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Original Article

# Structure validity of the Three-Factor Eating Questionnaire-R18 in Greek population

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**ABSTRACT**

Kavazidou E, Proios M, Liolios I, Doganis G, Petrou K, Tsatsoulis A, Tsiligiroglou-Fachantidou A. Structure validity of the Three-Factor Eating Questionnaire-R18 in Greek population. *J. Hum. Sport Exerc.* Vol. 7, No. 1, pp. 218-226, 2012. The aim of the present study was to examine the factor structure of the TFEQ-R18. The project was conducted in Greek population; thus, the questionnaire was translated in Greek language. 495 males and females aged between 12-45 years old participated in the present study. There were used a series of CFA techniques for structure analysis. Confirmatory and exploratory analyses were conducted. Several criteria were used to test the hypotheses factor structures of the AIMS. The results of CFA's showed that the R-18 item instrument had adequate psychometric properties for measuring three dimensions of eating behavior of the Greek population However these results \revealed that an R-16 item instrument was better adapted to the Greek population. The present study provided encouraging preliminary evidence supporting selected psychometric properties of the TFEQ-R18. This instrument seems to be a valid measure of the tendencies of cognitive restraint, uncontrolled eating and emotional eating of Greek population. **Key words**: TFEQ-R18, QUESTIONNAIRE, EATING BEHAVIOR, FACTOR STRUCTURE, GREEK POPULATION.

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## INTRODUCTION

Modern evidence confirms that among normal, obese and eating disordered populations different eating behavior patterns are expressed. These are consistent with restraint theory, purge opportunity and the forbidden foods hypothesis (Maus et al., 1988; Guertin, 1999).

There are different viewpoints concerning the methodology and the concept of evaluating psychological parameters of eating attitudes. As a result, several questionnaires have been developed and validated so as to examine eating behaviors (Karlsson et al., 2000; Belissle, 2009).

The most reliable questionnaires are the "Three Factor Eating Questionnaire (TFEQ)", "Dutch Eating Behavior Questionnaire (DEBQ)" and "Restraint Scale (RS)" instruments. These instruments differ in the sense that TFEQ and RS or DEBQ and RS do not show strong relevance. Whereas TFEQ and DEBQ seem to be strongly related (Herman & Polivy, 1975; Stunkard & Messick, 1985; Van Strien et al., 1986; Belissle, 2009).

TFEQ and DEBQ have been frequently used and adapted to different populations (Hyland et al., 1989; Van Strien & Oosterveld, 2008; Bellisle, 2009). TFEQ has been studied much further in comparison to the other two questionnaires and has been adapted to normal & clinical population, to different age-groups, nations and cultures (Stunkard & Messick, 1985; French & Jeffery, 1994; Shearin et al., 1994; Karlsson et al., 2000; Atlas et al., 2002; De Lauzon et al., 2004; Bardone-Cone & Boyd, 2007; Bas et al., 2008; Yeomans et al., 2008; Bas & Donmez, 2009). It focuses in psychological factors of eating behavior that influence the development and clinical expression of body adiposity and the status of dietary habits (Wagenknecht et al., 2007). TFEQ continues to be widely used (Belissle, 2009).

The first version of "Three Factor Eating Questionnaire", also known as Eating Inventory, or Stunkard-Messick Eating Questionnaire (SMEQ) was constructed in 1985 to measure three dimensions of human eating behavior in English population, with cognitive and behavioral components (Stunkard & Messick, 1985; Hyland et al., 1989; Wagenknecht et al, 1999). It is a 51-item self-assessment questionnaire, splited to 3 subscales: a 21-item dietary restraint scale (TFEQ-R), a 16-item dietary disinhibition scale (TFEQ-D) and a 14-item hunger scale (TFEQ-H). The instrument contains 36 items with a yes=no response format, 14 items on a 1 - 4 response scale and one vertical rating (Karlsson et al., 2000).

TFEQ has been validated for normal adult population (Hyland et al., 1989), adolescents (Simmons at al., 2002) and different race populations (Bardone-Cone & Boyd, 2004). It has been translated in many languages, as English, French, Swedish, German, Dutch, Czech, Turkish and Finnish (Stunkard & Messick, 1985; Westerterp-Plantenga et al., 1999; Karlsson et al., 2000; De Lauzon et al., 2004; Wagenknecht et al., 2007; Keskitalo et al., 2008; Bas et al., 2008; Belissle, 2009).

