Published in final edited form as:

Appetite. 2012 October ; 59(2): 610–615. doi:10.1016/j.appet.2012.04.005.

Factor structure of the Emotional Eating Scale in overweight and obese adults seeking treatment ☆

E.M. Goldbacher^{a,*}, H.E. Grunwald^c, C.A. LaGrotte^{a,1}, A.A. Klotz^b, T.L. Oliver^b, K.L. Musliner^b, S.S. VanderVeur^b, and G.D. Foster^b

^aDepartment of Psychology, La Salle University, 1900 W. Olney Ave., Philadelphia, PA 19141, United States

^bCenter for Obesity Research and Education, Temple University, 3223 N. Broad St., Philadelphia, PA 19140, United States

^cInstitute for Survey Research, Temple University, 1509 Cecil B. Moore Avenue, Suite 401 ECEC, Philadelphia, PA 19121, United States

Abstract

The purpose of this study was to examine the factor structure and anthropometric correlates of the Emotional Eating Scale in overweight and obese adults presenting for weight loss. Participants were 217 men and women with a mean body-mass index of 33.1 (± 3.4) kg/m². Results indicated a four factor structure: depression, anger, anxiety, and somatic arousal. These factors demonstrated strong internal consistency, and together accounted for approximately 60% of the total variance. Women had significantly higher depression and total scores than did men. There were no significant correlations between the Emotional Eating Scale scores and anthropometric measures. This work begins to add to the literature base regarding the applicability of the original design of the Emotional Eating Scale for samples consisting of men and African Americans.

Keywords

Emotional eating; Weight; Obesity; African American

Introduction

Obesity is a heterogeneous condition both in terms of etiological factors (Marcus & Wildes, 2009) and treatment response (Foreyt & Goodrick, 1993). Over 30% of Americans are obese, with even higher rates of obesity present among African-Americans, with statistically significant increases in prevalence rates among African-American women (e.g., Flegal, Carroll, Ogden, & Curtin, 2012). Emotional eating, defined as “eating in response to a range of negative emotions” (Arnow, Kenardy, & Agras, 1995), is a potential contributor to individual differences in body weight. Individuals high in emotional eating exhibit a pattern of responding to emotional distress with increased appetite and food intake, especially for sweet and high-fat foods (Konttinen, Mannisto, Sarlio-Lahteenkorva, Silventoinen, & Haukka, 2010; Macht, 2008; van Strien & Ouwens, 2003). Compared to healthy weight individuals, overweight individuals report greater levels of emotional eating (Fitzgibbon,

☆This study was supported by NIH F32 DK083910.

© 2012 Elsevier Ltd. All rights reserved.

*Corresponding author. goldbacher@lasalle.edu (E.M. Goldbacher).

¹These data were collected when EG was a post-doctoral fellow and CL was a project coordinator at Temple University.

Stolley, & Kirschenbaum, 1993; Geliebter & Aversa, 2003; Horschner, Tuinebreijer, & Kelder, 2002), and increased urges to eat in response to negative emotions (Burton, Smit, & Lightowler, 2007; Geliebter & Aversa, 2003; Macht & Simons, 2000). Moreover, some studies have shown that emotional eating was associated with higher body mass index (BMI) and obesity (Ganley, 1989; Konttinen, Haukkala, Sarlio-Lahteenkorva, Silventoinen, & Jousilahti, 2009; Ozier et al., 2008; Waller & Osman, 1998), particularly in women (Keski-Rahkonen et al., 2007; Lluch, Herbeth, Mejean, & Siest, 2000; van Strien, Frijters, Roosen, Knuiman-Hijl, & Defares, 1985), although others have failed to find significant cross-sectional associations (Fischer et al., 2007; Ricca et al., 2010). Finally, reductions in emotional eating were associated with greater weight loss in overweight women (Teixeira et al., 2010). These findings suggest that emotional eating is an important phenotype to identify and assess in Caucasian and African-American obese treatment seekers.

