAS 2.0-Obes presented adequate convergent validity, reliability, and one-factor structure results, which makes it suitable for Brazilian candidates for bariatric surgery or any individual who is within BMI > = 30 kg/m^2.

Keywords Food addiction · Bariatric surgery · Binge eating · Craving

Key Points
- BR-YFAS-2.0-OBES is a reliable tool for measuring food addiction in obese patients.
- The internal consistency analysis presented a Kuder–Richardson α of 0.82.
- Br-YFAS 2.0-Obes scores showed a positive correlation with the mean FCQ-Tr scores.

Introduction

Obesity is a disease with multifactorial causes and is often associated with compulsive behaviors or dependence on certain types of food [1–3]. Bariatric surgery is

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an effective treatment for obesity and an essential factor for its success is the prior and continuous psychological assessment of patients who undergo it [4].

The concept of food addiction does not refer to hyperphagia, but to the need for regular consumption of one or more specific foods, a factor that, despite causing negative consequences and loss of control over food, brings eating behavior closer to the concept of drug addiction [1, 5, 6]. The increased consumption of certain foods and drugs can lead some people's organisms to elevate their tolerance to these substances over time and require a consumption of even larger amounts to maintain intoxication, or satiety [7, 8]. Sugary foods and highly processed fatty foods trigger a "rewarding high" sensation through the release of dopamine in the brain [9, 10]. The repeated ingestion of hyperpalatable foods decreases this dopaminergic response, which causes individuals to impulsively and compulsively resort to food stimuli [1, 3, 11]. Food craving—an intense desire to eat a specific food—activates the hippocampus, insula, and caudate nucleus, which is similar to what happens in drug craving [1, 7, 10–12].

The term food craving is used to characterize compulsive eating disorders. It is related to an intense and uncontrollable desire to consume certain highly palatable foods [13, 14].

The Yale Food Addiction Scale-2.0 (YFAS) is widely used to assess food addiction [15, 16]. It aims to identify individuals who are more likely to develop markers of addiction to foods with high concentrations of fats and sugar [15, 16]. The Short Version of the Food Craving Questionnaire – Trait, the FCQ-T-reduced, evaluates the development of certain characteristics of people with food craving disorders [13, 14]. YFAS 2.0 has already been translated and validated into different languages and cultures, including Italian [17], Japanese [18], Spanish [19], French [20], Germanic [21], Chinese [22], and Arabic [23].

There are other adapted versions of the questionnaire translated into Portuguese, but not specifically YFAS 2.0 [24, 25]. To date, few studies have validated YFAS 2.0 in a population of candidates for bariatric surgery [10, 12, 26].

In view of the above, and taking into account the intensity and chronicity of obesity, the multiplicity of factors that can incur as triggering factors, the need for instruments assisting patients who undergo bariatric surgery [27], the significant relationship between these diverse demands, and the exponential increase of obesity in Brazil, we defend that it is relevant to validate the Portuguese version of the Br-YFAS 2.0-Obes and to apply it to the Brazilian population with obesity. The present study aims to validate the Br-YFAS 2.0-Obes so that it can be applied to the population seeking specialized treatment in Brazilian bariatric surgery programs.

Materials and Method

This is a cross-sectional study, and its sample was selected through a telephone survey applied to patients from the Bariatric Surgery and Primary Care programs of the Hospital de Clínicas, located in Porto Alegre, Brazil. The included participants constituted a clinical population, were aged over 18 years, and had a body mass index (BMI) greater than 30 kg/m^2. Individuals who refused to participate or had trouble understanding our questions were excluded from the study, as well as those with less than 5 years of schooling, due to their increased risk of misunderstanding the issues addressed in the instruments. The project was organized by the Research Ethics Committee of the Hospital de Clínicas de Porto Alegre and the Pontifical Catholic University of Rio Grande do Sul, both located in Brazil. The study also received a grant from the Fund for Research and Event Promotion (FIPE). Individuals who consented to participate filled out the Informed Consent Form, which stated that they could withdraw from the research any time, and contained information about the objectives of the study and its procedures, such as the duration of the research and the time available to answer the questions. The questionnaires were only applied after we obtained all participants' signatures.