By examining the factor structure of TFEQ and making cross-correlations with DEBQ and RS questionnaires, Karlsson et al. (2000) concluded in construction and discrimination weaknesses, in terms of validity of the TFEQ questionnaire and supported the idea of revising this instrument for enhancing its usefulness. They proposed a new shorter scale, revised by an 18-item questionnaire with 3 subscales. They suggested a revised version of TFEQ, where "Disinhibition" and "Hunger" scales were grouped in one single subscale, labeled as "Uncontrolled Eating" (UE) including 9 questions. The "Cognitive Restraint" Scale (CR) was shortened to 6 subscales and a third subscale was added containing 3 items labeled as "Emotional Eating" (EE) concerning feelings of loneliness, desolation, melancholy and anxiety. Karlsson et

 

al. (2000), support that the revised instrument is a more reliable and flexible tool, appropriate for multivariation and large scale studies.

To this day, studies that have examined the factor structure of the TFEQ-R18 have been based mostly on multitrait/multi-item scaling analysis excluding factor analysis (exploratory and confirmatory analysis), examining only the relation of items for every scale separately and not the possible relation of a scale item to other scale items.

There seems to be an exception in a new study which used the exploratory factor analysis, supporting the factor structure of the TFEQ-R18 (Angle et al., 2009). Nevertheless the confirmatory analysis has been omitted from this study as well, the most appropriate in this case as there exists a priori knowledge of the number of factors (Stevens, 1996). The absence of factor analysis in examining the factor structure of the TFEQ-R18, demonstrates the significance of this present study which makes use of the above analyses.

According to de Lauzon et al. (2004) psychometric analysis of the TFEQ-R18 has shown that the items of each subscale exceed the minimum desired level for items' convergent validity ($r \geq 0.40$, corrected for overlap). Correlations between cognitive restraint items and the other 2 scales are low ($r < 0.35$) and therefore all cognitive restraint items succeed in the discriminant validity test. Cronbach α for each of the 3 subscales is above 0.70 and below 0.90, as recommended for individual assessment. These coefficients are similar to those found in the study of Karlsson et al. (2000), applied in Swedish obese population.

In the present research the revised version of TFEQ was selected to be translated in Greek language, while a) TFEQ seems to be more flexible instrument among different cultures and societies and b) the revised version boosts both the convergent and discriminant validity of the primary version (51-items) and moreover is a practical tool for multivariate researches (Westerterp-Plantenga et al., 1999; Karlsson et al., 2000; De Lauzon et al., 2004; Bas & Donmez, 2008). The purpose of the present study was to examine the factor structure of the TFEQ-R18.

## MATERIAL AND METHODS

*Participants*

In the present study, 495 males and females aged between 12-45 years old participated. Out of the 495 individuals who agreed to participate in the study, 13 individuals were excluded from the final analysis because of many missing data in questionnaires' items. 278 of them were students from the Aristotle University of Thessaloniki (M = 22.5, SD = 2.778) and 204 were pupils from Ioannina's Technical Schools of Secondary Education (M = 17.77, SD = 6.154). They were orally informed about the aim of the present study and consent was solicited from them. The questionnaires were distributed twice, in a period of 2 weeks. The questionnaire completion lasted between 15-20 minutes.

*Three-factor Eating Questionnaire-R18*

A Greek version of the TFEQ-R18 was used to the present study. The questionnaire was translated from English to Greek by a Native American teacher of English Language in Greece. A second translation from Greek to English followed, made by a Greek teacher of English language. The two English questionnaires were compared and corrections were made in cooperation with the 2 teachers. A pilot study followed, with 24 participants, which were asked to make verbal comments concerning the understanding of the questionnaire's content. They reported an ease in completing the questionnaire, while no clarifications were needed.

TFEQ-R18 refers to current dietary practice and assesses 3 different aspects of eating behaviour: restrained eating (conscious restriction of food intake in order to control body weight or to promote weight loss), uncontrolled eating (tendency to eat more than usual due to a loss of control over intake accompanied by subjective feelings of hunger), and emotional eating (inability to resist emotional cues). It is consisted of 18 items, where 9 concern uncontrolled eating, 6 restrained eating and 3 emotional eating. It responds to a 1 to 4 score system and total scores range between 18 and 72 points. As higher the score the more depended to cognition, stress or emotion the eating patterns appear.

