Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity (2021) 26:295–303
https://doi.org/10.1007/s40519-020-00854-2

ORIGINAL ARTICLE

Eating self-efficacy: validation of a new brief scale

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Received: 3 October 2019 / Accepted: 20 January 2020 / Published online: 1 February 2020

Abstract

Purpose Eating self-efficacy (ESE) is the belief in one's ability to self-regulate eating. Social and emotional situations may be differently challenging depending on the individual eating habits, body mass index and affects. Several ESE scales have been developed but most of them focus on weight management, dieting or healthy eating. The aim of the study was to validate a new brief scale assessing ESE in situations in which people face social or emotional pressures for excessive food intake.

Methods Study 1: A sample of 412 volunteer females (age $M = 25.44 \pm 5.03$) completed a first 25-item version of the scale. Exploratory factor analysis (EFA) was conducted for selecting a subgroup of items composing the ESE brief scale (ESEBS). Study 2 assessed its psychometric properties through a Confirmatory Factor Analysis (CFA), analyzing the responses of 410 volunteer adults (273 females, 137 males).

Results EFA of Study 1 evidenced a bifactorial structure. Four items for each factor were selected, explaining 63% of the variance. Study 2 confirmed the good fit of the bifactorial model (CFI = 0.9589; χ^2 (19) = 62.852, $p < 0.001$; RMSEA = 0.075; SRMR = 0.040) and provided support for the measurement invariance of the scale across gender. The internal consistency was as follows: Social ($\alpha = 0.786$), Emotional ($\alpha = 0.820$). The concurrent validity of the subscales was demonstrated by significant latent negative correlations with measures of eating disorders and emotional eating.

Conclusions The 8-items ESEBS appears as a valid and reliable instrument to assess eating self-efficacy related to social and emotional situations. Future studies should evaluate its potential use in non-clinical and clinical research and interventions.

Level of evidence Level V, descriptive cross-sectional study.

Keywords Eating self-efficacy · Eating behaviour · Scale · Validation · Factorial analysis

Introduction

Self-efficacy is the belief in one's ability to self-regulate a behaviour and it is linked to specific contexts and situations [1]. Applied to the eating domain, eating self-efficacy may be defined as the belief in one's ability to self-regulate eating [1–3] and previous literature suggests that the relevant situations, that may challenge self-regulation of eating, are related to internal states (e.g. emotional or internal/physical) or external contexts like social activities or situations in which food is easily available [1–3].

Emotional states and emotion dysregulation have been highlighted as playing an important role in food intake. It has been hypothesized that the dysregulation of emotions results in a greater tendency to use food as a strategy for coping with negative emotions and to overeat when food is available [4]. Several findings confirm that the use of dysfunctional strategies for regulating emotions is associated with increased food intake and especially with increased consumption of comfort foods [5]. Experimental induction of negative affect has been shown to cause greater food intake in laboratory settings, particularly among individuals who restrain eating or with high levels of self-reported emotional eating [6] or binge eating and obesity [7]. A meta-analysis by Cardi et al. [8] confirms these findings, indicating that negative mood induction is significantly associated with greater food intake, especially in restrained eaters and

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binge eaters. Furthermore, other evidence [9] suggests that individual differences (such as negative affects or BMI) may play a crucial role in determining an increase in food intake. For example, non-eating disordered individuals with overweight/obesity and high negative affect eat significantly more after negative mood induction and tasty food exposure than after a neutral manipulation, whereas individuals with overweight/obesity but low negative affect do not [9]. Like the low negative overweight/obese subtype, the normal weight high and low negative affect subtypes do not show different responses to the manipulations.

Social eating events (e.g. having dinner with friends, family, colleagues, parties, etc.) are also situations that may impact eating behaviour, increasing or limiting food intake [10]. The presence of others may function as "social-facilitation" of eating in healthy individuals that eat with familiar people [11, 12] or as a limitation to food intake when eating with unfamiliar persons [13] or when contextual social pressures or norms are perceived as relevant, in both restrained and non-restrained individuals [10, 14]. Situations in which a high quantity of food is available and social control is absent (e.g. when you are alone at home and the fridge is full of foods) may be associated to increased food intake, especially in individuals with eating disorders, for instance binge eating disorder (BED), who report to eat significantly more when they are alone than in the presence of others [15].

