Spanish translation of the Yale Food Addiction Rating Scale and its evaluation in a Mexican population. A factorial analysis

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Original article

ABSTRACT

Introduction

Obesity has a multifactorial etiology and is a global public health problem which also affects Mexican population. Obesity is characterized by excessive body adiposity, as well as high prevalence of diverse comorbidities, which diminish life quality. Sedentary lifestyle and hypercaloric food overconsumption are amongst the causes of obesity. It has been suggested that some traits seen in obese patients may represent an addictive behavior, similar to those observed in substance-dependent patients.

Objective

The aim of this work was the validation of the Spanish version of the Yale Food Addiction Rating Scale (YFAS) in a Mexican adult population sample.

Method

The scale was applied twice to 160 participants with a three-week period in-between. The factorial model was corroborated with Bartlett's sphericity test and with that of Kaiser-Meyer-Olkin.

Results

Internal consistency was calculated by means of Cronbach's alpha which was $\alpha = 0.7963$; reliability, measured with Spearman's coefficient by means of the test-retest method, was $r = 0.565$, $n = 96$. Convergence validity was estimated using the Binge Eating Scale (BES) and Spearman's correlation ($r = 0.5868$ $p \leq 0.0001$; $n = 157$). Bartlett's sphericity test showed ($\chi^2_{(300)} = 1572.33$, $p < 0.05$) and that of Kaiser-Meyer-Olkin (KMO = 0.825), showing consistency for the factorial model. Spearman's correlation between YFAS and body mass index (BMI) showed $r = 0.2843$ $p \leq 0.001$; $n = 151$.

Discussion and conclusion

The Spanish version of the YFAS showed psychometric properties not different from the original and adapted existing versions. Therefore, YFAS Spanish version could be useful in healthcare and clinical research in Mexican population.

Key words: Obesity, addictive behavior, validation study.

RESUMEN

Introducción

La obesidad es la acumulación excesiva de grasa corporal, lo que condiciona una alta comorbilidad. El consumo descontrolado de alimentos hipercalóricos es causa de su desarrollo; ésta es una conducta de características similares a la de pacientes con adicción a sustancias. La escala de adicción a los alimentos, YFAS (Yale Food Addiction Scale), permite identificar a sujetos con conducta adictiva a los alimentos.

Objetivo

Validar la escala YFAS en español en una muestra de población mexicana adulta.

Método

La muestra de participantes (160) respondió a la encuesta en dos ocasiones, con un período de tres semanas entre cada aplicación. La pertinencia de un modelo factorial se corroboró con las pruebas de esfericidad de Bartlett y la medición del parámetro de Kaiser-Meyer-Olkin.

Resultados

El α de Cronbach = 0.7963 corroboró la consistencia interna de la escala. Para la confiabilidad se obtuvo el coeficiente de Spearman por la metodología test-retest, de $r = 0.565$, $n = 96$. La validación por convergencia, correlacionando con la escala para trastorno por atracón (Binge Eating Scale, BES) ($r = 0.5868$ $p \leq 0.0001$; $n = 157$). Las pruebas de Bartlett ($\chi^2_{(300)} = 1572.3$, $p < 0.05$) y Kaiser-Meyer-Olkin (KMO = 0.825) mostraron pertinencia del modelo factorial. Además, se correlacionaron los resultados de la YFAS con el índice de masa corporal (IMC) ($r = 0.2843$ $p \leq 0.001$; $n = 151$).

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Discusión y conclusión

Esta versión de YFAS presentó propiedades psicométricas adecuadas y similares a las de la original y a otras de sus traducciones y adaptaciones. Se considera entonces con utilidad para la prácti- ca asistencial y para estudios de investigación clínica en población mexicana.

Palabras clave: Obesidad, adicción a los alimentos, validez.