***Data Analysis***

Our goal in the current study was to use CFA techniques to examine the structure of the TFEQ-R18. Nonetheless previous research results have shown that the Cognitive Restraint factor tends to split up in two or several components (Allison et al., 1992; Karlsson et al., 2000; Ricciardelli & Williams, 1997). All these have prompted us to examine this subject matter. For this reason an exploratory factor analysis (EFA) was computed using the varimax procedure on SPSS 15.0. One such analysis is designed when the correlation between the observed and latent variables is uncertain (Byrne, 2001).

Concerning the models, these were tested using confirmatory factor analyses with maximum likelihood (ML) parameter estimates in AMOS 5.0 (Arbuckle, 2003). CFAs were applied because there was a priori knowledge of the number of factors at the initial stages of the questionnaire development (Stevens, 1996). The sample size in this study was adequate to estimate the various models based on criterion, the ratio of the total sample size to the number of freely estimated parameters should be greater than 10:1 and approximating 20:1 (Kline, 2005).

Several criteria were used to test the hypotheses factor structures of the AIMS. The traditional measure of fit for CFAs models is the x2 goodness of fit test statistic. Non-significant values suggest a good fit, since they indicate only a minor discrepancy between the observed and the estimated covariance matrix. However, there is now general agreement that the x2 statistic is sensitive to sample size and violations of multivariate normality (Bollen & Long, 1992). The comparative fit index (CFI) and goodness-of-fit index (GFI) are two indexes that values greater than roughly 0.90 may indicate reasonably good fit of the researcher's model (Hu & Bentler, 1999).

In addition, the root mean square error of approximation (RMSEA) is included here as a measure of fit. The RMSEA ≤ 0.05 indicates close approximate fit; values between .05 and .08 suggest reasonable error of approximation and RMSEA ≥ 0.10 suggests poor fit (Brown & Cudeck, 1993).

## RESULTS

Pre-analysis tests for the suitability of this data set for factor analysis were computed as recommended by Comrey (1978) The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.86 and the Bartlett test of sphericity was significant at $p<0.001$, indicating the suitability of this data for factor analytic procedures. The ratio in these cases was 482:18 or 26.8:1, covering the preconditions determined by some factor analysts (e.g., Gorsuch, 1983; Nunnally, 1978).

An initially factor analysis without iteration was computed. The Scree Test (Cattell, 1966) indicated a four-factor solution. All factors held eigenvalues greater than unity (Cattell, 1978) whilst this four-factor solution accounted for the 55.09 per cent of the total variance. A further analysis was thus computed, reducing the number of factors to four by means of interaction and rotation (18-items varimax and oblique). Items with a

 

loading more than 0.40 were considered to load one factor (Hikin, 1995). Both varimax and oblique rotations produced the same solution that appeared to represent the four-factor accounted for 55.09 per cent of the total variance. This was not the predicted solution for this study. The newfound factor came up from the separation of the Cognitive Restraint into two different subfactors. There was a high correlation between the two subfactors.

The internal consistency estimate (alpha reliability) in this study was computed separately for the three subscales of the TFEQ-R18 (Cronbach, 1951). All scales had an alpha above or very close to the recommended criterion of 0.70, except of the new factor, which had an alpha of 0.41.

The AMOS program was used to test whether the data fit to each model (Arbuckle, 2003). Values of goodness-of fit indices for CFAs of (a) a correlated three-factor model (Mc), (b) an uncorrelated three-factor model, and (c) a correlated four-factor model are shown below (Table 1).

***Table** 1. Goodness of fit for the TFEQ-R18 in the Greek population.*

| Models | $X^2$ | *df* | GFI | CFI | RMSEA |
|---|---|---|---|---|---|
| *Four-factor model 1:* R-18 correl. | 301.10 | 129 | 0.936 | 0.933 | 0.053 |
| *Three-factor model 2*: R-18 correl. | 315.35* | 132 | 0.932 | 0.929 | 0.054 |
| *Three-factor model 3*: R-18 uncorrel. | 500.04* | 135 | 0.902 | 0.858 | 0.075 |
| *Three-factor model 4*: R-17 correl. | 269.25* | 116 | 0.939 | 0.939 | 0.052 |
| *Three- factor model 5*: R-16 correl. | 238.44* | 101 | 0.943 | 0.944 | 0.053 |