It seems reasonable that emotional and social situations may trigger divergent or mixed eating responses, depending on their eating habits, BMI and affect, and it is reasonable that they also posit different challenges to the individuals' self-regulation of eating. Since the belief in one's ability to regulate a specific behaviour is one of the most effective predictors of that behaviour [1], it is plausible that in emotional and social situations, the self-efficacy beliefs to self-regulate eating will also influence the eating behaviours.

Among the different scales that have been developed to assess the belief in one's ability to self-regulate eating in different situations, the first scale developed and validated by Glynn and Ruderman [3] yielded two reliable factors: one assessing eating self-efficacy when experiencing negative affect and the other with eating self-efficacy during socially acceptable circumstances. These two subscales evaluate with 25 items the perceived control on overeating, measuring how difficult it is to control participants' overeating in the above-mentioned situations on a 7-point Likert response scale ranging from 1 "no difficulty controlling eating" to 7 "most difficulty controlling eating". Another instrument developed by Clark et al. [2] is the Weight Efficacy Lifestyle Questionnaire (WEL). This scale measures self-confidence in one's ability to resist eating under a variety of physical, psychological and social conditions. It consists of 20-items and five situational factors: negative emotions, food availability, social pressure, physical discomfort, and positive activities. WEL shows good psychometric properties and subscales score demonstrates to be predictive of weight loss during treatment and is associated with adherence to weight-loss strategies [16–18]. A short-form of WEL (WEL-SF) has been developed and validated by Ames et al. [16] in a sample of obese patients seeking weight loss treatment. This short-form includes 8 items and shows a one-factor structure and good statistical and clinical validity [19]. Two further brief scales with 11 items have been developed by Stich et al. [20] and Wilson-Barlow et al. [21]. The first one is a scenario-based dieting self-efficacy scale (DIET-SE) developed from Dieter's Inventory of Eating Temptations (DIET, [22]) and shows a three factors structure representing challenges to adhere to a diet (high-caloric food temptations, social and internal factors and negative emotional events). The second scale is the Healthy Eating and Weight Self-Efficacy Scale (HEWSE). It consists of two factors: the consumption of healthy foods and a healthy weight. This brief scale seems to be a reliable and valid measure assessing individuals' belief in their ability to consume healthy foods and to maintain a healthy weight. Another recent and brief measure to assess eating self-regulatory capacity among adults is the Self-regulation of Eating Behaviour Questionnaire (SREBQ, [23]). The SREBQ includes 5 questions asking, respectively: (1) which foods (out of a list) is considered "tempting"; (2) the intention (yes/not) to not eat much of those foods selected in the list; (3) the intention (yes/not) to have a healthy diet; (4) a list of 5 questions regarding behaviours, thoughts, attention given to eating. The validation study [23] showed that the questionnaire has a very good construct validity.

Despite the number of instruments proposed, most of them are composed by questions assessing self-efficacy in regulating dieting, weight management, overeating, healthy eating and restriction of caloric consumption and are appropriate for being used in contexts evaluating weight-loss interventions [24, 25]. Moreover, although the SREBQ specifically addresses the self-regulation of eating behaviour in general (instead of in weight-loss situations), the construct of self-regulation is different from that of self-efficacy since the last one may be considered a predictor of the first [1]. Finally, none of the recent brief scales allows to differentiate the beliefs of being able to self-regulate eating (eating self-efficacy) in those two situations (emotional and social) that frequently challenge eating self-regulation both for healthy or overweight people and for patients with obesity or eating disorders. Our aim is to validate a new brief scale, inspired by previous questionnaires. The new scale intends to specifically address those two situations that may trigger difficulties in self-regulation of eating taking into account eating habits without focusing on dieting or weight management. Moreover, the scale is meant to be used in clinical and non-clinical samples. Some studies demonstrated the relation between eating self-efficacy and eating disorders [26,

27] or disordered eating habits in non-clinical samples (e.g. [28, 29]), evidencing its potential role not only in obesity but also in eating disorders research, prevention and treatment.