INTRODUCTION

Excessive food consumption is a phenomenon that has recently become a topic of interest, especially as one of the causes of obesity, a pandemic associated to potentially fatal comorbidities,[1] which, despite medical progress and government actions, has not been possible to revert.[2]

Obesity is an excessive accumulation of body fat that poses health risks and is defined by a BMI higher or equal to 30 kg/m^2.[3] According to the World Health Organization (WHO), obesity has nearly doubled since 1980. By 2014, more than 1.9 billion adults (39%) had a body mass index (BMI) higher than 25 kg/m^2, from which 600 million (13%) were in an obesity range.[4]

A sedentary lifestyle and the excessive consumption of a hypercaloric diet (high in sugar and fat), even with enough body energy reserves, seem to overtake the innate homeostatic control that joins up food intake and energy expenditure.[5-7]

Several clinical studies have shown that binge eating disorder (BED) has a high frequency in obese subjects, so it has been proposed that it contributes to the development of obesity.[8-12] The association of obesity and binge eating has been related to the degree of body adiposity, comorbid psychopathological features and response to treatment.[13-15]

BED is characterized by recurrent episodes of eating large quantities of food in lack of regular compensatory behavior, such as vomiting or laxative abuse. Some related characteristics include eating until one feels uncomfortably full, eating when not being hungry, eating alone while feeling depressed or guilty.[16] BED has been associated with different psychopathological entities such as major depressive disorder, anxiety disorders and personality disorders, which are also comorbidities of obesity.[17,18]

Although BED is not limited to obese people, its association is more common in this group than with any other eating disorder. In the general population, the prevalence of BED has been estimated to be between 2 and 5%, whereas in individuals seeking treatment for weight control, the prevalence is 30%.[19]

The origin of binge eating of tasty foods has been homologated with drug addiction in terms of the dopaminergic reward system participation and as a consequence of the activation of positive reward mechanisms, in this case generated by food with a high caloric content.[20-22]

Although the food addiction concept has not been clinically accepted yet, there is evidence that shows affinity in the neurochemistry between drug-addicts and obese people,[23,24] suggesting that in some cases the latter could be the result of "food addiction" and thus could be evaluated considering the behavior patterns and symptomatology observed in other addictions.[25]

These patterns have been represented in the Yale Food Addiction Scale (YFAS), which aim is to define the measurement of food addiction by translating the diagnostic criteria for substance use disorders identified in the DSM-5, for its application in the eating behavior.[26]

The original version of this scale has proved to be internally reliable (Kuder Richardson coefficient α = 0.86) and convergent, obtained when comparing the instrument with the Eating Attitudes Test-26, EAT-26 and with the Emotional Eating Scale (EES), getting in both cases significant correlations. Discriminatory validity has been the result of a comparison between the Daily Drinking Questionnaire (DDQ) and the Routgers Alcohol Problem Index (RAPI), and as an instrument to evaluate impulsivity the Alan Gray Behavioral Inhibition/Behavioral Approach System model has been used, known as BIS/BAS reactivity. Discriminatory validity is considered adequate since there is no significant correlation with DDQ or BAS and there is only a small but reliable correlation with the RAPI and the BIS.[26]

The YFAS is also an indicator of binge eating disorder measured with the Binge Eating Scale (BES), which assesses the clinical entity of binge eating disorder, accepted by the DSM-5[25] and that would be equal to the phenomenon of food addiction.[26]

The YFAS has been used in several studies and its translated versions in German, French, and Spanish (applied in Spain) have already been validated obtaining a Cronbach's α of 0.81 - 0.83, 0.90, and 0.82, respectively.[27-31] Also, a short version of the scale has been developed, containing only nine items, one for each behavioral aspect of the addiction (seven items) plus two items to evaluate significant clinical manifestations (α = 0.75-0.84).[32] There is also a scale version adapted for children (α = 0.78).[33]

Considering the high occurrence of compulsive food consumption reported by obese patients,[34] it is also important to point out that obesity may be the result of metabolic alterations leading to a positive energy balance, i.e., a lower outflow of glycogen and lipids although their reserves are large.

