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RESEARCH ARTICLE

The Metacognitions about Binge Eating Questionnaire: Investigation of the association between specific metacognitions and Binge Eating Disorder

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Abstract

Literature suggested that metacognitions are involved in eating problems and may be relevant to the understanding of Binge Eating Disorder (BED). The goal of the current studies was to develop the first self-report instrument on metacognitions about binge eating. In Study 1, a community sample completed the Metacognitions about Binge Eating Questionnaire (MBEQ); an Exploratory Factor Analysis (EFA) was performed. In study 2, a community sample completed the MBEQ and measures assessing severity of binge eating, irrational food beliefs, anxiety, depression, impulsiveness. A Confirmatory Factor Analysis (CFA) was performed. Concurrent and incremental validity were assessed. In study 3, a clinical sample of participants with a diagnosis of BED completed the MBEQ and other measures. Bivariate correlational analysis and hierarchical linear regression were performed. Participants from the general population and participants with a diagnosis of BED were compared. EFA and CFA supported a two-factor solution consisting of positive and negative metacognitions about binge eating. Concurrent and incremental validity were acceptable. The metacognitions factors correlated positively with anxiety, depression, irrational food beliefs, impulsiveness in the community sample, and anxiety, irrational food beliefs, impulsiveness in clinical sample. The metacognitions factors contributed to the prediction of BEDs symptoms, in community and clinical samples, over and above age, gender, impulsiveness, anxiety, depression, irrational food beliefs. The MBEQ possesses good psychometric properties and appears a reliable and valid measure of positive and negative metacognitions about binge eating. Metacognitions about binge eating could be a therapeutic target to reduce the severity of binge eating episodes.

KEYWORDS

Binge Eating Disorder, metacognitions, questionnaire

1 | INTRODUCTION

In the early 1990s Wells and Matthews (1994, 1996) prosed the Self-Regulatory Executive Function (S-REF) model according to which psychological dysfunction was purported to be linked to maladaptive metacognitions. Metacognitions refer to beliefs about one's cognitive-affective states and strategies to control such states. In the S-REF model metacognitions broadly take two forms: positive (i.e., beliefs pertaining to the benefits of engaging in specific strategies to control cognitive-affective states) and negative (i.e., beliefs about the uncontrollability and danger of strategies to control cognitive-affective states and the detrimental derivates of employing such strategies) (Wells & Matthews, 1994, 1996). Metacognitions have been reported to underlie etiological and maintenance mechanisms as well as severity of symptoms, in both general and clinical populations, for a wide range of psychological disorders including Generalized Anxiety Disorder, Major Depressive Disorder, Obsessive–Compulsive Disorder, Stress-Related Disorder, Psychotic Disorders, Personality Disorders, the spectrum of addictive behaviours, emotion dysregulation and Physical Illnesses (Hamonniere & Varescon, 2018; Lenzo et al., 2020; Mansueto et al., 2019, 2022; Rogier et al., 2021; Sellers et al., 2017; Spada, Caselli, Nikčević, & Wells, 2015; Spada et al., 2021; Sun et al., 2017).

Although metacognitions may appear to overlap with expectancies, research has shown (Nikčević et al., 2017; Spada et al., 2007) that they are two different constructs. Expectancies have been described as learned relations between behaviours and their consequences that are stored in memory and that influence future behavioural choices (Bolles, 1972; Rotter, 1954; Tolman, 1932). Through learning experiences (Miller et al., 1990), individuals learn that if a given behaviour is activated, then a specific consequence is expected to follow. Metacognitions, differ from expectancies, as they are specifically focused on the positive or negative cognitive-affective effects of engaging in problematic behaviours (Wells, 2009). Indeed, previous studies have demonstrated that metacognitions and expectancies are only moderately correlated, and that metacognitions were associated with both smoking and drinking behaviour in general population, over and above expectancies (Nikčević et al., 2015, 2017; Spada et al., 2007).

