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# Psychometric properties of the Three-Factor Eating Questionnaire-R18 (TFEQ-R18) in Mexican patients with obesity

## *Propiedades psicométricas del Cuestionario Tres Factores de la Alimentación-R18 (TFEQ-R18) en personas mexicanas con obesidad*

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**Abstract:** The aim of the study was to evaluate the psychometric properties of the Three Factor Eating Questionnaire (TFEQ-R18) in Mexican patients with obesity. Methods: 292 Mexican adults (194 women, 98 men) who entered a multidisciplinary treatment program for obesity at a third level hospital in Mexico, completed the TFEQ-R18 to obtain the psychometric properties. Results: The TFEQ-R18 has a good internal consistency showing a global Cronbach´s a= 0.88, and McDonald's w=0.88, and maintained the original three factors (cognitive restraint, uncontrolled eating and emotional eating); CFA showed adequate goodness-of-fit indices, except for the $X^2$ ($X^2$ = 274.5, df = 142, p <.001; RMSEA

= .061, CI [.051, .071]; CFI = .93; TLI = .92; SRMR = .071). There is a significant positive correlation with the diagnosis of eating disorder and emotional eating with uncontrolled eating and emotional eating factors. Conclusions: The TFEQ-R18 allows an adequate evaluation of the three eating factors in Mexican patients with obesity and allows a differentiation between cases with or without eating disorders.

**Key words:** Eating behavior, cognitive restraint, uncontrolled eating, emotional eating.

**Resumen:** El objetivo del estudio fue evaluar las propiedades psicométricas del Cuestionario de tres factores de alimentación (TFEQ-R18) en pacientes mexicanos con obesidad. Método: Participaron 292 adultos mexicanos (194 mujeres, 98 hombres) que ingresaron a un tratamiento multidisciplinario para obesidad en un hospital de tercer nivel en la Ciudad de México. Resultados: El TFEQ-R18 tiene una buena consistencia interna mostrando un a de Cronbach global= 0,88, y w de McDonald =0,88, mantiene los tres factores originales (restricción cognitiva, alimentación descontrolada e ingesta emocional); El CFA mostró índices de bondad de ajuste adecuados, excepto la $X^2$ ($X^2$ = 274.5, df = 142, p <.001; RMSEA = .061, IC [.051, .071]; CFI = .93; TLI = . 92; SRMR = 0,071). Existe además una correlación positiva significativa entre el diagnóstico de trastorno de la conducta alimentaria y la ingesta emocional con los factores de alimentación descontrolada y alimentación emocional de la escala. Conclusiones: El TFEQ-R18 permite una adecuada evaluación de los tres factores alimentarios en pacientes mexicanos con obesidad y permite diferenciar entre casos con o sin trastornos alimentarios.

**Palabras Clave:** Conduta alimentaria, restricción cognitiva, alimentación descontrolada, ingesta emocional.

## Introduction

Few public health issues are as wide reaching and complex as obesity, which is one of the main risk factors for the development of chronic degenerative diseases (De Lorenzo et al., 2019; WHO 2000). Various eating behaviors, including overconsumption of high-energy, dense, and fatty foods, fast food intake, and frequent snacking between meals, have been indicated as predictors of this condition (Almoraie et al., 2021; Whitney & Rolfes 2007).

Self-assessment questionnaires are of great importance in the evaluation of eating behaviors; nevertheless, all these instruments require validation to demonstrate their usefulness and applicability in different populations and contexts (Anglé et al., 2009).

Currently, there are several questionnaires widely used in the study of eating behavior, among which the Restraint Scale (RS) (Herman & Polivy, 1980), the Three-Factor Eating Questionnaire (TFEQ) (Stunkard & Messick, 1985), and the Dutch Eating Behavior Questionnaire (DEBQ) (Van Strein et al., 1986), are some of the most prominently cited in the scientific literature.

The TFEQ consists of 51 items, which evaluate three dimensions of the eating behavior, being these: cognitive restraint, disinhibition, and hunger (Stunkard and Messick 1985).This questionnaire was subsequently modified by Karlsson and his colleagues (2000), who proposed a short version called the TFEQ-18, which comprises 18 only from the original 51 items and explores three dimensions of eating behavior through different scales: Cognitive Restraint (CR), referring to conscious limitation of food intake, Emotional Eating (EE) which refers to the influence of both positive and negative emotions over the way people eat, and finally Uncontrolled Eating (UE) which explores the tendency to consume large

amounts of food in a short period of time, which is usually accompanied by a loss of control over intake and feelings of guilt (Lauzon-Guillan et al., 2006). The TFEQ-18 was first applied to people with obesity, making it highly appreciated and frequently employed in the research endeavors addressing this problem (Hyland et al., 1989). In addition to showing acceptable psychometric properties (α = .70 and 0.73) in Greek (Kavazidou et al., 2012) and Persian population (Mostafavi et al., 2017).

