

# Returning to emotional eating: the emotional eating scale psychometric properties and associations with body image flexibility and binge eating

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## Abstract

**Purpose** This study tests the Emotional Eating Scale (EES) psychometric properties and correlates, and the moderator effect of body image flexibility on the association between emotional eating and binge eating.

**Methods** The EES factorial structure was examined in female college students and women from the general population, through a principal component analysis and a confirmatory factor analysis. EES psychometric properties and moderation analyses were further conducted.

**Results** The EES presented a three-factor structure—Depression, Anxiety and Anger—a good model fit, internal consistency, construct validity and temporal stability. EES was positively associated with general and eating psychopathology, binge eating, and negatively associated with mindfulness and body image flexibility. Body image flexibility moderated the association between emotional eating and binge eating.

**Conclusions** Findings showed that EES is a valid measure of emotional eating, and clarified the association between emotional eating and binge eating moderated by body image flexibility.

**Keywords** Emotional eating · Binge eating · Body image flexibility · Psychometrics · Moderation

## Introduction

There is growing research on how emotions impact individuals eating behaviour. Emotional eating refers to the tendency to overeat in response to a range of negative emotions, such as anxiety, depression or anger [1, 2]. Emotional eating was initially described in Bruch's psychosomatic theory [3], according to which it derives from the inability to distinguish hunger sensations from physiological cues linked to emotional states. Furthermore, affect regulation models state that eating may be an attempt to escape, distract oneself from or avoid aversive affective states [4, 5].

Emotional eating is associated with mental health problems and plays an important role in body image, weight and eating-related disorders [6–9]. In particular, studies suggest that negative mood states, combined with disturbing eating and body image-related thoughts, are precipitants of binge eating [10, 11]. In fact, binge eating may serve to avoid such negative internal events [4, 12], being however a futile strategy in the long term that creates greater distress, fueling a self-perpetuating cycle [13], with serious health and psychosocial consequences [14]. Thus, emotional eating has been highlighted as an important target of psychotherapeutic interventions for eating psychopathology, namely binge eating.

There is growing research showing the efficacy of mindfulness and acceptance-based interventions in reducing emotional eating and binge eating. Such interventions target the willingness to adaptively cope with negative emotions and undesirable thoughts to promote adaptive living [15–18]. A particularly important process of change in the treatment of binge eating is body image flexibility, the capacity to fully and openly experience body image-related negative thoughts and feelings, whilst engaging in

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value-consistent behaviours, instead of in reactive attempts to avoid them, such as emotional eating [19–22].

The development and refinement of assessment tools to address emotional eating and examine its interaction with processes relevant for body image and eating behaviours are therefore particularly relevant. Distinct self-report measures have been used to assess emotional eating [10, 23]. The Emotional Eating Scale (EES) [1], first developed in obese women, includes 25 items comprising three subscales reflecting the desire to eat in response to Anger/Frustration, Anxiety, and Depression. The scale presented good psychometric properties, and scores were sensitive to changes in binge eating treatment. Waller and Osman [8] further examined EES in non-eating-disordered female undergraduates and confirmed the scale's internal reliability and that emotional eating was significantly associated with disordered eating behaviours, namely bulimic symptoms, and increased weight status. Nevertheless, this study used a small sample and did not confirm whether the scale structure replicated the original EES. A recent study investigated the scale's factor structure in a larger sample of treatment-seeking overweight and obese participants [24]. Although results confirmed the utility of the EES with this population, they did not replicate the original EES factor structure. The EES was also examined in specific samples (e.g., children and adolescents [25]) with results revealing a loading pattern distinct of what was originally found. Other adaptations of the scale added items comprising positive emotions [26, 27], but the specificity of the samples used (undergraduate students) precluded conclusions regarding the measure's structure. Nonetheless, findings corroborated that negative affect was significantly associated with disordered eating behaviours (whilst positive affect failed to present significant associations).

To sum up, EES has been regarded as useful to evaluate emotional eating across distinct populations. This measure's factor structure reveals however some disparities, which suggests that the EES may be sensitive to the characteristics of the sample it is being applied to [24]. Also, negative emotions seem to co-occur within and across individuals and thus, the overlap between certain emotional states should be considered when analysing negative affect scales [28].