The internal consistency of the YFAS 2.0 was evaluated according to the Kuder–Richardson method (KR-20). A confirmatory factor analysis (CFA) was performed to assess the adequacy of the studied sample in relation to the original instrument. The statistical indices evaluated were the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI), the Tucker–Lewis Index (TLI), and the Standardized Root Mean Squared Residual (SRMR).

Participants

This experiment opted for the convenience sampling method. The final sample consisted of ($n = 329$) individuals, of which 70 were men (21.3%) and 259 were women (78.7%), all classified as obese (BMI > = 30 kg/m^2), aged between 18 and 78 years old, with a mean age of 46.6 and standard deviation (SD) of (13.6) (Table 1).

Instruments

YFAS 2.0

The one-factor structure of the YFAS 2.0 aims to assess the presence of food addiction in individuals by analyzing their food consumption in the 12 previous months through a self-reported questionnaire with 35 items [16], which are based on the 11 diagnostic criteria of the DSM-5 for

Table 1 Sample characteristics ($n = 329$)

Characteristics	Frequency (%) or mean* (SD)
Gender	
Feminine (*n*,%)	259 (78.7)
Age (years)	46.6 ± 13.6*
Marital status (n)	
Single	122 (37.0)
Married	175 (53.1)
Separated	20 (6.0)
Widowed	12 (3.6)
Education level	
Elementary	87 (26.4)
High School	168 (51.1)
Higher or postgraduate education	74 (22.5)
BMI (kg/m^2, SD)	41.6 (± 8.7)*
< 35	90 (27.4)
35 to 39	73 (22.2)
40 to 49	121 (36.8)
50 to 77	45 (13.7)
FCQ-T-r (average, SD)	46.9 (± 12.4)*
BR-YFAS 2.0-Obes—Diagnosis of Food Addiction (FA)	
No FA	174
Positive diagnostic score	155 (47.1)
Mild FA	19 (12.2)
Moderate FA	36 (23.2)
Severe FA	100 (64.5)

SD, standard deviation; *BMI*, body mass index; *FCQ-T-r*, Food Cravings Questionnaire—Trait-reduced

Disorders by Substance Use and Addictive Disorders [28]. Patients must answer the questions using the Likert scale, which ranges between 0 (never) and 7 (every day) [16].

The 11 diagnostic criteria were considered met if one or more relevant questions related to each criterion reached the scale limit. Two different summary scores were created: one counting the presented symptoms (0–11) and one indicating the patient's diagnosis with its severity level (mild, moderate, or severe). The symptom count scale was created through the sum of the 11 diagnostic criteria (scores ranged from 0 to 11). The diagnosis/severity scale was based on the DSM-5 diagnostic criteria for Substance-Related Disorders and Addictive Disorders: patients were considered to have mild food dependence if they met two to three DSM-5 criteria and to have moderate food dependence if they met four to five criteria. To be effectively diagnosed with food addiction, patients were also required to present clinically significant distress (assessed by separate items) [28].

Food Cravings Questionnaire – Trait-reduced (FCQ-T-r)

Comprising 15 items, the Food Cravings Questionnaire – Trait-reduced (FCQ-T-r) was developed from the items with the highest correlations in the German validation of the FCQ-T [29, 30]. The FCQ-T-r maintained the five subscales measuring patients' ongoing states, which were already present in the original version: lack of control over eating (5 items), thoughts or concerns about food (5 items), intentions and plans to consume food (2 items), emotions before or during food cravings (2 items), and cues that can trigger food cravings (1 item). However, the items corresponding to the subscales of the original version—anticipation of positive reinforcement and anticipation of relief from hunger and guilt—were not included in the FCQ-T-r [14]. The answer scores in the instrument varied from 1 to 5 points, ranging from "totally disagree" to "totally agree," which means that the results could vary from 15 to 75 points [14]. There are several versions of the FCQ. In order to correlate the constructs, we chose to use the Brazilian version of the FCQ-T-r [31, 32]. Our sample had an internal consistency of 0.91.