The original TFEQ has been adapted in a community sample in Mexico, showing good internal consistency (α = .87) as well as concurrent validity, positively correlating with the EAT-40 (r = .58 - r = .62) and BULIT (r = .75) scales. Discriminant validity was determined by comparing groups with and without eating disorders, which supports its utility to identify pathological eating behaviors like eating restriction, binge eating and susceptibility to hunger among the general population (López-Aguilar et al., 2011). Nevertheless, there is no evidence available to date supporting its applicability in its 18-item version among Mexican patients formally diagnosed with clinical obesity. Thus, the aim of this study was to test the internal consistency and to validate the TFEQ-R18 in a clinical sample in Mexico.

## Method

### *Participants*

There was a showing of 292 Mexican adults who attended the Obesity and Eating Disorders Clinic from The National Institute of Medical Sciences and Nutrition Salvador Zubirán for treatment (other than bariatric surgery) of which 194 (66.4%) were women and 98 (33.6%) men, with an average age of 42.3±11.9 years.

**Table 1. Sociodemographic characteristics by sex.**

| Variable | All patients (n= 292) | Women (n=194) | Men (n=98) | p |
|---|---|---|---|---|
| Age | 42.3 (11.9) | 43.4(11.5) | 40.1(12.4) | .02 |
| BMI | 43.2(8.7) | 43.3(8.5) | 42.9(9.2) | .77 |
| Education | | | | |
| Elementary school | 40 (13.8%) | 30 (15.5%) | 10 (10.3%) | |
| High school | 109 (37.6%) | 76 (39.3%) | 33 (34%) | .19 |
| University or higher | 141 (48.6%) | 87 (45%) | 54 (55.6) | |
| Occupation[a] | | | | |
| Housewives | 69 (23.5%) | 69 (23.5%) | (0) | |
| Technicians and associate professionals | 49 (16.7%) | 30 (15.4%) | 19 (19.4%) | |
| Professionals | 45 (15.4%) | 28 (14.4%) | 17 (17.4) | |
| Service and sales workers | 31 (10.6%) | 18 (9.2%) | 13 (13.3%) | <.001 |
| Service workers | 26 (8.9%) | 12 (6.2%) | 14 (14.3%) | |
| Unemployed | 21 (7.2%) | 11 (5.6%) | 10 (10.2%) | |
| Students | 20 (6.8%) | 10 (5.1%) | 10 (10.2%) | |

*Note*. For age and BMI mean and standard deviation are presented, for the rest of the variables frequencies and proportions are presented.

[a] The remaining 11% of the sample is distributed among the following categories: Clerical support workers, Skilled agricultural, forestry, and fishery workers, Craft and related trades workers, Plant and machine operators, Elementary occupations and missing values.

The classification of obesity was made according to body mass index (BMI) and based on the official cut-off points established by the World Health Organization (WHO), with an average BMI of 43.2±8.7 kg/m$^2$. Regarding the classification of obesity, 33 (11.3%) participants had obesity class 1, 96 (32.9%) class 2 and, 163 (55.8%) class 3. Table 1 summarizes the sociodemographic variables.

## Measures

Three Factor Eating Questionnaire-R18. The TFEQ-R18, a shortened and revised version of the original 51-item TFEQ, is a self-assessment questionnaire developed to measure the cognitive and behavioral components of eating behavior (Stunkard & Messick, 1985). The Spanish version of the TFEQ-R18 (TFEQ-SP) was obtained by conducting a translation and back translation procedure, without any overlap across the members who performed the translation and the back translation processes (Jáuregui-Lobera, 2014). For the purposes of this study, this Spanish version was reviewed by a panel of experts to confirm the understanding of the items in Mexican population. The questionnaire refers to current dietary practice and explores three different aspects of eating behavior: restrained eating, uncontrolled eating, and emotional eating. The TFEQ-R18 consists of 18 items on a 4-point response scale where scores are as follows: 1 = definitely true, 2 = mostly true, 3 = mostly false, and 4 = 1 definitely false. Total scores are calculated for each dimension according with the following scores: cognitive restraint 6-24, uncontrolled eating 9-36, and emotional eating 3-12 (de Lauzon-Guillan et al., 2006).