Within the area of eating disorders, studies have shown that both positive and negative metacognitions are significantly higher in individuals with a diagnosis of an eating disorder (i.e., Anorexia Nervosa, Bulimia Nervosa, Eating Disorders Not Otherwise Specified) than in healthy controls from the general population, as well as in individuals from the general population with problematic eating attitudes compared to those with normal eating attitudes (Palmieri, Mansueto, et al., 2021). While the role of metacognitions in Anorexia Nervosa, Bulimia Nervosa, and Eating Disorders Not Otherwise Specified has been investigated (Palmieri, Mansueto, et al., 2021), up until present, metacognitions related to BED remain an area for further investigation. A recent qualitative study (Palmieri, Gentile, et al., 2021), using the Metacognitive Profiling Interview, identified the presence of specific positive and negative metacognitions about binge eating in individuals with a diagnosis of BED. Positive metacognitions about binge eating were found to be related to the usefulness of engaging in binge eating as a means of (i) interrupting perseverative thinking about concerns; (ii) feeling well-being and happiness; (iii) releasing tension and relax; (iv) compensating for boredom (Palmieri, Gentile, et al., 2021). Examples of positive metacognitions about binge eating include 'When I binge, my worries disappear' or 'When I binge my negative thoughts and feelings disappear' (Palmieri, Gentile, et al., 2021). Negative metacognitions about binge eating have been conceptualized as beliefs concerning the uncontrollability of binge eating and its negative impact on cognitive-affective states (Palmieri, Gentile, et al., 2021). Examples of negative metacognitions about binge eating include: 'Once I start to binge, I cannot stop' or 'I have little control over my bingeing' (Palmieri, Gentile, et al., 2021).

Key Practitioner Message

- The Metacognitions about Binge Eating Questionnaire (MBEQ) may help to identify positive and negative metacognitions about binge eating.
- The metacognitions contributed to the prediction of Binge Eating Disorders symptoms.
- Metacognitions about binge eating could be a therapeutic target.

To date no validated measures of specific metacognitions in BED have been put forward. The development of a validated measure by which to identify and assess metacognitions related to binge eating may help clinicians and practitioners to explore, in depth, the role of specific metacognitions involved in the activation and perseveration of binge eating.

The present study aims to fill this gap in the literature by developing and validating a psychometric measure of metacognitions underlying BED, the Metacognitions about Binge Eating Questionnaire (MBEQ). The specific aims of our studies were (1) In Study 1 to explore the factor structure of the preliminary version of the MBEQ; (2) In Study 2 to confirm the factor structure of the MBEQ and examine its concurrent and incremental validity; and (3) In Study 3 to examine the MBEQ in a clinical sample as well as to compare participants with a diagnosis of BED and participants from the general population.

Study 1: Construction of the Metacognitions about Binge Eating Questionnaire (MBEQ)

We conducted a study to explore the factor structure of the preliminary version of the MBEQ in a community sample.

2 | METHOD

2.1 | Participants

A sample of individuals from the general population agreed to participate in the study, which was approved by the Ethics Committee of the School of Applied Sciences (Division of Psychology) at London South Bank University. All procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. For purposes of inclusion participants were required to (1) be 18 years of age or above; (2) consent to participate; (3) understand spoken and written Italian; and (4) report at least one episode of binge eating within the previous 3 months.

A total of 205 individuals completed the measures of which 170 (82.9%) were females and 35 (17.1%) were males (the mean age of the sample was 35.72 ± 11.53 years) and 0 (0%) was non-binary. With regard to ethnic background, 204 (99.5%) participants were White and one Latin American (0.5%). With regard to education level, two (1%) participants completed secondary school, 57 (27.8%) completed high school, 101 (49.3%) were graduates, and 45(21.9%) achieved a post-bachelor degree. With regard to civil status, 103 (50.3%) participants were unmarried, 56 (27.2%) were married, 39 (19%) were cohabiting, 6 (3%) were divorced and one (0.5%) was widower.

2.2 | Materials

Metacognitions about Binge Eating Questionnaire (MBEQ, preliminary version)

The MBEQ items representing positive and negative metacognitions about binge eating were derived from previous research on profiling metacognitions in Binge Eating Disorder (Palmieri, Gentile, et al., 2021), as well as from the authors' clinical experience and from deductions based on the metacognitive model of psychopathology (Wells, 2009).

The items selected as positive metacognitions about binge eating concerned the usefulness of bingeing in achieving mental and emotional regulation (e.g., 'Bingeing helps me get distracted from my thoughts', 'Bingeing reduces my irritability'). The items selected as negative metacognitions about binge eating concerned the uncontrollability of binge eating and bingeing-related thoughts (e.g., 'When start bingeing I cannot stop', 'My thoughts about bingeing are uncontrollable'). A total of 24 items were framed in terms of statements to which participants were required to report the extent of their agreement on a four-point Likert-type scale (1 = '*Do not agree*', 2 = '*Agree slightly*', 3 = '*Agree moderately*' and 4 = 'Agree very much'). Higher scores indicate higher levels of maladaptive metacognitions. The original MBEQ was developed in Italian and completed in Italian by the participants. Successively, the MBEQ was translated into English by M.M.S. and S.P. given that the research project has been submitted to the Ethics Committee of the School of Applied Sciences (Division of Psychology) at London South Bank University.