The present paper includes two studies: the first aims at developing a brief scale and the second aims at assessing its psychometric properties. Data of both studies were obtained within the screening part of two studies approved by the Institutional Review Board of the Department of Psychology at Sapienza University of Rome on 25 March 2011. Preliminary results of both studies have been previously presented at an international congress and published in the conference proceedings [30].

Study 1

Aim

Study 1 aims at: (1) developing a very brief scale assessing eating self-efficacy in situations in which people face external (i.e. food availability and social eating) or internal (i.e. emotions, tension and hunger) pressures for excessive food intake; (2) evaluating the construct validity of that scale.

Method

Participants

A convenience sample of females from the Student Community of Sapienza University of Rome was invited to participate in a study during classes in a period between September 2011 and October 2011. A sample size larger than 300 is generally considered good in order to obtain reliable results from an Explorative Factor Analysis [31, 32]. In the present study, 412 voluntarily agreed to provide written informed consent. They completed the pilot version of the self-report questionnaire and few questions regarding age, gender, weight and height.

Instruments and procedure

The proposed *Eating Self Efficacy Brief Scale (ESEBS)* aims to measure how easy it would be to resist the urge to eat in two different situations on a 6-point Likert response scale ranging from 0 "not easy at all" to 5 "completely easy":

1. Internal: in presence of positive and negative emotional states (e.g. "when you feel sad or depressed") or in presence of particular internal states (e.g. "when you are very hungry").
2. External: in the context of social situations [e.g. "When you eat outside (e.g. restaurant, bar, pizzeria) with friends"] or in situations with high food availability (e.g. "when you are at a party in which there is a buffet full of foods").

The first version of the questionnaire included 25 items mostly inspired by Glynn and Ruderman's scale [3].

Data analyses

Data were normally distributed, therefore parametric tests were used. First, Explorative Factor Analysis (EFA) was performed. Since the amount of the missing data in the first study was very small (max = 1.2%), it was treated using listwise deletion method. The construct validity was assessed by examining the underlying dimensionality of the scale using the Maximum Likelihood extraction method and Oblimin with Kaiser normalization rotation since we hypothesized a correlation between the two dimensions.

Reliability analyses for the two subscales were calculated by means of Cronbach's alpha. Ideally, the Cronbach alpha coefficient of a scale should be above 0.70, and higher values indicating greater reliability [33, 34]. Data were analysed with the statistical program SPSS version 25.0 (IBM Corp, Armonk, NY, USA).

Results

Participants were 412 females (age $M = 25.44 \pm 5.03$; BMI $M = 21.77 \pm 3.12$). Scree Test criteria suggested to select 2 factors with eigenvalues of 7.70 and 2.66, respectively (Fig. 1). The initial cumulative variance explained by these two factors, considering all the 25 items, was 46.03%.

In order to have a brief instrument, the 4 items with the highest factor loadings (> 0.60) for each theoretical dimension, respectively eating self-efficacy in social circumstances (*Social*) and eating self-efficacy while experiencing negative emotional states (*Emotional*), were selected.

The exploratory factor analysis was subsequently repeated considering only the 8-items brief scale. Results showed that this solution accounts for a large portion of variance (63.27%). Factor loadings were all above 0.65. All communalities were equal or above 0.40, ranging between 0.40 and 0.66, which is within the common range of magnitude in social sciences, from low (0.40) to moderate (0.70) [35]. The factors were positively correlated ($r = 0.198$; $p < 0.05$) and the corresponding subscales showed good internal consistency. A summary of the results and the contents of the item are reported in Table 1.

Moreover, mean values, standard deviations and frequency distribution of eight items of the ESEBS are reported in Table 2. Skewness and kurtosis values indicated that data are normally distributed [36].