There are currently several self-report instruments to measure emotional eating, although no single measure is used consistently across studies (e.g., Ganley, 1988; Masheb & Grilo, 2006; Stunkard & Messick, 1985; van Strien, 2006). However, these measures assess a limited range of emotions or mood states, or only ask about binge eating episodes. The Emotional Eating Scale (EES; Arnou et al., 1995) measures the urge to eat in response to a wide range of emotions that factor into three distinct affective states: anger/frustration, anxiety and depression. The EES, one of the most frequently used measures of emotional eating, has been shown to demonstrate adequate reliability and validity in overweight binge eaters (Arnou et al., 1995; Ricca et al., 2009), as well as good validity in non-eating-disordered normal weight, overweight, and obese individuals (Ricca et al., 2009; Waller & Osman, 1998). Despite the potential utility of the EES for evaluating emotional eating across a variety of overweight and obese samples, the factor structure has been estimated solely from relatively small samples ($Ns = 51$) of overweight binge eating (Arnou et al., 1995) and normal weight (Waller & Osman, 1998) women whose ethnicity was not reported. Although symptoms of aberrant eating have similar prevalence rates in African American and Caucasian individuals (e.g., Reagan & Hersch, 2005), there is a relative dearth of information regarding the validity of measures of emotional eating in samples consisting of African Americans.

The purpose of the current investigation was to examine the factor structure of the EES and its correlation with anthropometric measures in overweight and obese men and women (approximately 45% African American) presenting for weight loss treatment. Specifically, we aimed to: (1) describe the univariate descriptive statistics of the EES total and original subscale scores; (2) examine whether results obtained on the EES from the current sample would reduce into a similar factor structure (i.e., anger/frustration, anxiety, and depression) as in previous reports (Arnou et al., 1995; Waller & Osman, 1998); (3) report descriptive data for new factor structure scores derived in the current sample; and (4) examine associations of these new factor structure scores with the anthropometric and demographic measures.

Methods

Study design

Data for this study were obtained as part of the initial, face-to-face screening of potential participants in an internet-based weight loss study at Temple University's Center for Obesity Research and Education. Following written informed consent, participants completed a demographics form, the EES, and anthropometric measures, as described below. As the EES was administered only during the face-to-face screening evaluation, no follow-up data are available. This study was approved by Temple University's Institutional Review Board.

Participants

Participants were 217 consecutive treatment-seeking overweight and obese (BMI = 25–40 kg/m²) adults (approximately 80% female) presenting for participation in an internet-based weight loss trial. Participants were recruited from the local area via newspaper advertisements, fliers, and clinic referrals. A total of 2896 individuals were screened via phone to determine if they met basic inclusion criteria for the weight loss trial (i.e., absence of any significant medical conditions, abstinence from tobacco use, no weight loss greater than 10 pounds over the previous three months, and ability to be physically active). Out of the 2,896 calls, 440 individuals were eligible to be scheduled for the face-to-face screening evaluation. Of those 440 eligible participants, 232 consecutive individuals presented for the face-to-face evaluation, during which the EES was administered. Individuals were excluded if they reported behaviors consistent with BED (i.e., consuming unusually large amounts of food in a short period of time; experiencing a loss of control over eating) in the face-to-face interview. Of the 232 consecutive individuals, 15 were excluded for incomplete data on the EES ($n = 12$) or weight ($n = 2$), and one was excluded based on a BMI > 40; none were excluded for BED.

Measures

The Emotional Eating Scale—The EES is a 25-item self-report measure designed to assess the urge to eat in response to a variety of negative emotions (e.g., resentful, uneasy, bored; Arnow et al., 1995). It has three subscales, measuring eating in response to: (1) anger/frustration; (2) depression; and (3) anxiety. Items are scored on a 5-point Likert-type scale that assesses the urge to eat in response to each emotion (i.e., no desire, small desire, moderate desire, strong urge, and an overwhelming urge). Higher scores indicate a greater urge to eat in response to emotions. The EES has demonstrated good internal consistency, construct validity, and discriminant validity in overweight and obese binge eating and normal weight nonclinical samples (Arnow et al., 1995; Ricca et al., 2009; Waller & Osman, 1998). However, no information is available regarding the factor structure of this scale when administered to men and women from multiple races (e.g., Caucasian and African American) who are not exclusively selected for binge eating.