Semi-structured Clinical Interview for DSM-5 developed and administered by the head psychiatrist of the Obesity and Eating Disorders Clinic. Current DSM-5 diagnoses of Binge Eating Disorder (BED), Night Eating Syndrome (NES) and the presence of Emotional Eating (EE) were determined by a trained psychiatrist. Criteria for full-threshold BED followed the guidelines provided in Appendix B of the DSM-5, and considered: a) binge-eating that occurred at least twice per week for the past 6 months long with distress response, b) three or more features associated with binge eating (e.g., eating more rapidly than normal, eating until uncomfortably full, eating large amounts of food when not physically hungry, eating alone because of feeling embarrassed about how much one is eating, and feeling disgusted, depressed, or guilty after eating), c) the absence of regular compensatory behaviors, and d) symptoms that were not better described by Anorexia Nervosa (AN) or Bulimia Nervosa (BN) (American Psychiatric Association, 2006). Diagnostic criteria for NES included: 1) recurrent episodes of night eating, as manifested by eating after awakening from sleep or by excessive food consumption following the evening meal, 2) awareness of those eating episodes, and 3) significant distress or impairment caused by the disorder. Exclusion criteria are binge-eating disorder or another mental disorder, as well as medical disorders or medication intake that might better explain the disordered eating pattern (American Psychiatric Association, 2013).

Body Mass Index (BMI). The height and weight of participants was recorded so that BMI could be determined. BMI was calculated by dividing the individual's weight in kilograms by their height in meters squared (BMI = kg/m$^2$).

## Procedure

The study protocol was approved by the Ethics in Research Committee of The National Institute of Medical Sciences and Nutrition Salvador Zubirán (INCMNSZ, Reference number: 1251). Before completing the TFEQ-R18, every patient signed an informed consent protocol as a requisite for participating in the study, after which they were handed out the instrument along with a section of general information attached. Each patient then completed the questionnaire individually before being assigned to the standard treatment offered by the institution. At all times there was a trained member of the personnel who facilitated assistance to tackle any questions or concerns for completion. Finally, all questionnaires were collected by the personnel.

## Statistical Analyses

To determining construct validity of the TFEQ-R18, confirmatory factor analysis (CFA) was performed based on the model proposed by Karlsson et al. (2000).

Considering the following parameters as good fit indices: non-significant values of $X^2$, Root Mean Square Error of Approximation (RMSEA) values smaller than .06; Comparative Fit Index (CFI) values equal or above 0.95; Tucker-Lewis coefficient (TLI) values above 0.9 and Root Mean Square Residual (RMR) coefficient smaller than .05 (Barret, 2007; Diamantopoulos & Siguaw, 2000; Hu & Bentler, 1999; Pituch & Stevens, 2016; Steiger & Lind, 1980).

Alpha and omega coefficients of reliability were then calculated for each dimension of the instrument and for the total scale, and correlation matrices among items were carefully analyzed seeking to keep both coefficients between 0.7 and 0.9 to avoid redundancy or very low correlations.

Convergent validity was obtained through Point biserial correlations given the categorical nature of the scales, between formal diagnosis of an eating disorder and the scores obtained by the TFEQ-R18.

To compare patients with and without eating disorder, U Mann-Whitney test for unpaired samples was performed. The associations between age and BMI as outcome variables with the absence or presence of an eating disorder were explored using Student t test. Descriptive data were finally obtained for TFEQ-R18.

## Results

After psychiatric screening, 102 of the patients were identify with some type of eating disorder, 59 (21.5%) of which had Binge eating disorder, 18 (6.6%) had Night eating syndrome, 24 (8.7%) patients met the criteria for both disorders, and one person (0.4%) was diagnosed with Bulimia Nervosa.

### *Confirmatory factor analysis*

Analysis including the original 18 items and three dimensions of eating behavior showed adequate goodness-of-fit indices, except for the $X^2$ ($X^2 = 274.5$, $df = 142$, $p < .001$; RMSEA = .061, CI [.051, .071]; CFI = .93; TLI = .92; SRMR = .071); the final model is presented in figure 1.