The current study aimed at conducting a more comprehensive evaluation of the EES dimensionality and psychometric properties in a wide nonclinical Portuguese sample of women. This study also intended to further examine the associations between emotional eating, psychopathology and body image and eating-related psychopathology, and treatment-relevant constructs. In particular, it was examined whether body image flexibility significantly moderated the association between emotional eating and binge eating.

## Materials and methods

### Participants

A principal component analysis (PCA) was conducted in 506 participants presenting a mean age of 24.71 (SD = 9.13) and 14.09 years of education (SD = 1.80). Most participants were students (81.5 %). Body mass index (BMI) mean was 22.45 (SD = 3.41), 6.4 % were underweight, 74.9 % presented normal weight, 14.9 % were overweight, and 3.8 % obese.

A confirmatory factor analysis (CFA) and subsequent analyses were conducted in an additional sample ( $n = 512$ ). Participants' mean age was 21.81 (SD = 4.17) and years of education' mean was 13.98 (SD = 1.98); most were students (81.3 %). BMI mean was 21.72 (SD = 3.00); 10.4 % were underweight, 75.5 % had normal weight, 12.3 % were overweight and 1.8 % obese. Fifty-one participants were randomly selected to fill the retest of the EES after a 1-month period.

### Measures

BMI was calculated by dividing current weight (in kg) by height squared (in m).

Eating Disorder Examination Questionnaire (EDE-Q [29, 30]) provides a comprehensive assessment of eating psychopathology. It includes four subscales (restraint, eating concern, weight concern and shape concern) and presents good psychometric properties.

Binge Eating Scale (BES [31, 32]) assesses behavioural manifestations and emotional/cognitive factors linked to binge eating. It comprises 16 items with each item including three/four statements representing a rating of severity ranging from 0 (no difficulties with binge eating) to 3 (severe problems with binge eating). Participants are asked to choose the statement that best describes their experience. The scale has good internal consistency [31, 32].

Mindful Attention Awareness Scale (MAAS [33, 34]) is a self-report instrument that assesses dispositional mindfulness. MAAS includes 15 items related to everyday experiences, regarding which participants are asked to select an option using a 6-point Likert scale (ranging from 1 "Almost always" to 6 "Almost never"). MAAS presents a high internal consistency [33, 34].

Body Image Acceptance and Action Questionnaire (BIAAQ [19, 21]) was designed to measure body image flexibility [21]. It includes 12 items, rated in a 7-point Likert scale (1 "Never true" to 7 "Always true"), regarding which participants are asked to rate the subjective truth of each statement. BIAAQ presents good psychometric properties [19, 21].

Depression Anxiety and Stress Scales—21 (DASS21 [35, 36]) assesses levels of Depression, Anxiety and Stress symptoms. Participants are asked to indicate the frequency they experienced each symptom over the past week using a 4-point Likert scale (0 “Did not apply to me at all” to 3 “Applied to me very much or most of the time”). The scale reveals adequate internal consistency [35].

## Procedure

With the consent from the authors of the original EES, the scale was translated into Portuguese by a bilingual researcher and analysed by a research group with a large experience with eating psychopathology. The comparability of content was verified through stringent back-translation procedures.

Participants were female college students recruited from various higher education courses, and women from the general population collected within different public and private institutions. The boards of all involved institutions approved the study and participants provided their informed consent.

## Data analyses

The EES factor structure was examined through a PCA, following the analytical procedures of the original study of the scale and previous research [1, 24]. The internal consistency of the scale was examined by McDonald’s Omega coefficients (using the statistical software R).

The obtained structure was confirmed through a CFA, with Maximum Likelihood as the estimation method. The items were specified to load on the respective latent first-order factor, and these were specified to load on a second-order factor of emotional eating. The following indices were selected to examine model fit [37, 38]: Chi square ( $\chi^2$ ); normed Chi square ( $\chi^2/df$ ), with 2–5 indicating good fit; goodness of fit index (GFI) and comparative fit index (CFI), with 0.90 suggesting good fit; parsimony goodness of fit index (PGFI); and root mean square error of approximation (RMSEA), with 0.05–0.08 indicating reasonable error and acceptable fit [37, 38]. Construct validity was further established through the calculation of the composite reliability (CR; indicator of construct reliability), the average variance extracted (AVE; indicator of convergent validity), and the discriminant validity. The association between the EES and the study variables was examined through Product-moment Pearson correlations [39].