*Note: *p<0.01, GFI= goodness-of-fit index, CFI= comparative fit index, RMSEA=root mean square error of approximation.*

Primarily the indices of the new four-factor model being revealed in this study were examined. This model has been found to have acceptable indices appropriateness (RMSEA=0.053; GFI=0.936; CFI=0.933). Thereinafter the multiple fit indices were examined on the second model which revealed that RMSEA was 0.054, indicating a good model fit, just like the CFI (0.929) and GFI (0.932). In contrast, the third model (Mu) indicated a poor fitting model. In additional all fit indexes regarding the two-factor model with correlated latent factors (Model 2) indicated there was room for model improvement. If the model is correct, it is expected that the absolute value of most standardized covariance of residuals will be less than two (Arbuckle, 1997). Inspection of the standardized residual covariances matrix revealed that two observed variables “cognitive restraint 4” and “uncontrolled eating 8” yielded values well above two on many occasions. These large values indicate that the two variables are not being well explained by the proposed model (Bentler, 1995).

Thus, the analysis was repeated excluding initially the item "(15) How frequently do you avoid 'stocking up' on tempting foods?" (model 4) and in continuity the item "(14) How often do you feel hungry" (model 5). Although the chi-square value was significant, all fit indices indicated satisfactory fit of both models, with model 5 developing a greater improvement in conformity indices. The estimated alpha coefficients of the cognitive restraint, uncontrolled eating and emotional eating was 0.76, 0.83 and 0.83, respectively. An association emerged between the emotion eating and uncontrolled eating ($r= 0.52$, $p<0.01$) and cognitive restraint ($r= 0.21$, $p<0.01$).

## DISCUSSION

This study objective was to examine the structural validity of the Three-Factor Eating Questionnaire-R18 on Greek population. The results showed that the R-18 item instrument had adequate psychometric properties for measuring three dimensions of eating behavior of the Greek population. However these results revealed that an R-16 item instrument was better adapted to the Greek population.

Even though we originally intended the use of the confirmatory analysis alone for the three-factor solution of the R-18 instrument, previous references have led us to firstly use an exploratory factor analysis. The results of the EFA were not supportive of the three-factor solution of the TFEQ-R18 (e.g., Angle et al., 2009; de Lauzon et al., 2004; Karlsson et al., 2000). These revealed items 15 and 16 of the cognitive restraint factor charging on a different agent and by that suggesting a four-factor solution. This outcome reinforces the assertion that Cognitive restraint factor tends to split up in two in two or several components (Allison at al., 1992; Ricciardelli & Williams, 1997). The newly-found factors which have arisen from the cognitive restraint scale separation were found strongly correlated. There was a reference of a similar result in a previous study. Karlsson's colleagues claimed that when items correlate intensely they cannot be included in scales of different meanings.

The confirmatory analysis' results have nonetheless confirmed the previous result revealing the existence of another solution (of the four-factor) concerning the eating behavior study of the Greek population. However, the outcome of the low internal consequence of the fourth factor in this study casts a shadow over the fourth factor model appropriateness.

In contrast this study results support that the TFEQ-R18 is a valid and reliable instrument (Angle et al., 2009; De Lauzon, 2004; Karlsson at al., 2000). Nevertheless, in the item-scale correlation of items study for every scale separately, item 15 was strongly evident whereas item 16 of cognitive restraint scale was found inferior. A resembling reference on item 15 particularly, has been previously made (de Lauzon et al., 2004). Moreover, items 15 and 16 proved defective due to the standardized residual covariances matrix screening.

Up to date evidence factor analysis (exploratory and confirmatory analysis) related to the factor structure of the TFEQ-R18 is limited. It seems reasonable to assume that the structure of the TFEQ-R18, has acted similarly suggesting the instrument valid despite the slight modification of two of the eighteen items.

 

## CONCLUSIONS

The present study provided encouraging preliminary evidence supporting selected psychometric properties of the Three-Factor Eating Questionnaire R-18. Additionally, TFEQ-R18 is favored to be a psychometrically sound and valid measure of the tendencies of cognitive restraint, uncontrolled eating and emotional eating of Greek population.

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