Figure 1 shows standardized β coefficients represented by straight arrows and standardized covariance coefficients between the three latent variables considered, represented by curved and bidirectional arrows. Both β coefficients and covariances were statistically significant (p <.001).

### *Internal consistency*

Alpha and omega coefficients were calculated for each dimension and for the total of the scale. According to these, the TFEQ-R18 has a good internal consistency over all with a global Cronbach´s Alpha of 0.88; whilst all dimensions showed the following coefficients: UE =.90 (good), EE =.91 (good) and finally the CR factor shows the least Cronbach´s alpha (.67) being categorized as questionable. Regarding McDonald's omega, global coefficient was good (w=.88), as well as all dimensions: UE =.90, EE =.86 and CR =.67.

### *Convergent validity.*

Point biserial correlations between the diagnosis of an eating disorder and the scores of the three dimensions of the Three Factor Eating Questionnaire-R18 (TFEQ-R18) were obtained. Table 1 shows that the UE and EE scales are positively correlated with the diagnosis of ED and the presence of emotional eating, being these findings statistically significant. The CR scale showed a rather low negative correlation with the diagnosis of ED, resulting this also significant.

**Table 2. Correlations between eating disorder diagnosis and the TFEQ-R18.**

| | Uncontrolled eating (UE) | Emotional eating (EE) | Cognitive restraint (CR) |
|---|---|---|---|
| Diagnosis of eating disorder (DED) | .51** | .39** | -.15* |
| Presence of emotional eating (PEE) | .42** | .55** | -.06 |

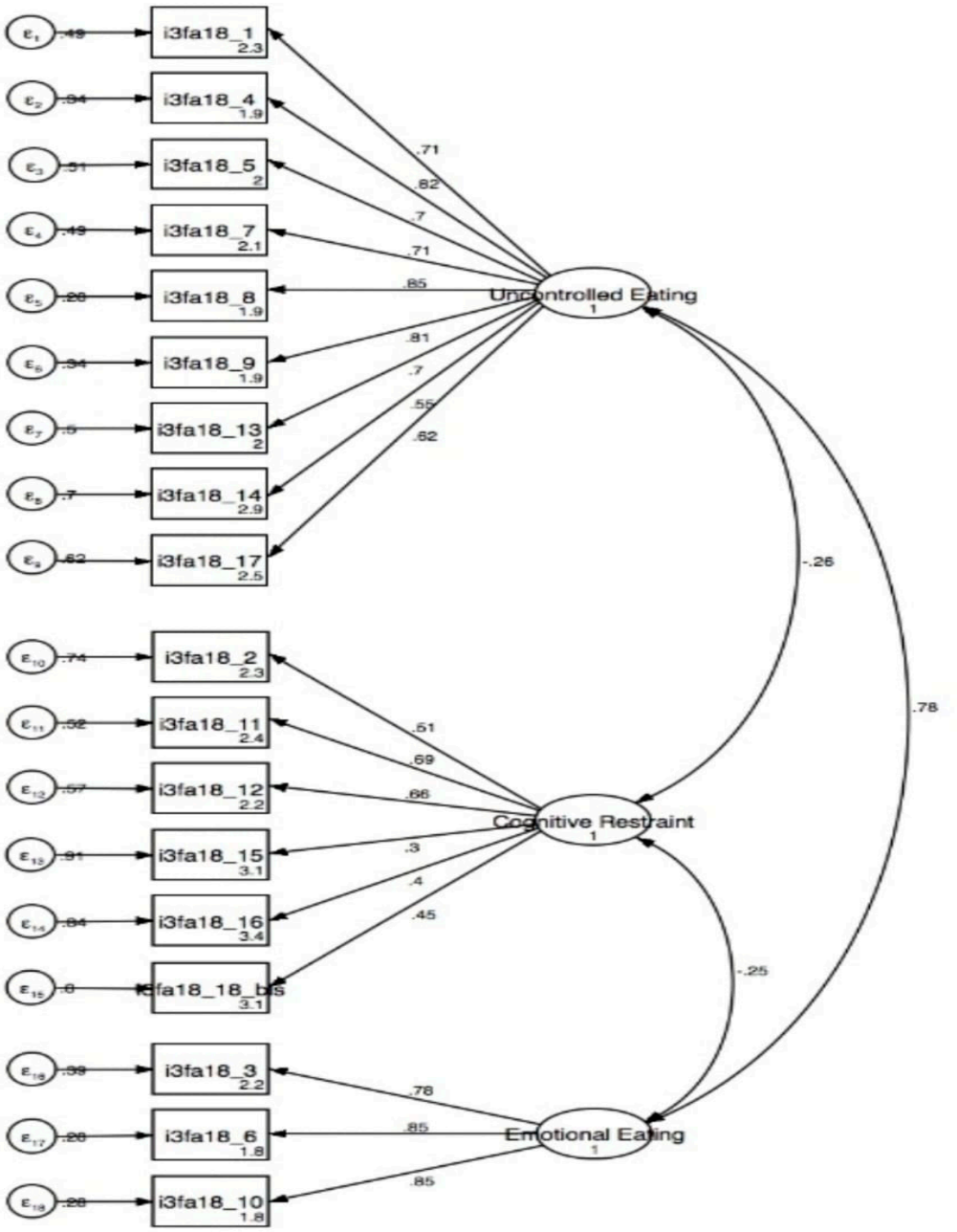
Note: Diagnosis of eating disorder included Binge eating disorder (BED), Night eating syndrome (NES) and Bulimia Nervosa (BN).