The regulation of these signals through leptin, insulin, and ghrelin hormones, which are released from the adipose

tissue, pancreas, or stomach, are given by the size, volume of adipocytes, or glycogen stored, as well as the presence of nutrients in the digestive system.

It is possible that the release and signaling of these hormones are altered in patients with obesity and, in those conditions, their treatment would be focused on solving the metabolic disorder. However, a psychiatric disorder may also be involved. Mood disorders are common in patients with obesity and can lead to uncontrolled food consumption in the order of the anxiolytic effect that comes along in fats and carbohydrates.

Therefore, the relevance of having an instrument like this, translated into Spanish and adapted to the foods and terms commonly used in Mexico, represents the possibility of detecting in the Mexican population a behavior of hyperphagia that may reflect psychiatric disorders traits that lead to obesity.

METHOD

Sample

Transversal and descriptive study using a convenience sampling of 160 workers and students from different ISSSTE centers, such as the ISSSTE's School and Center of Dietetics and Nutrition (*Escuela y el Centro de Dietética y Nutrición del ISSSTE*) between February and July 2015.

Instruments

The Yale scale is an instrument of 25 items that analyzes the appearance of the criteria proposed by DSM-5 to identify substance dependence.[25]

The scale includes dichotomous and frequency scoring options: frequencies (*never*, *once a month*, *2-4 times a month*, *2-3 times a week*, *4 or more times a week or daily*: corresponding to 0, 1, 2, 3, or 4 points, respectively) evaluate actions that individuals without addiction problems might do, whereas dichotomous options (*yes* or *no*: 0 or 1 point) are used in questions that indicate more severe problems of food consumption.

Finally, the values are analyzed to determine whether each one of the criteria is fulfilled or not. The diagnosis of food addiction is given if the subject meets at least three positive criteria.[35]

In our study, the Spanish adaptation of YFAS was conducted by direct translation and was revised by two psychiatrists, two neuroscience and two nutrition specialists, all native Spanish speakers with good command of the English language, with the aim of translating and optimizing the clarity of the questions.

BES is a self-administered instrument developed to identify BED in people with obesity; it measures behavioral aspects such as the consumption of large food quantities and feelings or emotions around an episode of binge eating. This tool has proven to be useful for identifying individuals with BED and for assessing the intensity of the disorder. It also allows discrimination between individuals with moderate or severe BED and individuals without this disorder.[36-41]

Process

The height and weight of each participant were obtained using a Tanita scale (TBT-215, Tokyo, Japan). The cut-off points for defining normal, overweight and obesity BMI were those designated by the WHO: 18.5 - 24.9 kg/m² (normal), 25 - 29.9 kg/m² (overweight) and ≥ 30 kg/m² (obesity).[42]

The inclusion criteria considered to select the participants were: men and women who came for the first time to the ISSSTE's Dietetics and Nutrition Center of the School of Dietetics and Nutrition (*Centro de Dietética y Nutrición de la Escuela de Dietética y Nutrición del ISSSTE*), aged between 18 and 45 years and who agreed to participate in the study by signing an informed consent form.

The exclusion criteria were: women in menopause period, smokers, patients on antidepressant treatment or anti-obesity drugs, patients on diet therapy and with chronic alcohol consumption (more than two alcoholic drinks per day), since these are factors that can modify the eating behavior by themselves.

Participants were told to answer the scale considering their diet in the last year and, in particular, their consumption of foods rich in fat and/or sugar, which are the most consumed during binge eating.

The frequencies of participants were compared by gender and BMI using the χ^2 test considering a significant difference when presenting value of $p < 0.05$.

Statistical analyses

The internal consistency was determined by calculating the Cronbach's α which was considered adequate when it was higher than 0.7. The convergence validity was performed by Spearman correlation with the BES considered significant when the value of $p < 0.05$. The method used to evaluate the reliability of the YFAS, i.e. the stability between two measurements of the same scale, was the test-retest (three-week difference between the first and second application) and the calculation of Spearman's coefficient in regard to both measurements, being considered satisfactory when $p < 0.05$.

