



Research report

Factor structure of the Emotional Eating Scale in overweight and obese adults seeking treatment[☆]E.M. Goldbacher^{a,*,1}, 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, G.D. Foster^b^a Department of Psychology, La Salle University, 1900 W. Olney Ave., Philadelphia, PA 19141, United States^b Center for Obesity Research and Education, Temple University, 3223 N. Broad St., Philadelphia, PA 19140, United States^c Institute for Survey Research, Temple University, 1509 Cecil B. Moore Avenue, Suite 401 ECEC, Philadelphia, PA 19121, United States

ARTICLE INFO

Article history:

Received 5 December 2011

Received in revised form 28 March 2012

Accepted 5 April 2012

Available online 14 April 2012

Keywords:

Emotional eating

Weight

Obesity

African American

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.

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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, & Haukkala, 2010; Macht, 2008; van Strien & Ouwens, 2003). Compared to healthy weight individuals, overweight individuals report greater levels of emotional eating (Fitzgibbon, Stolley, & Kirschenbaum, 1993; Geliebter & Aversa, 2003; Horchner, 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; Arnow 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 (Arnow 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

[☆] Acknowledgements: This study was supported by NIH F32 DK083910.

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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 ($N_s \leq 51$) of overweight binge eating (Arnow 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 (Arnow 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 ($BMI = 25\text{--}40 \text{ kg/m}^2$) 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

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