The moderator effect of body image flexibility on the association between emotional eating (independent variable) and binge eating (dependent variable) was examined through a hierarchical regression analysis. A standardized

procedure was adopted, centering the values of the two predictors. The interaction product of the predictors was obtained by multiplying the two centred variables [40].

Analyses were conducted using IBM SPSS Statistics 20 (Statistical Package for the Social Sciences, Chicago, IL, USA) and the software AMOS (Analysis of Momentary Structure, software version 18, SPSS Inc. Chicago, IL).

## Results

### EES factorial structure and initial psychometric properties

The suitability of the data for the analysis was confirmed through the Kaiser–Meyer–Olkin test (.93) and the Bartlett’s sphericity test ( $\chi^2_{(351)} = 6031.64$ ,  $p \leq .001$ ). All items presented high communalities (item 4 presented the lowest value;  $h^2 = 0.35$ ). The Kaiser–Guttman criteria suggested four factors. However, the parallel analysis indicated that three components had eigenvalues exceeding the 95th percentile of the eigenvalues obtained in a random matrix.

The analysis was then recalculated with a Direct Oblimin rotation with a three-factor solution, which explained 52.39 % of the variance. To achieve a parsimonious solution, a conservative approach was followed which indicated the progressive deletion of items 1, 13, 20, 5, 11, 19 and 3, for presenting factorial loadings below 0.45. This resulted in an increase of the variance explained to 58.88 %, with the first factor explaining 38.68 % of the variance, the second 12.78 %, and the third 7.43 %.

Results indicated a good reliability for the first factor [coefficient omega = 0.89, 95 % CI (0.87, 0.91)] and the third factor also presented good reliability [coefficient omega = 0.88, 95 % CI (0.86, 0.90)]. The second factor revealed a lower coefficient [coefficient omega = 0.71, 95 % CI (0.66, 0.75)] and results indicated that the removal of item 4 would increase the internal consistency to 0.76 [95 % CI (0.70, 0.80)]. The total scale internal consistency was 0.90 [95 % CI (0.89, 0.92)].

A final PCA without item 4 was conducted and this structure explained 61.39 % of the variance (Table 1). Factor 1 explained 40.64 % and comprised items reflecting depression; factor 2 explained 13.51 % and involved items regarding anxiety and somatic activation; and factor 3 explained 7.24 % and its items tapped into anger states.

### Confirmatory factor analysis

EES items showed acceptable values of skewness and univariate and multivariate kurtosis [37]. The first model had a mediocre fit ( $\chi^2 = 580.94$ ,  $p = .000$ ;  $\chi^2/df = 5.01$ ;

**Table 1** Principal component analysis factor loadings ( $\lambda$ ), communalities ( $h^2$ ), mean ( $M$ ), standard deviation ( $SD$ ;  $n = 506$ ); standardized regression weights (SRW) and squared multiple correlations (SMC) in the confirmatory factor analysis ( $n = 512$ )

Items	Factors			$h^2$	$M$	$SD$	SRW	SMC
	$\lambda$ Depression	$\lambda$ Anxiety	$\lambda$ Anger					
Factor 1—Depression					19.03	7.79		
8—blue	0.87	0.10	0.11	0.67	2.45	1.31	0.63	0.39
10—sad	0.83	0.15	0.03	0.65	2.29	1.31	0.61	0.37
16—lonely	0.72	0.24	0.11	0.55	2.60	1.26	0.64	0.41
24—helpless	0.71	0.03	0.14	0.61	1.94	1.14	0.72	0.52
23—bored	0.69	0.20	0.06	0.51	2.23	1.18	0.61	0.38
2—discouraged	0.65	0.11	0.05	0.50	1.91	1.10	0.64	0.40
15—frustrated	0.59	−0.11	0.30	0.57	2.06	1.21	0.70	0.49
14—worried	0.57	−0.09	0.20	0.45	1.90	1.14	0.61	0.37
22—guilty	0.56	0.02	0.22	0.49	1.67	1.07	0.57	0.32
Factor 2—Anxiety					5.91	2.67		
6—excited	0.01	0.82	0.00	0.67	2.06	1.12	0.73	0.53
7—rebellious	0.08	0.80	0.15	0.73	1.83	1.02	0.80	0.64
9—jittery	0.13	0.72	0.07	0.61	2.03	1.12	0.65	0.43
Factor 3—Anger					9.05	4.62		
17—furious	0.15	0.10	0.91	0.78	1.72	1.10	0.82	0.67
21—angry	0.05	0.07	0.79	0.71	1.74	1.11	0.80	0.64
18—on edge	0.03	0.04	0.78	0.66	1.76	1.15	0.67	0.45
12—irritated	0.09	0.02	0.77	0.68	1.92	1.15	0.77	0.60
25—upset	0.30	0.02	0.59	0.61	1.90	1.09	0.66	0.44