Physical measures

Height and weight were measured as previously described (Foster et al., 2010) using calibrated scales and wall-mounted stadiometers. Waist circumference was measured in centimeters using a standard tape measure (Gulick II; Country Technology, Gays Mills, WI). Participants remained standing while the measuring tape was placed in a horizontal plane around the abdomen at the midpoint between the highest point of the iliac crest and the lowest part of the costal margin in the themed-axillary line. Three measurements were taken, with the final value representing the average of those three measurements.

Statistical analysis

Data from the EES were first scored on the original subscales (Arnow et al., 1995) to provide information about the distribution of these scores in the current sample. Scores were calculated for the original anger/frustration, anxiety and depression subscales as well as the total, as originally determined by Arnow et al. Next, to determine whether the EES items for the current sample would be reduced into factors that were similar to the original factors, all items in the EES were subjected to a principal components analysis (PCA) with an orthogonal rotation, to most closely replicate the previous factor analyses conducted with this scale (Arnow et al., 1995; Waller & Osman, 1998), maintain independence of the factors and reduce multi-collinearity. In addition to replicating analytical procedures in previous studies, the new factors were used in subsequent analyses to explore race and

gender differences in new factor scores and examine associations with anthropometric measures.

Data were examined for univariate outliers and deviations from normality. Descriptive statistics indicated the data were appropriate for a principal component analysis. Three criteria were used to determine the number of factors to retain: (1) retaining factors with eigenvalues greater than one; (2) examination of the scree plot (Dunteman, 1989; Jolliffe, 1986); and (3) examination of the resultant factors for interpretability and face validity. Once factors were initially identified, a reliability analysis was conducted using Cronbach's alpha to test whether or not reliability would increase if any of the individual variables were eliminated from the factors. Final factors were constructed as additive linear indices where variables with factor loadings greater than or equal to 0.30 were retained. This is a commonly used cut-off for including variables in factors. (Guttman, 1953; Kaiser, 1974). In cases where variables cross-loaded on multiple factors, they were included in the factor on which they had the greatest face validity.

Once new factor scores were calculated, Pearson's correlation coefficients were calculated to assess associations of the revised EES subscales (latent factor structures) and total scores with BMI and WC. *t*-Tests and ANOVAs were employed to examine gender and race differences (respectively) in total and new subscale scores on the EES. All tests were two-tailed.

Results

Data screening

Histograms of the EES items and subscales did not demonstrate any deviations from normality.

Sample characteristics and original EES subscales

Descriptive statistics for demographic characteristics and anthropometric measures are presented in Table 1. The mean age of the sample was 43.1 years ($SD = 11.0$, range = 18–63). Approximately 45% ($n = 97$) were African American, and approximately 43% ($n = 94$) were Caucasian; data for race were missing for two participants. The mean BMI was 33.1 kg/m^2 ($SD = 3.4$), and the mean WC was 105.0 cm ($SD = 10.3$); data for WC were missing for four participants. The mean (SD) scores for the EES subscales and total scale were: anger/frustration, 10.2 (8.7); anxiety, 9.4 (7.1); depression, 7.9 (4.5); and total, 27.4 (18.2).

Principal components analysis of sample data

Visual inspection of the correlation matrix, Bartlett's test of sphericity and the KMO index suggest that the data were appropriate for data reduction techniques (Dziuban & Shirkey, 1974). All original items were retained for the principal components analysis (PCA). In the first attempt at a PCA of the data, four factors had eigenvalues greater than 1. Conceptually, we named these factors depression, anger, anxiety, and somatic arousal. Together, these factors accounted for 59.7% of the total variance in the sample data; these factors were also supported by examining the scree plot. The resulting factor structure is presented in Table 2. Two items cross-loaded on two factors, with loadings of 0.4 and 0.6. The item "sad" had a primary loading on anxiety and a secondary loading on depression; "nervous" had a primary loading on somatic and a secondary loading on anxiety. These two items were moved to their secondary factors to increase the face validity and clinical significance of each subscale. Note that these data elicited an additional factor (somatic) than the original EES subscales of anger/hostility, anxiety, and depression. This will be expanded upon in the Discussion section.