Translation

In order for the BR-YFAS 2.0-Obes to be developed, its original version (YFAS-2.0), written in English [16], was translated into Brazilian Portuguese by two Brazilian authors, and then translated back into English by two external professional translators, one of whom was a native English speaker (Table 2). Two independent judges evaluated the two translations of each item, comparing them to the original versions by assessing semantic, idiomatic, conceptual, linguistic, and contextual discrepancies, and subsequently developing a final synthesis, which was reviewed by the author of the instrument.

Sample Calculation

The sample size suggested by the literature would be at least five times the number of items in the questionnaire [33]. However, to ensure a more robust sample, it was decided to calculate the required quantity of participants by multiplying the number of core items of the instrument by nine. Considering that the YFAS 2.0 consists of 35 items [16], it was defined that the study should have a sample of 315 participants, considering the possibility of possible sample losses.

Ethical Procedures

The participants received the Free and Informed Consent Form (ICF), approved by the Scientific Committee and by the Research Ethics Committee of Hospital de Clínicas de Porto Alegre, CAEE 29662520600005327, in accordance

Table 2 Diagnostic criteria of the Brazilian version of the Yale Food Addiction Scale 2.0 ($n=329$)

Diagnostic criteria	Individuals who met the criteria (%)	Factor loading
Consumed more food than intended	180 (54.7)	0.58*
Was unable to cut down or stop food consumption	189 (57.4)	0.63*
Spent a great deal of time eating	101 (30.7)	0.61*
Gave up on important activities	126 (38.3)	0.60*
Consumed food despite physical/emotional consequences	132 (40.1)	0.70*
Developed tolerance to overconsumption	97 (29.5)	0.76*
Went through withdrawal	204 (62.0)	0.62*
Consumed food despite interpersonal/social problems	172 (52.3)	0.62*
Failed to meet role obligations	139 (42.2)	0.58*
Consumed food in physically hazardous situations	152 (46.2)	0.72*
Experienced food cravings	121 (36.8)	0.67*
Presented impairments/distress	161 (48.9)	

* $p<0.001$, calculated with the confirmatory factor analysis

with the ethical aspects of research with human beings proposed by Resolution 510 of April 7, 2016 (CNS 510/2016). All participants signed the ICF before answering the questionnaire, thus consenting to participate in the research and acknowledging their ability to withdraw from it at any time.

Results

Reliability Analysis

The resulting value of the Kuder–Richardson Formula-20, applied during the internal consistency analysis of the 11 domains, was 0.82. There were no significant changes in scale consistency, which means no domains were excluded.

Confirmatory Factor Analysis

The RMSEA value was 0.042 (95% CI: 0.021; 0.058), and the CFI, TLI, and SRMR values were 0.990, 0.986, and 0.074, respectively. Two diagnostic criteria ("Consumed more than intended" and "Failed with his obligations") presented a factor loading of 0.58. The other diagnostic criteria had a factor loading of 0.60 or greater.

Prevalence of Food Addiction Diagnosis with the Br-YFAS2.0-Obes

The mean sum of the food addiction diagnosis criteria in the Br-YFAS2.0-Obes is 4.9 (SD = 3.13; range = 0–11). The proportion of subjects who reached the score threshold for each diagnostic criterion ranged from 29.5 to 62%.

A total of 155 (47.1%) participants were considered to have some degree of food addiction: according to our assessment, 19 (12.2%) participants had low level addiction, 36 (23.2%) had moderate addiction, and 100 (64.5%) had severe addiction (Table 1).

Correlation Analysis

In order to examine the construct validity, Pearson's correlation analysis between the YFAS 2.0 and FCQ-T-r questionnaires was r = 0.43 (p < 0.001). A higher body mass index was associated with an increase in mean food addiction symptoms indicated by the Br-YFAS2.0-Obes (Table 3).

Convergent Validity

The correlation between the number of symptoms indicated by the Br-YFAS 2.0-Obes and the total FCQ-Tr score showed $r=0.43$, $p<0.001$ (Table 3).