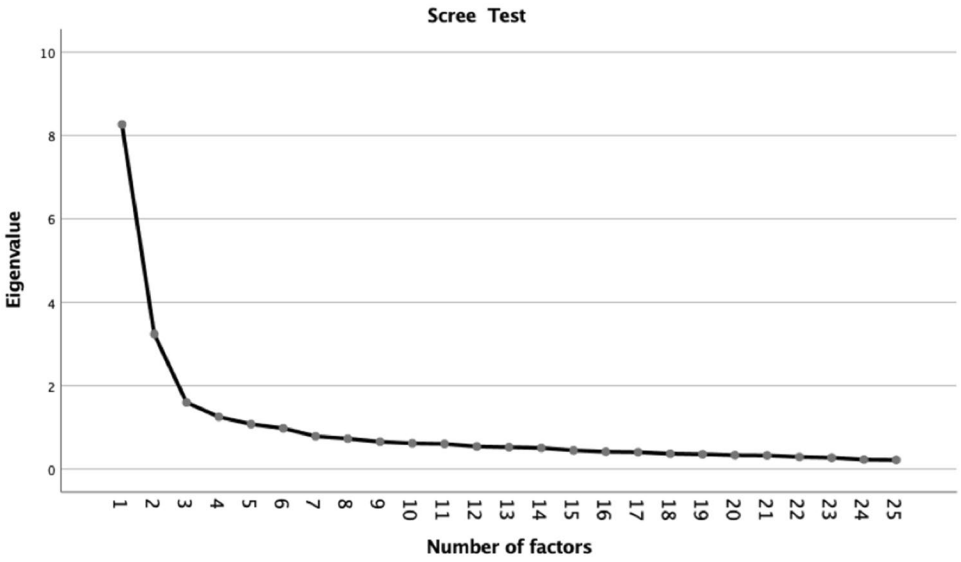

Fig. 1 Scree Test derives from the EFA

Table 1 Items analysis summary of the ESEBS

Social (4 items) $\alpha = 0.791$	Saturation	Communality
1. When you eat outside (e.g. restaurant, bar, pizzeria) with friends	0.730	0.460
2. When you are at a party in which there is a buffet full of foods	0.720	0.524
3. When you are in company and prepare food	0.676	0.465
4. When you are with someone who eats foods that you like	0.670	0.655
Emotional (4 items) $\alpha = 0.817$	Saturation	Communality
5. When you are nervous for personal reasons	0.810	0.583
6. When you are worried about work or studies	0.769	0.504
7. When you are very upset and angry	0.701	0.517
8. When you feel sad or depressed	0.631	0.398

Table 2 Means, standard deviations and frequency distribution of the 8 items

	M	SD	Skewness	Kurtosis
Social				
ESEBS 1	2.27	1.62	0.10	− 1.11
ESEBS 2	2.44	1.53	0.08	− 1.02
ESEBS 3	1.99	1.60	0.34	− 1.03
ESEBS 4	2.65	1.52	− 0.14	− 0.89
Emotional				
ESEBS 5	2.90	1.58	− 0.29	− 0.94
ESEBS 6	2.93	1.63	− 0.37	− 1.02
ESEBS 7	2.64	1.67	− 0.07	− 1.25
ESEBS 8	2.76	1.73	− 0.21	− 1.24

Study 2

Aim

Study 2 aims to: (1) test the factorial structure of the ESEBS along with its invariance across gender, (2) assess the criterion validity of the 8-items Eating Self-Efficacy Brief Scale (ESEBS).

Method

Participants

A convenience sample of 410 adults from the Community of Sapienza University of Rome volunteered to participate in the study, providing written informed consent. Recruitment was conducted during classes between

September 2012 and October 2012. The sample consisted of 137 males and 273 females, with a mean age of 31.73 (SD = 10.78) and a mean BMI of 22.73 (SD = 3.81). The total sample size, given the posited measurement model for ESEBS, gave us a statistical power of 0.76 [37], which is considered adequate for conducting Confirmatory Factor Analysis [38, 39]. All those that agreed, were asked to complete the battery of self-reported questionnaires described below.