** Correlation is significant at the .001 level (2-tailed).

* Correlation is significant at the .05 level (2-tailed).

**Figure 1.**

**Confirmatory Factor Analysis based on the 18-item solution**




A comparative analysis was conducted between people with eating disorder diagnosis and people without eating disorder to explore differences in age, BMI, and the factors of TFEQ. Even when no differences were found in either age (p = .62) or BMI (p = .19), there were significant differences in the scores of the scale. Table 3 shows that the scores of people with Diagnosis of eating disorder are lower in cognitive restraint, and higher in uncontrolled eating an emotional eating.

Finally, descriptive data for each dimension of the scale were obtained (Table 4).

**Table 3. Comparisons between the scores of the TFEQ-R18 and the diagnosis of eating disorders.**

| | Patients with Eating Disorder (n = 102) | Patients without Eating Disorder (n = 172) | Rosenthal's R | P value |
|---|---|---|---|---|
| Age | 42.1 ± 11 | 42.8 ± 12.3 | -- | .62 |
| BMI | 44.1 ± 8.8 | 42.7 ± 8.6 | -- | .19 |
| Cognitive Restraint (CR) | 15 (12-16) | 16 (13-18) | 0.14 | .01 |
| Uncontrolled eating (UE) | 24 (20-29) | 16 (12-20) | -0.51 | <.001 |
| Emotional eating (EE) | 9 (6-11) | 5 (3-7) | -0.39 | <.001 |

**Table 4. Global scores of Three Factor Eating Questionnaire-R18 (TFEQ-R18) Scale (N = 292)**

| Factor | Median | (min - max) | Percentile 25, 75 |
|---|---|---|---|
| Cognitive restraint | 15 | (12 - 17) | 6, 24 |
| Uncontrolled eating | 18 | (9 - 35) | 14, 24 |
| Emotional eating | 6 | (3 - 12) | 4, 9 |

## Discussion

The objective of the study was to obtain the psychometric properties of the TFEQ-R18 in patients with obesity. The results showed that the TFEQ- R18 is adequate for measuring three dimensions of eating behavior in patients with obesity.

The analysis of the data showed that the TFEQ-R18 presented an adequate internal consistency (global α =.88), in contrast with other studies that have found lower values (α = .70 and .73) (Kavazidou et al., 2012; Mostafavi et al., 2017).

The coefficients for uncontrolled eating and emotional eating were good and higher than those obtained by other studies (de Lauzon et al., 2006; Karlsson et al., 2000; Wrzecionkowska & Rivera, 2021). The cognitive restraint factor showed the lowest Cronbach´s alpha, which is consistent with previous findings obtained in people with obesity (Karlsson et al., 2000), as well as in Finnish general population (Anglé et al., 2009), and Mexican adults with both normal weight and overweight (Wrzecionkowska & Rivera, 2021). In all these studies, two items were excluded from the original cognitive restraint dimension due to the low correlations among items.