GFI = 0.88; PGFI = 0.67; CFI = 0.87; RMSEA = 0.09, 90 % CI = 0.08–0.10). The analysis of the modification indices (MI) and standardized residuals (SR) suggested the correlation of the errors of items 8 and 10 (MI = 109.013, SR = 4.506). The content analysis of these items supported this decision given their similarity (with “blue” being a more prosaic term for expressing sadness). This resulted in an improvement of the model adjustment ( $\chi^2 = 459.61$ ,  $p = 0.000$ ;  $\chi^2/df = 4.00$ ; GFI = 0.90; PGFI = 0.68; CFI = 0.91; RMSEA = 0.08, 90 % CI = 0.07–0.08).

Results indicated that the three first-order factors—Depression, Anxiety and Anger—significantly loaded on the second-order factor (0.64, 0.59, and 0.96, respectively). All items revealed adequate standardized regression weights [38], ranging from 0.57 (item 22) to 0.72 (item 24) in the first subscale, 0.65 (item 9) and 0.80 (item 7) in the second, and 0.66 (item 25) and 0.82 (item 17) in the third subscale. Squared multiple correlations’ results confirmed the instrument reliability; items presented values ranging from 0.32 (item 22) to 0.67 (item 17).

#### Validity analyses

The first factor revealed a CR of 0.91, the second 0.85, and the third 0.92. Also, the total score showed a CR of 0.96. Regarding the AVE, results indicated a value of 0.53 for

the first factor, 0.66 for the second, and 0.69 for the third factor. Given that the AVE of the three factors is higher than  $r^2$  of the correlation between them ( $r^2 = .14$ ,  $r^2 = .32$ , and  $r^2 = .37$ ), the factors also showed adequate discriminant validity.

#### Retest reliability

Results revealed significant positive correlations between the test and retest versions of the EES subscales ( $r_{\text{Depression}} = .70$ ,  $r_{\text{Anxiety}} = .40$ ,  $r_{\text{Anger}} = .36$ ) and global score ( $r = 0.57$ ). Furthermore, no significant differences were found between the two assessment moments ( $t_{\text{Depression}(50)} = 1.10$ ,  $p = 0.278$ ;  $t_{\text{Anxiety}(50)} = 0.91$ ;  $p = 0.366$ ;  $t_{\text{Anger}(50)} = 0.58$ ,  $p = 0.563$ ;  $t_{\text{Total}(50)} = 1.06$ ,  $p = 0.293$ ).

#### EES correlations with other measures

The EES subscales presented moderate to large significant associations between them and are strongly associated with the total EES score (Table 2). Also the EES subscales Depression and Anger, and total score, were positively associated with EDE-Q. There were no significant associations between the EES subscale Anxiety and EDE-Q. Furthermore, the EES Depression and Anger subscales and total score were significantly and strongly associated with binge eating. The subscale Anxiety was moderately linked

to binge eating. There were no significant associations between the three emotional eating subscales and participants' BMI.

Positive lower correlations were found between the EES subscales and general psychopathology.