Instruments and procedure

The following self-reported questionnaires were administered:

(a) the 8-item *Eating Self Efficacy Brief Scale (ESEBS)* assessing Eating Self-Efficacy during Social and Emotional circumstances;
(b) the Disordered Eating Questionnaire (DEQ; [40]), which includes 24 items assessing dysfunctional eating-related behaviour patterns. DEQ produces a valid and reliable global score of disordered eating-related behaviours, including items about food restriction, ruminating and worrying about weight and body shape, willing to lose weight, binge-eating, engaging in intense physical exercise to lose weight, etc. The clinical cut-off score is 30 [41]. The Cronbach alpha in this study was 0.922.
(c) the Emotional Eating Scale (EES; [42]) in the Italian version by Lombardo and San Martini [43] is a 25 items scale assessing desire to eat after negative emotions. This 25-item scale is a valid and reliable instrument and includes three subscales: emotional eating after depression (EES-D), emotional eating after anxiety/confusion (EES-A), and emotional eating after anger (EES-R). Participants were asked to indicate the extent to which certain feelings lead them to feel an urge to eat (e.g. when they felt depressed, bored, angry, agitated, etc.) on a five-point Likert scale ranging from "no desire to eat" to "an overwhelming urge to eat". Cronbach alphas in the present study were respectively 0.884 for the EES-D, 0.816 for the EES-A and 0.904 for the EES-R.
(d) Eating Attitude Test (EAT-26, [44]) is a widely used 26-item scale assessing eating disorders related symptoms and attitudes. In the present study, we used the Italian version validated by Dotti and Lazzari [45], considering the total score which has been demonstrated good reliability [45]. In the present study, Cronbach alpha was 0.918.

Self-reported height and weight were used to calculate Body Mass Index (BMI). As previously reported [41], the BMI computed on the bases of self-reported height and weight is a valid and reliable proxy of actual BMI.

Data analysis

The small amount of missing data (max = 1.6%) was treated using the Full Information Maximum Likelihood method implemented in Mplus [46]. All the analyses were carried out using Mplus 7 [46]. A confirmatory factor analysis (CFA) was performed to test the factorial structure of the ESEBS. In accordance with the conceptual framework and the results of the exploratory factor analysis of study 1, we posited two correlated factors. The model fit was assessed using the ML Chi square test statistic and multiple fit indices [comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR)], referring to the common guidelines for an acceptable model fit (i.e. CFI < 0.95; RMSA < 0.06; SRMR < 0.08) [47].

The measurement invariance of the scale across gender was examined by means of a hierarchical series of multigroup CFAs. Measurement invariance was tested at the configural, metric (equality of factor loadings), and scalar (equality of intercepts) levels [48, 49]. Configural invariance refers to the fact that males and females conceptualize eating self-efficacy in the same way. This implies that the same number of eating self-efficacy dimensions (Emotional and Social), with the same dimension–item correspondence, must fit the data equally well across the two groups. For metric invariance to exists, items' factor loadings on the eating self-efficacy dimensions must be equal across gender, meaning that males and females interpret the items in the same way. When scalar invariance is reached, the latent means across groups can be meaningfully compared [50], since adults with the same type and level of eating self-efficacy have chosen the same response options for the same items, regardless of their gender.

A series of hierarchically nested models were examined, with increasingly restrictive constraints of equality being imposed across groups on the parameters [51, 52]. The fit of the nested models was compared using the criteria of change in CFI (ΔCFI $\leq$ 0.01), RMSEA (ΔRMSEA $\leq$ 0.015), and SRMR (ΔSRMR $\leq$ 0.010) recommended by Cheung and Rensvold [53] and Chen [54]. The differences in the Social and Emotional dimensions across gender were examined by means of latent factor mean difference tests [55]. Criterion validity was evaluated by examining the latent correlations between each scale and disordered eating, emotional eating, body mass index [56]. The basic assumption of all the performed analysis was that observations are drawn from a continuous and multivariate normal population.