Factorial analysis

In order to define the relevance of a factorial design, Bartlett's sphericity tests and the Kaiser-Meyer-Olkin parameter measuring were applied. Subsequently, the factorial rota-

tion procedure of the components was used under the Varimax standardization system. The SPSS program was used for this analysis.

A Spearman correlation was also conducted between the YFAS scale scores and the BMI, which was considered significant when $p < 0.05$. Statistical analyzes were completed by using the GraphPad Prism software, version 6.

RESULTS

160 participants were recruited between February and July 2015 and those who did not return to the second application of the scale were excluded; also those who did not answer all the items of both scales were excluded. The study sample consisted of 37 individuals aged 14 from whom 123 (77%) were women ($\chi^2 = 153,342$, $p < 0.001$). Regarding BMI, 71 (46%) participants were in the normal range, 51 (33%) in the overweight range and 31 (21%) in the obesity range. Of all subjects with obesity, 20 (65%) had grade I obesity, 8 (26%) had grade II obesity, and 3 (9.9%) had morbid obesity ($\chi^2 = 300,319$, $p < 0.001$).

Considering the sample regardless of gender, 46.1% had a normal BMI and 53.9% was the combined percentage between overweight and obesity ($\chi^2 = 3.817$, $p = 0.148$).

Internal consistency

The Cronbach's α value for the 22 transformable reagents was 0.7963. The Spearman coefficient for the two applications of the Yale scale was $r = 0.565$, $p < 0.01$, $n = 96$.

Factorial analysis

The results of the Bartlett's sphericity test showed values that verified the adequacy of the matrix for the analysis, indicating relevance of the factorial model (table 1). Using the main component extraction method, seven components with their own values greater than unity (7.82, 5.88, 4.32,

Table 1
Sampling adequacy statistics

Kaiser-Meyer-Olkin Measure of sampling adequacy		0.825
Bartlett's test of sphericity	Approx. Chi-square	1572.330
	df.	300
	Sig.	0

Note: The table shows the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy, which indicates the proportion of the variance that the variables analyzed have in common. The KMO coefficient was close to the unity (KMO = 0.825), supporting that the adequacy of the model to the factorial analysis is good. Bartlett's Test of Sphericity contrasts the null hypothesis that the correlation matrix is an identity matrix, in which case there would be no significant correlations between the variables and the model would not be relevant. However, the values of the test corroborate that the data have suitable characteristics for the accomplishment of a factorial analysis.

3.10, 1.35, 1.30, 1.1) were identified, accounting for 72% of the sample variance.

Table 2 shows the saturations of the items in each factor under the Varimax standardization system.

From the five main components, the first is formed by items 1, 2, 3, 4, 5, 6, 7, 12, 13, and 20, which represent three of the seven criteria that assemble the substance addiction construct and the model from which the same concept was extracted, being: consumption of the substance in a greater amount or for a longer period of time the subject intends, use more time in obtaining-using the substance, have withdrawal symptoms.

The second component contains questions 9,15,17,19, and 21. These represent tolerance criteria, that is to say, continue the use in spite of knowing its negative consequences and of those that describe the dysfunction and the discomfort outcome.

The third component, consisting of questions 22, 23, 24, and 25, represents the criterion of continuous desire or inability to reduce or cease consumption.

The fourth component consisted of questions 8, 10, and 14, which constitutes the criterion of reduction or cessation of occupational or recreational social activities, except for question 14, which is part of the abstinence criterion.

The fifth component consists of questions 11, 15, and 18 that correspond to the consequences of malaise and dysfunction and with the criterion of reduction or cessation of occupational or recreational social activities.

The explained total variance is also included (table 3)

Convergent validity

The Spearman coefficient for the Yale and Gormally (BES) scores was: $r = 0.5868$ $p \leq 0.0001$; $N = 157$.

Correlation with BMI

The Spearman coefficient regarding the Yale scale scores and the BMI was $r = 0.2843$ $p \leq 0.001$; $N = 151$.