**Table 2** EES subscales correlations and correlations with other measures ( $n = 512$ )

	EES			
	Depression	Anxiety	Anger	Total
<b>EES</b>				
Depression	1	0.30***	0.54***	0.89***
Anxiety	0.30***	1	0.48***	0.61***
Anger	0.54***	0.48***	1	0.83***
Total	0.89***	0.61***	0.83***	1
<b>EDEQ</b>				
Restriction	0.19***	-0.03	0.10*	0.15***
Eating concern	0.34***	0.08	0.22***	0.31***
Shape concern	0.27***	0.02	0.13**	0.22***
Weight concern	0.25***	0.03	0.15**	0.22***
Total	0.29***	0.03	0.16***	0.25***
<b>BES</b>				
BES	0.53***	0.20**	0.49***	0.56***
<b>DASS21</b>				
Depression	0.23***	0.12**	0.20***	0.24***
Anxiety	0.17***	0.21***	0.15**	0.21***
Stress	0.28***	0.25***	0.22**	0.31***
<b>MAAS</b>				
MAAS	-0.29***	-0.19***	-0.19***	-0.30***
<b>BIAAQ</b>				
BIAAQ	-0.31***	-0.11*	-0.19***	-0.29***
<b>BMI</b>				
BMI	0.07	-0.07	0.04	0.04

EES emotional eating scale, EDEQ eating disorders examination questionnaire, DASS21 Depression Anxiety and Stress scales-21, MAAS mindful attention awareness scale, BIAAQ body image acceptance and action questionnaire, BMI body mass index

\*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$

Results indicated a significant and negative association between EES and mindfulness and psychological flexibility regarding body image, with the EES Depression subscale revealing the strongest negative association with these variables.

The predictive effect of emotional eating on binge eating having body image flexibility as a moderator

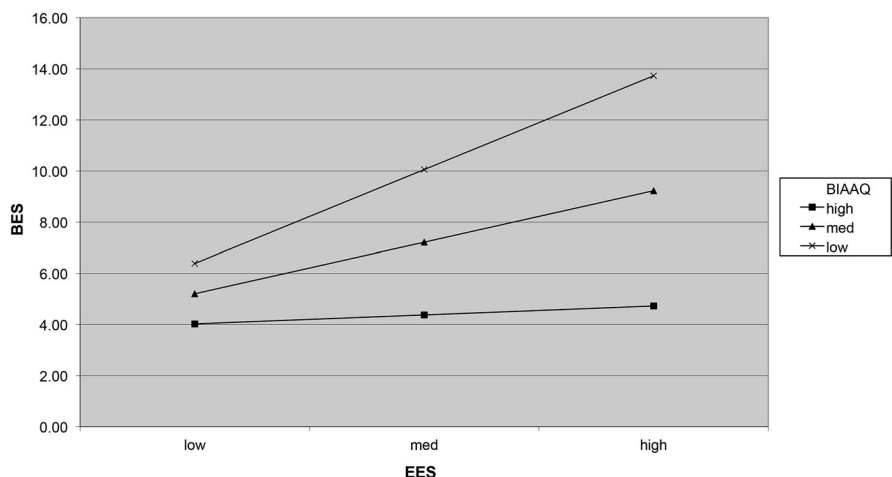
EES was entered as a predictor in the first step of the regression model. Body image flexibility was entered on step two. The predictors produced statistically significant models [Step 1:  $R^2 = .36$ ,  $F_{(1, 214)} = 121.59$ ,  $p < .001$ ; Step 2:  $R^2 = .54$ ,  $F_{(1, 213)} = 82.53$ ,  $p < .001$ ]. The third step produced a significant increase in  $R^2$  to 0.60 [ $F_{(1, 212)} = 32.88$ ,  $p = .000$ ]. Results revealed a  $\beta$  of 0.27 for EES ( $t_{(212)} = 5.17$ ,  $p < 0.001$ ), a  $\beta$  of -0.38 for body image flexibility ( $t_{(212)} = -7.24$ ,  $p < .001$ ), and that the interaction between the two was significant [ $\beta = -0.30$ ,  $t_{(212)} = -5.83$ ,  $p < .001$ ].

A graphic representation of the moderation analysis (Fig. 1) considered three levels of body image flexibility: low (one SD below the mean), medium (mean) and high (one SD above the mean [40]). The visual inspection of the graphic indicated that in women with the same tendency to eat in response to negative emotions, those with higher body image flexibility present lower levels of binge eating.

**Discussion**

Emotional eating plays an important role in mental health problems, namely body image and eating-related difficulties [6, 11]. Also, research emphasizes that these difficulties should be considered from a dimensional perspective, supporting therefore the relevance of assessing emotional

**Fig. 1** Moderator effect of body image flexibility (BIAAQ) on the association between emotional eating (EES) and binge eating (BES)





eating both in clinical and nonclinical samples. The EES is one of the most cited measures in the literature used to assess the tendency to eat when emotional [1]. Nevertheless, its psychometric properties have only been partially examined in specific samples, with studies revealing mixed findings regarding its structure.