These findings could be explained by the fact that some patients responded inconsistently to the questions exploring cognitive restriction regarding intake reduction. It is important to mention that it is difficult to assess cognitive restraint through self-reported scales in the absence of a direct behavioral measure of food-intake restriction (van Strien et al., 2006). Additionally, cognitive restraint as a one-dimensional factor has been questioned given that in reality, the construct itself seems to be comprised by two components, *flexible* and *rigid cognitive restraint* characterized by an "all-or-nothing" approach, even when for analysis purposes all items are usually considered as a whole. It is possible that items comprising this factor should be better analyzed separately (Karlsson et al., 2000; Meule et al., 2011).

In our study, correlations between the eating disorder diagnosis of the psychiatric interview and the TFEQ-R18 showed a positive correlation with the UE and EE scales.

Originally, uncontrolled eating and emotional eating factor were considered as part of a wider construct named *desinhibition* which, according to some studies, correlated positively with compulsive overeating and binge eating (Adami et al., 1996; Foster et al., 1998). The association of uncontrolled eating and emotional eating with the diagnosis of eating disorders provides evidence of the criterion validity of both dimensions and emphasizes the heterogeneity of the patients with obesity, who tend to exhibit eating

regulation disturbances, specially observed in people with binge eating and night eating syndrome.

Regarding the negative correlation found between cognitive restraint and the presence of an eating disorder, a review by Johnson et al. (2012) reports contradictory findings, which could be explained by the adoption of different methodologies, measures and studied populations.

Restrained eating is different from disordered eating; but restraint has become a marker for disordered eating (Stice, 2002; Polivy and Herman, 2002) and it is known that cognitive restraint induces overeating after caloric preload but only in cases when both cognitive restraint and disinhibition scores are very high (Van Strien, 2000); this is consistent with our findings, where it is observed that all three dimensions showed scores higher that the scale median.

Apfeldorfer & Zermati (2001) mentioned that the "theory of cognitive restriction" consider that restrictive diets to lose weight produce a state of cognitive restriction. In this way, the individual ends up organizing his eating behavior around his fear of failure, frustration or guilt and problems in the comforting pattern (pleasure).

According to Meule et al. (2011) high cognitive restraint in its rigid form seems to be associated with overeating behavior.

The TFEQ-R18 showed adequate criterion validity with the psychiatric diagnosis, which suggests that the three factors of the questionnaire converge with the eating behavior of the patients.

Currently, there are no studies that establish the accuracy of the TFEQ compared to a psychiatric clinical interview for diagnostic purposes, which constitutes a discriminant validity measure of the instrument. It is known that no questionnaire to date results sufficient for establishing a formal diagnosis; nevertheless, in the absence of one, the TFEQ-R18 can be well used to discriminate people with eating disorder from those who doesn't have this problem.

Among the available instruments assessing eating behaviors in representative samples, the Eating Attitudes Test (EAT), Eating Disorder Inventory (EDI), Questionnaire of Eating and Weight Patterns Revised (QEWP-R) and Eating Disorder Examination-self-report questionnaire (EDE-Q) have proven to be valid and reliable (Iñárritu-Pérez et al., 2004); however, none of them have tested their validity through a formal diagnostic given by a professional. Hence, the main strength of this study constitutes the inclusion of the diagnosis of an eating disorder provided by a trained psychiatrist as a gold standard, supporting the questionnaire scores as a criterion validity measure. Also, we sought to complement the findings by including various measures of reliability and validity, seeking internal consistency and construct validity.

This study comprises some limitations; while our study was conducted in a clinical setting, our results may not apply to the general population given that our sample only includes people with obesity that sought treatment (other than bariatric surgery), and therefore cannot be compared to overweight individuals in general, people with average weight, or people with obesity not interested in losing weight or seeking treatment. Due to such selection biases, sociodemographic variables like sex were not equally distributed causing group comparisons to be non-equivalent. Nonetheless, differences among sex in each factor: cognitive restraint, uncontrolled eating and emotional eating were explored, yielding only significant differences in emotional eating. Since comparisons by sex were not equivalent and differences were found only in one dimension, final analysis included both men and women, yielding a model with adequate fit indexes. Still, differences regarding emotional eating between men and women should be further explored in more detail. Therefore, our results can only be applied to people with the aforementioned characteristics.

Finally, even when men and women were different in mean age, the lack of association between age and the presence of an eating disorder downplay the initial finding.

## Conclusion

In conclusion, the TFEQ-R18, allows a more adequate evaluation of the three eating factors, thus being a useful tool in the psychological approach of patients with obesity and which in turn allows a differentiation between cases with or without eating disorders.

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