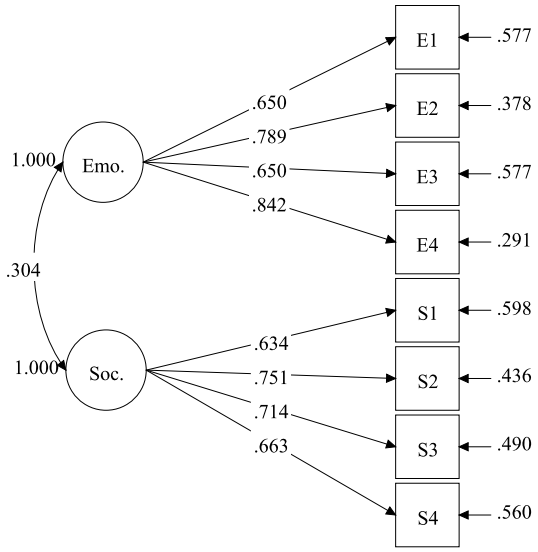

Fig. 2 Confirmatory factor analysis results. All the estimates are standardized and statistically significant ($p < 0.001$)

Results

The results of the CFA (Fig. 2) empirically confirmed the measurement model hypothesized for the ESEBS: the two-factor model had a good fit with the data (χ^2 (19) = 62.852, $p < 0.001$; CFI = 0.959; RMSEA = 0.075; SRMR = 0.040.), the standardized loadings ranged from 0.634 to 0.842 and the two factors were positively correlated (0.30; $p < 0.001$). The posited two-factors model created the best balance between the desirable characteristics of parsimony and good fit to the observed data as compared to an alternative model with one factor solution (fit of the one factor model: χ^2 (20) = 436.628, $p < 0.001$; CFI = 0.612; RMSEA = 0.226; SRMR = 0.155).

Internal consistency was acceptable since the Cronbach's alphas were above 0.70 [33, 34], namely being 0.820 for the Emotional scale and 0.786 for the Social scale. In addition, the reliability of the two scales was estimated by means of coefficient omega [57], which was respectively 0.836 and 0.831.

Measurement invariance

The results of the multi-group CFAs are summarized in Table 3. The fit indices of the unconstrained model demonstrated the configurable invariance of the ESEBS across gender. The model with all the factor loadings constrained to be equal across groups confirmed the full metric invariance of the ESEBS across the groups. Finally, the model in which all the item intercepts were constrained to be equal across gender groups showed full scalar invariance.

Latent mean differences

With males being the reference group, the latent mean on the Emotional scale was − 0.31 ($p < 0.01$) and on the Social scale − 0.27 ($p < 0.05$). Therefore, the results of the analyses across gender with respect to the two scales show that females, compared to males, reported significantly lower levels of eating self-efficacy in both subscales.

Criterion validity

Table 4 shows the latent correlations controlling for gender between each ESEBS factor and the disordered eating score, the three emotional eating scores, and the BMI.

Table 3 Summary of fit statistics for the assessment of measurement invariance of the ESEBS across gender

Invariance hypothesis	CFI	ΔCFI	RMSEA	ΔRMSEA	SRMR	ΔSRMR
Configural invariance (gender)	0.944	–	0.085	–	0.055	–
Metric invariance (gender)	0.942	0.002	0.084	0.001	0.062	0.007
Scalar invariance (gender)	0.937	0.005	0.083	0.001	0.063	0.001

Table 4 Latent correlations controlling for gender between eating self-efficacy factors, disordered eating, emotional eating, and body mass index

	DEQ	EAT-26	EES-D	EES-A	EES-R	BMI
Emotional ESEBS	− 0.29**	− 0.16**	− 0.48**	− 0.21**	− 0.53**	− 0.17**
Social ESEBS	− 0.14*	− 0.03	− 0.23**	− 0.22**	− 0.17**	0.07