Therefore, the current study aimed at conducting a more extensive study of the EES structure and psychometric properties in a large and heterogeneous nonclinical sample. Furthermore, we intended to further investigate the association between emotional eating and variables that are increasingly being pointed out as relevant for clinical interventions targeting disordered eating behaviours (e.g., binge eating), such as mindfulness and psychological flexibility (e.g., [15, 17]).

Findings indicated a similar three-factor structure identified in the original scale [1]. Nevertheless, we opted to follow a more stringent approach to the data. Rigorous criteria for item retention were adopted to reach a brief but reliable measure, and a CFA was conducted to attest the adequacy of the obtained structure. A preliminary reliability assessment revealed that the scale presented high internal consistency. The first subscale included items reflecting the original Depression subscale (e.g., eating when feeling blue, lonely or bored), and also included items that, even though were originally included in the Anger/Frustration subscale and in the Anxiety subscale, can be considered as being part of the pattern of affects co-occurring in a depressive state (i.e., feelings of helplessness, discouragement, guilt, failure and rumination [28]). The second subscale included items referring to the tendency to eat when feeling in a state of physiological activation and anxiety. The third subscale included items reflecting anger states and an additional item (“upset”), originally belonging to the Anxiety subscale, but that may be conceptually understood as integrating the constellation of affects co-occurring when one is angry. CFA results confirmed that this EES model was plausible and that all items significantly contributed to the assessment of the construct of emotional eating and its respective dimensions. The scale and respective subscales also presented good construct reliability, convergent and discriminant validities. The test–retest analysis EES indicated an adequate temporal stability, and also suggested that the anger and anxiety subscales may be particularly suitable to measure eating triggered by emotional states in laboratory studies.

Furthermore, findings indicated that the EES subscales are related but distinct constructs. As in prior research, emotional eating, namely the subscales Depression and Anger, was significantly associated with eating psychopathology and in particular with binge eating [1, 27]. Furthermore, the emotional eating subscales were associated with general psychopathology. These findings are

line with prior evidence and highlight that this variable merits attention in the context of mental well-being [27]. Additionally, results revealed significant associations between increased emotional eating, especially eating in response to depressive affect, and a lower ability to being receptive to and aware of what is happening in the present moment [33] as well as with lower body image flexibility [20, 21].

Last, the moderator effect of body image flexibility on the association between eating in response negative emotions and binge eating was tested. The model explained a total of 60 % of the variance of the severity of binge eating behaviours and findings suggest that in women who may present the tendency to eat in response to negative emotions, those with higher psychological flexibility regarding body image tend to present lower engagement in binge eating. Even though the cross-sectional design of the study does not allow to establish a causal ordering for the observed relationships between these variables, the current findings show that their covariation is in accordance with theoretical suggestions and research demonstrating the association between emotional eating, binge eating and self-regulatory processes. In fact, this model seems to extend the evidence on the association between emotional eating and constructs that have been clinically explored as relevant to address emotional eating and eating psychopathology in clinical populations, namely mindfulness and acceptance-based approaches, and further suggest the importance of body image flexibility [19, 20].

Other limitations should be considered when interpreting this study’s findings. Even though the EES was examined in a large population of women comprising both students and women from other occupational contexts, this sample is not representative of the general population and future research should be conducted to confirm the plausibility of the scale’s structure in other samples (e.g., explore invariance across genders). Furthermore, even though weight and eating-related difficulties are common in the community, the sample used in the current study also impairs the generalization of results to samples with varying degrees of overweight, and clinical populations (e.g., patients with binge eating disorder).

Nonetheless, this study extends prior research on the assessment of emotional eating by offering evidence that this more stringent examination of the scale resulted in a plausible structure with adequate psychometric properties and seems to be a reliable and useful instrument to assess emotional eating and its correlates. Furthermore, this study’s findings offer preliminary evidence that suggests that emotional eating and the ability to tolerate and accept painful or disturbing emotional states, without engaging in reactive attempts to avoid them, are relevant aspects to consider in binge eating prevention and treatment.

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**Conflict of interest** Cristiana Duarte declares that she has no conflict of interest. José Pinto-Gouveia declares that he has no conflict of interest.

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

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