DISCUSSION AND CONCLUSION

In this paper we calculated the internal consistency and the convergent validity of a Spanish version of the YFAS in a sample of subjects in the Mexican population.

The value of the internal consistency referred to the relation among the items of the scale as a whole, that is, how much could each item measure what was desired to be measured with the scale or instrument.[43] Different studies consider as acceptable values of α between 0.7 and 0.95,[44-47] indicating that the reliability of our version of the scale was adequate.

The convergent validity obtained through the Spearman coefficient between the scores obtained in both instruments (YFAS and BES) suggested a positive linear relation-

Table 2

Matrix of rotated components

Question		Component				
		1	2	3	4	5
1.	I have noticed that when I begin eating specific meals, I end up eating more than I expected.	0.785				
3.	I have noticed that I eat until I feel bad; e.g. with inflammation, stomach pain, nausea, indigestion, heartburn, etc.	0.779				
6.	I have noticed that during the day I eat specific foods repeatedly.	0.760				
7.	I have noticed that I try to get those particular foods when they are not available. E.g.: I have gone to the store to get them even if I had other options at home.	0.718				
2.	I have noticed that when I am eating said particular meals I have kept eating them even though I am no longer hungry.	0.687				
5.	I have spent a lot of time feeling slow, heavy, or tired from eating too much.	0.685				
20.	As time goes by I have noticed that I need to eat more and more to achieve the state of comfort I desire, such as reducing my negative emotions (anxiety or guilt) and increasing pleasure.	0.649				
13.	I have consumed specific meals to avoid feelings of anxiety or restlessness caused by stopped eating them (caffeinated beverages such as energy drinks, coffee, etc. not considered).	0.645				
12.	I have felt restless, anxious, or agitated when I have stopped consuming these particular foods (caffeinated beverages not considered).	0.609				
4.	It worries me that I have not been able to avoid consuming those particular meals or I have not been able to reduce their consumption.	0.575				
19.	I have kept eating the same type of food or the same amount of food, despite the fact that it has caused me psychological or physical problems (anxiety, guilt, diabetes, glucose intolerance, hypertension, obesity).		0.725			
9.	On some occasions when I have consumed these food so often or in such large quantities, I have had negative feelings (guilt, low self-esteem) because I have eaten too much, instead of working, hanging out with family or doing other activities that I enjoy.		0.664			
17.	My food consumption has caused me depression, anxiety, or guilt feelings.		0.642			
15.	My behavior regarding food and my way of eating generates discomfort (anxiety, guilt, depression).		0.557			
21.	I have noticed that eating the same amount of food no longer reduces my negative emotions or that they no longer increase the pleasurable sensations as I used to.		0.478			
23.	I have done something to curb or reduce my consumption of these specific meals.			0.830		
22.	I have wanted to stop or reduce my consumption of these meals.			0.781		
25.	How many times in the last year I have tried to curb or decrease the consumption of these particular meals.			0.722		
24.	I have succeeded in curbing or reducing my consumption of these meals.			0.598		
8.	Few times when I have consumed these meals so frequently or in such large quantities, I have stopped working, hanging out with family or doing other activities that I enjoy.				0.746	
14.	I have noticed that I have a great desire or urgency to consume those particular foods when I stop eating them.				0.620	
10.	I have avoided attending social or work events knowing that these particular foods will be available, for fear of overeating.				0.586	
11.	I have avoided attending social or work events because there were not those meals and I could not consume them.					0.828
15.	My behavior regarding food and my way of eating generates discomfort (anxiety, guilt, depression).					0.622
18.	My food consumption has caused me major physical problems (diabetes, glucose intolerance, hypertension, obesity) or has complicated the existing problems.					0.607
Eigenvalue		8.894	2.743	2.019	1.440	1.107
Explained variance		36%	11%	8%	6%	4%

Note: The factorial rotation procedure was performed under the Varimax normalization system. The rotated intend try that each of the original variables has a correlation close to 1 with one of the factors (components) and correlation close to 0 with the rest of the components. In this way high correlations between groups of variables are obtained. It bears mentioning that the extraction was performed for 5 components (6 components were originally planned) since component number 5 (1.279, 5% explained variance) did not accomplish the main criterion defining a component; that is to say, at least two correlated variables exist.