In Tukey's Test, the results of patients without food addiction only showed significant statistical differences when compared with results of participants with moderate and severe food addiction ($p<0.05$). An increase in the number

Table 3 Analysis of variance between BMI, Br-YFAS 2.0-Obes, and FCQ-T-r

	Br-YFAS *n*	Mean ± SD	FCQ-Tr *n*	Mean ± SD
BMI (kg/m^2)		$p=0.002$*		$p=0.382$*
< 35	91	4.1 ± 3.0	87	45 ± 11.2
35 to 39	72	4.5 ± 3.3	72	47.2 ± 12.4
40 to 49	122	5.1 ± 3.0	122	47.6 ± 13.1
50 to 77	44	6.1 ± 3.1	44	48.3 ± 12.8
Total	329	4.9 ± 3.1	325	46.9 ± 12.4

*Variance analysis

of symptoms in the Br-YFAS 2.0-Obes was associated with an increase in the FCQ-T-r mean (Tables 4 and 5).

Discussion

Through the Br-YFAS2.0-Obes, 47.1% of participants were diagnosed with food addiction. However, two North American studies that evaluated patients in the preoperative period of bariatric surgery observed lower proportions of this diagnosis (27.4% and 18%) [10, 12]. These studies also had differences related to the intensity of the addiction of diagnosed participants: 64.5% of subjects diagnosed with the YFAS BR presented a severe degree of addiction, while only 54.7% [12] and 56% [10] of participants in both American studies were found to be severely addicted. This disparity is greater in comparisons between the YFAS BR and international validation samples carried out with the general population of countries such as Japan (3.3%) [18], Italy (3.6%) [17], France 8.2% [20], and the USA 14.6% [16].

To conduct other validations of the YFAS 2.0, Clark [12] and Koball [10] collected their data in bariatric surgery programs and only included pre-surgery patients, as we did in our study, where the emphasis was the same. The samples of these two studies had some similarities to ours: approximately 80% of participants were adult women aged around 46 years old and with a BMI above 40. On average, 55% of the cases of food addiction identified by the YFAS 2.0 in the two studies were severe. Our study found an even higher figure, identifying 64% of addiction cases as severe.

The factor analysis proved compatible with other studies, confirming the one-factor structure for the BR-YFAS 2.0-Obes. The scale remained structurally aligned with the Japanese [18], German [21], French [20], Italian [17], and Spanish [19] versions of YFAS 2.0; and met Hu and Bentler's standards, that is, RMSEA ≤ 0.06, CFI ≥ 0.95, TLI ≥ 0.95, and SRMR ≤ 0.0830, for all diagnostic criteria except "Consumed more food than intended" and "Failed to meet role obligations," which indicated a factorial load of 0.58, approaching the expected limit. The Japanese [18] and French [20] validations presented respective factor analyses of 0.41 and 0.40 or higher for most criteria except for criterion 9, "Failed to meet role obligations" which indicated a factor loading of 0.31 in the Japanese version, and criterion 1, "Consumed more food than intended," which had a factor loading of 0.32 in the French version. More constant results

Table 4 Associations between Br-YFAS 2.0-Obes diagnoses and FCQ-Tr means

Classification of Br-YFAS 2.0-Obes	*n*	Mean FCQ-Tr	SD	95% confidence interval for mean Lower–Upper
No food addiction	172	42.9[a]	10.9	41.3–44.6
Mild food addiction	19	47.6[ab]	6.5	44.5–50.7
Moderate food addiction	36	48.6[b]	9.4	45.5–51.9
Severe food addiction	98	53.0[b]	14.1	50.2–55.9
Total	325	46.8	12.4	45.5–48.2

The overall test was significant and the mean groups with no significant differences are shown in the table (a and b); ANOVA: $F_{(3, 321)} = 16.18$, $p < 0.001$

Table 5 Associations between the FCQ-T-r score and the presence of Br-YFAS 2.0-Obes domains