The depression factor contained 9 items, which accounted for 39.8% of the total variance (Eigenvalue = 9.9), and conceptually reflected eating in response to depressive symptoms. The anger factor contained six items and accounted for 7.4% of the total variance (Eigenvalue = 1.84), and conceptually reflected eating in response to anger. The anxiety factor contained four items and accounted for 6.6% of the total variance (Eigenvalue = 1.6), and conceptually reflected eating in response to anxiety. The somatic factor contained six items and accounted for 6.1% of the total variance (Eigenvalue = 1.5), and conceptually reflected eating in response to somatic arousal symptoms.

New subscale structure and scores

Internal reliability for each of the new subscales was examined using Cronbach's alpha. As reported in Table 2, alpha's for the four subscales were all greater than .75, indicating moderate to strong internal reliability. No substantial increase in alpha for any of the subscales was achieved by eliminating any of the items. Composite scores for each of the four subscales were created by using a summative index of the variables on each factor, in which the score for each variable (i.e., 0–4) was multiplied by the factor loading for that variable. Descriptive statistics for the new subscales are reported in Table 3. Examination of the histograms for the new subscales suggested that there were no significant deviations from normality.

Additional factor analyses

In order to assess plausible explanations for the additional factor of somatic arousal, we conducted a PCA on the 172 women in the current sample because all previous estimates had been calculated on women only. The PCA of the women only sample again resulted in four factors with eigenvalues greater than 1. Together, these factors accounted for 57.3% of the total variance in the sample data. These factors were also supported by examining the scree plot, which illustrated a notable drop in the factor eigenvalues (such that the eigenvalues closely approximated one) following the fourth factor. This suggests that the presence of men in the sample was not the sole reason for the additional latent factor.

We continued to explore the potential for sample specific sensitivity of the four factors. We conducted a PCA of the data obtained from a random sample of approximately half ($n = 115$) of the participants in the current investigation. This analysis initially resulted in five factors with eigenvalues greater than 1. However, examination of the scree plot suggested that a four-factor solution may be more parsimonious, as the scree plots illustrated a notable drop in the factor eigenvalues (such that the eigenvalues closely approximated one) following the fourth factor. Thus, we forced a four factor solution and, the latent factors more closely approximated the items that fell into the four factors identified in the PCA of the data obtained from the full sample. This suggests that the four factors may be stable across repeated samples from a mixed race/gender population.

Finally, to explore the sensitivity of the EES factor structure in the current sample to the PCA analytical technique, a principal axis factoring (PAF) approach, with an orthogonal rotation, was used. In the first attempt at a PAF of the data we found four factors with eigenvalues greater than 1. Results were highly similar to the PCA approach, in that the four factors appeared to contain items which represented depression, anger, anxiety, and somatic symptoms. Together, these factors accounted for 59.7% of the total variance in the sample data; these results were again supported by examination of the scree plot. Additional information regarding results of these supplemental factor analyses is available upon request.

Associations of new subscale scores with sample characteristics

Correlational analyses showed no significant correlations between the new subscale scores (i.e., anger, depression, anxiety, and somatic arousal) and BMI or WC. There was a significant ($r(215) = .18$; $p = .01$) positive correlation between anger and age, indicating that older individuals reported a greater urge to eat in response to angry emotions. As presented in Table 3, t -tests showed that, compared to men, women had significantly higher depression ($t(215) = 3.34$, $p < .01$) and total ($t(315) = 2.16$, $p < .05$) scores. There were no significant race differences in subscale scores.

Discussion

The present study has three primary findings. First, the mean original EES subscale scores in the current, diverse sample of overweight and obese men and women appears to be similar to (anger and depression) or slightly higher than (anxiety) those reported among smaller samples of normal weight college-aged women (Waller & Osman, 1998), and higher than those reported among individuals with anxiety disorders (Arnow et al., 1995). The subscale and total scale scores in our sample appear lower than those reported among other clinical samples of overweight and obese individuals (e.g., Arnow et al., 1995; Fischer et al., 2007; Ricca et al., 2009), although these differences across studies could not be formally tested. Given the correlation between emotional eating and binge eating (e.g., Fischer et al., 2007; Ricca et al., 2009), the higher scores obtained in previous samples of overweight and obese participants may reflect the relatively high rates of binge eating in those samples (100%, 40% and 57%, respectively), as well as the differences in exclusion criteria (e.g., the absence of depression).