Table 3
Total variance explained. Data show the charges (cargas) of each item

Item	Total	% variance	Accumulated %
		Initial autovalues	
1	8.894	35.578	35.578
2	2.743	10.972	46.550
3	2.019	8.076	54.626
4	1.440	5.759	60.385
5	1.279	5.117	65.502
6	1.107	4.430	69.932
7	0.923	3.691	73.623
8	0.774	3.096	76.718
9	0.731	2.925	79.643
10	0.725	2.902	82.544
11	0.566	2.262	84.806
12	0.471	1.883	86.690
13	0.435	1.741	88.431
14	0.419	1.676	90.107
15	0.340	1.359	91.466
16	0.328	1.313	92.778
17	0.310	1.240	94.018
18	0.277	1.109	95.127
19	0.245	0.981	96.108
20	0.213	0.852	96.960
21	0.196	0.782	97.742
22	0.189	0.757	98.499
23	0.155	0.619	99.118
24	0.126	0.504	99.622
25	0.094	0.378	100.000

Nota: The extraction method was the analysis of main components.

ship between both of them, which is related to the criteria that evaluate both scales, i.e., an episodic excessive dietary behavior, associated with emotional components such as guilt and anxiety, despite the exacerbation of clinical sufferings; e.g., type 2 diabetes mellitus and hypertension. In brief, obtaining a positive result in the YFAS suggests that the result will be similar to the one obtained using the BES and vice versa.

Also, BES aims to measure the most similar conducts to the diagnostic criteria suggested in the clinic for "food addiction".[36]

Regarding the factorial analysis, five components were established, which included all the items compared to the original study that determined four, including only 21 of the 25 items. The differences could be due to the fact that in the current study, factors two and five conformed the criteria of the consequences of discomfort and dysfunction, while the original separated those questions that examine both.

The first component was the most extensive and represents the essence of food addiction construct in terms of what implies a greater and excessive consumption imply. The second described well the consequences associated with this excessive consumption. The third expressed properly how fragile will can be in the effort to stop consump-

tion. The fourth component expressed the carelessness of the other activities. Finally, the fifth was mostly composed by those questions that explore dysfunction and discomfort and were excluded from the original study. In general, the factorial structure of the criteria that make up the food addiction construct was conserved.

Regarding the correlation between the Yale scale and the BMI, Spearman's coefficient suggested a weak positive relation, which implies that a food addiction behavior could be presented even in individuals with normal weight. A sampling that considers a population with a higher prevalence of obesity would be advisable to better evaluate its correlation with YFAS.

In summary, the version of YFAS in Spanish used in this study presented proper psychometric properties similar to those of the original version and to other translations and adaptations of same; therefore, it is considered that it could be useful in the caring practice and in clinical research studies in the Mexican population.

Having a Spanish version of an instrument like this opens the possibility of detecting in Mexican patients a behavior of hyperphagia that may reflect traits of psychiatric disorders that lead to the development of obesity, which would facilitate its treatment, allowing a wider approach and in accordance with the hunger natural phenomenon. In fact, it will expand the perspective of obesity by adding the possibility of equating the addictive behaviors that lead to excessive intake with the model of substance abuse disorders.

The limitations of this study include those that are related to the food addiction construct, which is still under discussion and therefore does not have established and validated diagnostic criteria, much less other measurement instruments to establish a comparison with. On the other hand, the sample is small and belongs to a restricted group, which makes it not representative, thus reducing the external validity of the results and the use of more robust tests.

Despite the deficiencies mentioned in the statistical analysis used for this study, it is not possible to disqualify the usefulness and importance and it will be the clinician who decides its use and transcendence in order to make more complete and statistically solid.

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