ESEBS Eating Self-Efficacy Brief Scale, *DEQ* Disordered Eating Questionnaire, *EAT-26* eating attitude test-26, *EES-D* emotional eating-depression, *EES-A* emotional eating-anxiety, *EES-R* emotional eating-anger

**$p \leq 0.001$, *$p \leq 0.01$

Discussion

The purpose of the present study was to develop a brief scale with sound psychometric properties to measure perceived eating self-efficacy as the ability to resist the impulse to eat. The final version of the ESEBS scale includes 8-items designed to assess self-confidence in regulating eating behaviour in situations that challenge the self-regulation of this behaviour, such as social facilitation (e.g. in presence of familiar others and food availability) or emotional activation (especially negative emotions). The ESEBS differs from previous instruments that assess eating self-efficacy [2, 16, 20, 21] in numerous ways, such as having fewer items and focusing on eating self-efficacy beliefs in different circumstances, instead of focusing on dieting, healthy eating or weight management. Specifically, it differs from the only previous scale assessing these two selected situations [2] for having 8 items instead of 25, potentially facilitating its use in research and intervention programs. The results of Study 1, considering a preliminary 25-items version, evidenced a bifactorial structure. Hence, 4-items for each factor were selected, explaining 63% of the variance. Overall, the 8-items selected are well representative of the two posited situations. In Study 2, the CFA empirically confirmed the two-factor model that was hypothesized for the scale. The findings also supported the internal consistency of the ESEBS, especially if one takes into consideration the low number of items included in each subscale: the Cronbach's alpha values were 0.786 (Social) and 0.820 (Emotional), respectively. Furthermore, the multigroup CFA analysis showed a significant difference in the latent means of both subscales between males and females, indicating that the ESEBS may vary across gender. These results are in line with previous findings, demonstrating that females young adults, compared to males, report higher scores of emotional eating [58, 59] and social eating [60, 61].

Latent correlations with previously established measures of disordered and emotional eating supported the criterion validity of the ESEBS. In particular, the two latent ESEBS scales were negatively correlated with two measures of disordered eating and emotional eating. The association between eating self-efficacy and behavioural and psychological characteristics related to eating disorders [1, 26–29] is well documented in previous studies. Moreover, it has been reported an association between the use of dysfunctional strategies for regulating emotions and food intake increase [5, 6].

The present study has several limitations that need to be acknowledged. First, the findings may not be generalized since the majority of our sample was young adults. Future research should provide further validation of the ESEBS measure considering various other non-clinical and clinical populations. Second, reliability of the ESEBS still needs to be verified through test–retest assessment since the cross-sectional design limits our knowledge about stability of the responses. Third, future longitudinal studies will also allow to ascertain the predictive validity of the scale as well as to examine the convergent and discriminant validity. Moreover, including different clinical samples (e.g. different EDs diagnoses) and controls with and without obesity/overweight, Roc curves could be computed and cut-off scores estimated. Based on the findings from the present study, using a non-clinical sample, our 8-items brief scale appears to be a valid and reliable measure, which is also invariant across gender, to assess eating self-efficacy related to social and emotional contexts that may be used in intervention promoting health and wellbeing. Moreover, future studies should evaluate the psychometric properties of the ESEBS scale in clinical samples. The brevity of this scale, coupled with good psychometric properties, suggest that it could also be a useful instrument for reducing the response burden in clinical and research settings where time is limited.

What is already known on this subject?

Emotional and social factors can challenge individuals' eating self-efficacy. Despite the number of instruments proposed, most of them focus on dieting, healthy eating and weight, especially in contexts evaluating weight-loss interventions.

What does this study add?

The Eating Self Efficacy Brief Scale (ESEBS) is an 8-item brief and reliable tool for assessing eating self-efficacy beliefs. It differs from previous scales for its focus on the ability to resist the urge to eat during social and emotional circumstances and for its briefness, facilitating its use in research and intervention programs.

Funding This study did not receive specific fundings.

Compliance with ethical standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the Institutional Review Board of the Department of Psychology, Sapienza University of Rome 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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