Second, our results did not replicate the original three-factor structure of the EES. Our data suggested four latent factors (i.e., anger, depression, anxiety, and somatic arousal), which, in our sample, explained approximately 60% of the total variance, with the depression factor accounting for approximately 67% of the total (40% of the total explained variance (see Table 2 for exact percentages). Three of these factors (i.e., anger, depression, and anxiety) were conceptually similar to the original subscales, although there were differences in some of the individual items on each of these factors. A fourth unique factor, conceptually labeled “somatic arousal” appears to reflect physical arousal symptoms (e.g., jittery, shaky, excited) that may occur in the context of negative emotions. Alpha coefficients for each of these four factors were of sufficient magnitude to suggest that these four factors represent internally consistent measures of these constructs in this sample. These findings suggest that future investigations of the factor structure of the EES in more heterogeneous samples of overweight and obese individuals are warranted, and indicate that there may be differences in the types of emotions which contribute to emotional eating among heterogeneous samples of overweight and obese individuals. In addition, while we initially selected a PCA approach for these factor analyses in order to most closely replicate the original analysis, it is also notable that we obtained similar results using a PAF approach, which is purportedly a better overall approach for sample-based, data reduction. The reason for this is that PAF is focused on explaining the *shared* variance among the subject using a set of latent factors whereas PCA is focused on explaining all of the variance using a set of factors. PCA is computationally less intensive, and therefore earlier work tends to report PCA results. Thus, future studies should aim to replicate the factor structure of the EES via a PAF approach, in a sample that is similar to the original sample, to further evaluate the consistency and reliability of this factor structure across samples.

One potential explanation for the differences between the original EES subscales and the new factors described here is that there may be gender or racial differences in the precipitants of emotional eating, as has been suggested in the binge eating literature (e.g.,

Mitchell & Mazzeo, 2004; Napolitano & Himes, 2011). Although we did not find race differences in any of the new factor scores, our results did suggest that, compared to men, women reported greater urges to eat in response to depression and anxiety. This is consistent with literature supporting gender differences in emotional and binge eating (e.g., Larsen, van Strien, Eisinga, & Engels, 2006; Tanofsky, Wilfley, Spurrell, Welch, & Brownell, 1997). The current findings also suggest that physical arousal symptoms may be a unique contributor to emotional eating in treatment-seeking overweight and obese individuals, independent of feelings of anxiety, depression, or anger. The emergence of this fourth factor may reflect differences between the demographic characteristics of the current and previous samples (i.e., Arnow et al., 1995; Waller & Osman, 1998), as there is some evidence to suggest that race, education, and income may be related to increased presentation of somatic symptoms associated with depression (e.g., Blazer, Landerman, Hays, Simonsick, & Saunders, 1998; Brown, Schulberg, & Madonia, 1996). Further research is needed to examine racial and gender differences in urges to eat in response to the negative states identified by the new EES factors. In addition, our findings suggest that it may be important to further investigate the contribution of emotional arousal symptoms to emotional eating in overweight and obese individuals. However, further investigation of the factor structure of the EES in heterogeneous samples, as well as the validity and reliability of the factors identified herein, is needed.

Finally, we found no significant associations of the new factor scores (i.e., depression, anger, anxiety, and somatic arousal) with BMI or WC. One potential explanation for this finding is that the restricted range of BMI in the current sample (25–40 kg/m²) may have precluded the detection of significant associations between emotional eating and BMI. Nevertheless, the current data suggest that it is important to further understand the correlates of emotional eating among similar samples of treatment-seeking patients not selected for binge eating, as the variability in emotional eating does not appear to be accounted for by variability in BMI.