YFAS domains	Domain presence *n*	*t* (df)	*p*	Cohen's *d* (95% C.I.)
D1: Consumed more food than intended	178 (50.1)	5.4 (323)	< 0.001	0.59 (0.37–0.82)
D2: Was unable to cut down or stop food consumption	187 (50.64)	6.8 (323)	< 0.001	0.75 (0.53–0.98)
D3: Spent a great deal of time spent eating	99 (52.7)	5.8 (323)	< 0.001	0.70 (0.46–0.94)
D4: Gave up on important activities	125 (48.2)	1.5 (323)	0.144	0.16 (0.05–0.39)
D5: Consumed food despite physical/emotional consequences	130 (51)	5.1 (323)	< 0.001	0.57 (0.34–0.80)
D6: Developed tolerance to overconsumption	95 (54.5)	7.7 (323)	< 0.001	0.94 (0.69–1.19)
D7: Went through withdrawal	201 (49.9)	5.7 (323)	< 0.001	0.65 (0.42–0.88)
D8: Consumed food despite interpersonal/social problems	169 (49.1)	3.4 (323)	< 0.001	0.37 (0.15–0.59)
D9: Failed to meet role obligations	138 (48.3)	1.7 (323)	0.083	0.19 (0.02–0.41)
D10: Consumed food in physically hazardous situations	149 (48.1)	1.7 (323)	0.092	0.18 (0.031–0.40)
D11: Experienced food cravings	119 (52.8)	6.9 (323)	< 0.001	0.80 (0.56–1.03)
D12: Presented Impairments/distress	159 (51.1)	6.4 (323)	< 0.001	0.70 (0.48–0.93)

were observed in the German version, in which all criteria had factor loadings of 0.73 or higher [21].

Confirming the good reliability of the Br-YFAS 2.0-Obes, the resulting KR-20 value was 0.82 for the 11 analyzed criteria. Similar results were found in studies developing the YFAS 2.0 [16] and its French version: they obtained respective KR-20 values of 0.90 and 0.83, which also indicates that the BR-YFAS 2.0-Obes has good reliability and internal consistency.

As expected, the presence and severity of symptoms from the Br-YFAS 2.0-Obes in patients showed a positive correlation with the mean FCQ-Tr score (Table 4). Similar results were observed when this scale was translated into German, reinforcing this correlation: compared to participants without a diagnosis, participants diagnosed with food addiction by the YFAS 2.0 were found to have higher BMI levels and higher FCQ-T-r scores [21].

Our sample was predominantly composed of women. We expect new studies in this area to expand their samples, especially including more male members. Additionally, this study only included patients indicated for bariatric surgery, not considering the behavioral changes they might go through after the surgical procedure. Some questionnaires were administered via telephone survey. The questions were narrated according to the standard YFAS 2.0 OBES questionnaire, but were subject to misinterpretation by the participants.

Although food addiction is not yet recognized as a psychiatric disorder by the DSM-5-TR [5, 34], our study found a positive association between a higher BMI and an increase in average food addiction symptoms (Table 3), which reinforces the importance of validating both the questionnaire and the concept of food addiction for the population diagnosed with obesity.

We hope that a better understanding and diagnosis of food addiction pre-operatively can confer a better prognosis for bariatric surgery [35–37]. Pre-operatively, around 57% of candidates for bariatric surgery present at least one psychiatric disorder [21]. Therefore, psychological evaluations are essential not only to contraindicate surgery, but also to ensure patients can make a conscious and rational decision about the procedure and have internal resources to follow post-surgical indications [4].

Conclusion

The BR-YFAS 2.0-Obes scale presented adequate psychometric properties for use in individuals participating in bariatric surgery programs. This suggests that its translated and adapted version in Brazilian Portuguese is, much like the versions in other languages, a reliable tool. Comprising the DSM-5-TR [34] criteria, the BR-YFAS 2.0-Obes can be used to diagnose food addiction or to assess the number of food addiction symptoms in patients with obesity. The questionnaire can be used for any individual who is within BMI ≥ 30, not necessarily needing to undergo bariatric surgery.

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Declarations

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was approved by the Ethics Committee of the Hospital de Clínicas de Porto Alegre (reference number 2019–0810).

Consent to Participate Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare no competing interests.

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