The primary strength of the current investigation is the use of a large sample of men and women that included African-Americans and was not limited to individuals presenting with binge eating. Given that previous examinations of the factor structure of the EES have been restricted to less diverse samples of binge-eating and normal weight women, this study provides valuable information about the factor structure of the EES in a more heterogeneous sample of treatment-seeking overweight and obese individuals. This is particularly important in light of the previously discussed evidence for racial differences in the presentation of aberrant eating, as well as the rates and consequences of obesity. This study also has several limitations. First, the cross-sectional nature of this study precluded any investigation of the test-retest reliability or predictive validity of the new factor structure. In addition, the exclusion criteria for participation in the original study from which these data were drawn (e.g., non-smoking, the absence of significant medical conditions, an ability to be physically active), limits the ability to generalize these findings to the general population of overweight and obese individuals. Thus, further research is needed to replicate these findings. In addition, given evidence to suggest potential gender and racial differences in aberrant eating, future studies should examine the validity and reliability of the factors described herein in larger, samples of African-American overweight and obese treatment-seeking individuals, as the sample size in the current study was too small to justify examining the factor structure separately within African-American and Caucasian men and women. Thus, studies that are sufficiently powered to specifically examine the factor structure of the EES in African-American men and women are warranted. Finally, the current investigation did not include any other measures of eating behaviors (e.g., energy intake, restraint, disinhibition), which would provide additional information about the relation of emotional eating with other weight-related outcomes. Nevertheless, it is clear that individual differences play an

important role in the prevention and treatment of obesity (Brownell & Wadden, 1991), and, almost a decade ago, the NIH identified the goal of further understanding these individual factors, given that the identification and modification of traditional variables alone (e.g., energy intake, physical activity) is not always effective (see U.S. Department of Health & National Institutes of Health., 2011). Thus, emotional eating may be an important phenotype to consider in furthering our understanding of obesity. The current study is an important preliminary step toward establishing an optimal scoring system for the EES in overweight and obese adults, and continuing to delineate individual differences in the behavioral phenotypes of obesity.

References

- Arnold B, Kenardy J, Agras W. The emotional eating scale. The development of a measure to assess coping with negative affect by eating. *International Journal of Eating Disorders*. 1995; 18(1):79–90. [PubMed: 7670446]
- Blazer DG, Landerman LR, Hays JC, Simonsick EM, Saunders WB. Symptoms of depression among community-dwelling elderly African-American and white older adults. *Psychological Medicine*. 1998; 28(6):1311–1320. [PubMed: 9854272]
- Brown C, Schulberg HC, Madonia MJ. Clinical presentations of major depression by African Americans and whites in primary medical care practice. *Journal of Affective Disorders*. 1996; 41(3):181–191. [PubMed: 8988450]
- Brownell K, Wadden T. The heterogeneity of obesity. Fitting treatments to individuals. *Behavior Therapy*. 1991; 22:153–177.
- Burton P, Smit H, Lightowler H. The influence of restrained and external eating patterns on overeating. *Appetite*. 2007; 49:191–197. [PubMed: 17349717]
- Dunteman, GH. Principal components analysis. Vol. 07. Newbury Park, CA: Sage Publications; 1989.
- Dziuban CD, Shirkey EC. When is a correlation matrix appropriate for factor analysis? *Psychological Bulletin*. 1974; 81(6):358–361.
- Fischer S, Chen E, Katterman S, Roerhig M, Bochierricciardi L, Munoz D, et al. Emotional eating in a morbidly obese bariatric surgery-seeking population. *Obesity Surgery*. 2007; 17(6):778–784. [PubMed: 17879578]
- Fitzgibbon M, Stolley M, Kirschenbaum D. Obese people who seek treatment have different characteristics than those who do not seek treatment. *Health Psychology*. 1993; 12(5):342–345. [PubMed: 8223357]
- Flegal K, Carroll M, Ogden C, Curtin L. Prevalence of obesity and trends in the distribution of body mass index among US adults 1999–2010. *Journal of American Medical Association*. 2012; 307(5):491–497.
- Foreyt JP, Goodrick GK. Evidence for success of behavior modification in weight loss and control. *Annals of Internal Medicine*. 1993; 119(7):698–701. [PubMed: 8363200]
- Foster GD, Wyatt HR, Hill JO, Makris AP, Rosenbaum DL, Brill C, et al. Weight and metabolic outcomes after 2 years on a low-carbohydrate versus low-fat diet. A randomized trial *Annals of Internal Medicine*. 2010; 153(3):147–157.
- Ganley R. Emotional eating and how it relates to dietary restraint, disinhibition, and perceived hunger. *International Journal of Eating Disorders*. 1988; 7(5):635–647.
- Ganley R. Emotion and eating in obesity. A review of the literature. *International Journal of Eating Disorders*. 1989; 8(3):343–361.
- Geliebter A, Aversa A. Emotional eating in overweight, normal weight, and underweight individuals. *Eating Behaviors*. 2003; 3:341–347. [PubMed: 15000995]
- Guttman L. Image theory for the structure of quantitative variables. *Psychometrika*. 1953; 18:277–296.
- Horchner R, Tuinebreijer W, Kelder H. Eating patterns in morbidly obese patients before and after a gastric restrictive operation. *Obesity Surgery*. 2002; 12:108–112. [PubMed: 11868285]
- Jolliffe, IT. Principal components analysis. New York: Springer; 1986.
- Kaiser HF. Little Jiffy, Mark IV. *Educational and Psychological Measurement*. 1974; 34:111–117.

- Keski-Rahkonen A, Bulik C, Pietilainen K, Rose R, Kaprio J, Rissanen A. Eating styles, overweight and obesity in young adult twins. *European Journal of Clinical Nutrition*. 2007; 61:822–829. [PubMed: 17251930]
- Kontinen H, Haukkala A, Sarlio-Lahteenkorva S, Silventoinen K, Jousilahti P. Eating styles, self-control and obesity indicators. The moderating role of obesity status and dieting history on restrained eating. *Appetite*. 2009; 53:131–134. [PubMed: 19433123]
- Kontinen H, Mannisto S, Sarlio-Lahteenkorva S, Silventoinen K, Haukkala A. Emotional eating, depressive symptoms and self-reported food consumption. A population-based study. *Appetite*. 2010; 54(3):473–479. [PubMed: 20138944]
- Larsen J, van Strien T, Eisinga R, Engels R. Gender differences in the association between alexithymia and emotional eating in obese individuals. *Journal of Psychosomatic Research*. 2006; 60(3):237–243. [PubMed: 16516654]
- Lluch A, Herbeth B, Mejean L, Siest G. Dietary intakes, eating style and overweight in the Stanislas Family Study. *International Journal of Obesity and Related Metabolic Disorders*. 2000; 24(11):1493–1499. [PubMed: 11126347]
- Macht M. How emotions affect eating. A five-way model. *Appetite*. 2008; 50(1):1–11. [PubMed: 17707947]
- Macht M, Simons G. Emotions and eating in everyday life. *Appetite*. 2000; 35:65–71. [PubMed: 10896762]
- Marcus MD, Wildes JE. Obesity. Is it a mental disorder? *International Journal of Eating Disorders*. 2009; 42(8):739–753. [PubMed: 19610015]
- Masheb RM, Grilo CM. Emotional overeating and its associations with eating disorder psychopathology among overweight patients with binge eating disorder. *International Journal of Eating Disorders*. 2006; 39(2):141–146. [PubMed: 16231349]
- Mitchell KS, Mazzeo SE. Binge eating and psychological distress in ethnically diverse undergraduate men and women. *Eating Behaviors*. 2004; 5(2):157–169. [PubMed: 15093785]
- Napolitano MA, Himes S. Race, weight, and correlates of binge eating in female college students. *Eating Behaviors*. 2011; 12(1):29–36. [PubMed: 21184970]
- Ozier AD, Kendrick OW, Leeper JD, Knol LL, Perko M, Burnham J. Overweight and obesity are associated with emotion- and stress-related eating as measured by the eating and appraisal due to emotions and stress questionnaire. *Journal of the American Dietetic Association*. 2008; 108(1):49–56. [PubMed: 18155989]
- Reagan P, Hersch J. Influence of race, gender, and socioeconomic status on binge eating frequency in a population-based sample. *International Journal of Eating Disorders*. 2005; 38(3):252–256. [PubMed: 16211628]
- Ricca V, Castellini G, Lo Sauro C, Raval di C, Lapi F, Mannucci E, et al. Correlations between binge eating and emotional eating in a sample of overweight subjects. *Appetite*. 2009; 53(3):418–421. [PubMed: 19619594]
- Ricca V, Castellini G, Mannucci E, Lo Sauro C, Raval di C, Rotella CM, et al. Comparison of individual and group cognitive behavioral therapy for binge eating disorder. A randomized, three-year follow-up study. *Appetite*. 2010; 55(3):656–665. [PubMed: 20870000]
- Stunkard AJ, Messick S. The three-factor eating questionnaire to measure dietary restraint, disinhibition and hunger. *Journal of Psychosomatic Research*. 1985; 29(1):71–83. [PubMed: 3981480]
- Tanofsky M, Wilfley D, Spurrell E, Welch R, Brownell K. Comparison of men and women with binge eating disorder. *International Journal of Eating Disorders*. 1997; 21(1):49–54. [PubMed: 8986517]
- Teixeira P, Silva M, Coutinho S, Palmeira A, Mata J, Vieira P, et al. Mediators of weight loss and weight loss maintenance in middle-aged women. *Obesity*. 2010; 18(4):725–735. [PubMed: 19696752]
- U.S. Department of Health and Human Services, National Institutes of Health. Strategic Plan for NIH Obesity Research. A Report of the NIH Obesity Research Task Force. 2011. (NIH Publication No 11-5493). Retrieved from http://obesityresearch.nih.gov/about/StrategicPlanforNIH_Obesity_Research_Full-Report_2011.pdf

- van Strien T. The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International Journal of Eating Disorders*. 2006; 5(2): 295–315.
- van Strien T, Frijters JE, Roosen RG, Knuiman-Hijl WJ, Defares PB. Eating behavior, personality traits and body mass in women. *Addictive Behaviors*. 1985; 10(4):333–343. [PubMed: 4091066]
- van Strien T, Ouwens MA. Counterregulation in female obese emotional eaters. Schachter, Goldman, and Gordon's (1968) test of psychosomatic theory revisited. *Eating Behaviors*. 2003; 3(4):329–340. [PubMed: 15000994]
- Waller G, Osman S. Emotional eating and eating psychopathology among non-eating-disordered women. *International Journal of Eating Disorders*. 1998; 23(4):419–424. [PubMed: 9561432]

Table 1

Sample characteristics.

Characteristic	<i>n</i> (%)	Mean	SD
Variable			
Age (years)		43.10	11.04
Gender			
Men	45 (20.8)		
Women	172 (79.2)		
Race			
Caucasian	94 (43.3)		
African-American	97 (44.7)		
Hispanic	11 (5.1)		
Asian	7 (3.2)		
Other	6 (2.8)		
Missing	2 (0.01)		
Employed full- or part-time	188 (86.6)		
Body mass index (kg/m ²)		33.05	3.4
Waist circumference (cm)		104.97	10.3

Table 2

Revised EES factors, item loadings and reliability.

Factor	Item	Eigenvalue	Variance (%)	Loading	Alpha
Anger	Angry	1.84	7.40	0.75	0.85
	Jealous			0.69	
	Furious			0.67	
	Irritated			0.67	
	Resentful			0.62	
Anxiety	Rebellious	1.60	6.60	0.60	0.78
	Worried			0.71	
	Upset			0.67	
	Frustrated			0.66	
	Nervous			0.50	
Depression	Lonely	9.90	39.80	0.77	0.89
	Inadequate			0.74	
	Blue			0.62	
	Discouraged			0.58	
	Bored			0.58	
	Guilty			0.56	
	Helpless			0.56	
	Confused			0.51	
	Sad			0.49	
Somatic		1.50	6.10		0.79
	Jittery			0.85	
	Shaky			0.78	
	On edge			0.57	
	Uneasy			0.54	
	Excited			0.47	
	Worn out			0.43	

Factor	Item	Eigenvalue	Variance (%)	Loading	Alpha
Total					0.94

Table 3

Descriptive statistics for new subscales of the EES.

	Mean	SD
Anger full sample	3.04	3.3
Men ($n = 45$)	2.62	3.5
Women ($n = 172$)	3.15	3.3
Anxiety full sample ^a	3.33	2.5
Men ($n = 45$)	2.70	2.4
Women ($n = 172$)	3.5	2.6
Depression full sample ^c	7.25	4.8
Men ($n = 45$)	5.19	4.4
Women ($n = 172$)	7.79	4.7
Somatic full sample	3.46	3.5
Men ($n = 45$)	3.30	3.4
Women ($n = 172$)	3.50	2.9
Total full sample ^b	27.44	18.2
Men ($n = 45$)	22.29	19.5
Women ($n = 172$)	28.78	17.6

t-Test for gender differences:^a $p < .10$;^b $p < .05$;^c $p < .01$