Binge Eating Scale (BES; Gormally et al., 1982)

The BES consists of 16 items assessing binge eating on the basis of behavioural characteristics (e.g., amount of food consumed) and the emotional and cognitive responses (e.g., guilt, feeling out of control). Each item includes three to four statements that are differently weighted response options (from 0 to 3), which represent a rate of severity for each measured characteristic. Participants are asked to indicate the statement that best describes their experience, for example, question 1: (a) I don't feel self-conscious about my weight or body size when I'm with others; (b) I feel concerned about how I look to others, but it normally does not make me feel disappointed with myself; (c) I do get self-conscious about my appearance and weight which makes me feel disappointed in myself; (d) I feel very self-conscious about my weight and frequently, I feel intense shame and disgust for myself. I try to avoid social contacts because of my self-consciousness. The scale's total score ranges from 0 to 46, with higher scores representing higher endorsement of binge eating symptoms. The scale has three scoring categories: 17 or below (corresponding to non-bingeing), 18–26 (corresponding to moderate bingeing) and 27 and higher (corresponding to severe bingeing). Overall, the scale possesses good validity and reliability (Gormally et al., 1982) and has been widely used in both clinical and non-clinical research samples (Celio et al., 2004). The scale has been validated in Italian (Di Bernardo et al., 1998). In the present study the BES showed good internal consistency (Cronbach's alpha = 0.93).

2.3 | Procedure

Participants were recruited using e-mail lists and advertisements on social network groups. A web link directed the participants to the study website. The first page of the study explained the purpose of the study: 'To develop a self-report questionnaire to assess beliefs people hold about eating'. Participants were then directed, if consenting to participate in the study, to a second page containing basic demographic questions (age, gender, educational level, marital status, height, weight and ethnicity) and the self-report measures. On completion participants were asked to click on the 'Submit' button. Once participants had clicked on 'Submit', their data were forwarded to a generic postmaster account in order to guarantee the anonymity of the responses. A second submission from the same IP address was not allowed so as to avoid multiple submissions from the same participant.

2.4 | Statistical analyses

Exploratory Factor Analysis (EFA), employing principal component analyses method with Promax rotation, was used to explore the factor structure of the MBEQ. The lowest accepted loading was 0.4 or above. Kaiser-Meyer-Olkin (KMO) test (Kaiser, 1970) and Bartlett's test of sphericity (Bartlett, 1937) were performed. Data were analysed using version 27 of SPSS (IBM SPSS Statistics). The number of factors to be extracted was firstly determined according to the consideration of the Kaiser's eigenvalue criterion (eigenvalues > 1), (Kaiser, 1970) and to the scree-test criteria (Cattell, 1966). We then assessed the items as indicators of the latent variables using a Promax rotation adopting kappa = 4 (Nikčević & Spada, 2020). It was decided a priori that items that loaded less than 0.4 on any factor would be discarded as would be items that loaded above 0.4 on both factors. If, however, an item loaded more than 0.4 on only one factor, but the second factor loading was within 0.2 of the loading on the first factor, it would also be discarded. For example, if a factor loaded 0.5 on the first factor, it would be discarded if the loading on the second factor was above 0.3. This protocol, as previously suggested (Caselli et al., 2018; Hinkin, 1998; Nikčević et al., 2015; Nikčević & Spada, 2020) was used in order to exclude items that influenced both factors.

3 | RESULTS

A Principal Components Analysis (PCA) for factor extraction was performed. Assumptions for PCA were met: a linear relationship between the variables was confirmed by examining the correlation matrix (all items were correlated at least .03 with at least one other item), the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.94, and the Barlett's test of sphericity was significant (<0.001) suggesting that data was suitable for factor analysis. The communalities were in the range between 0.32–0.83.

The PCA of the MBEQ items yielded four factors with an eigenvalue >1. The scree-plot indicated a four-factor solution. After removing the item which loaded on more than one factor, a second PCA was run. The second PCA yielded three factors: not all items loaded clearly on one of these factors. Finally, we tested a conceptual two factor solution, including all 24 items, with positive

TABLE 1 MBEQ factor loadings. Principal components analysis with Promax rotation.

	Factor 1 Positive metacognitions about binge eating	Factor 2 Negative metacognitions about binge eating
1. Bingeing reduces my worries	**0.810**	−0.025
2. Bingeing helps me get distracted from my thoughts	**0.781**	0.071
3. When I binge, my worries disappear	**0.770**	0.046
4. When I binge my negative thoughts and feelings become less important	**0.871**	−0.090
5. Bingeing helps me to stop thinking	**0.812**	0.080
6. Bingeing makes me relaxed	**0.867**	−0.150
7. Bingeing reduces my irritability	**0.942**	−0.196
8. Bingeing alleviates my boredom	**0.781**	−0.091
9. Bingeing makes my worries more bearable	**0.807**	0.055
10. Bingeing helps me to relax when I am agitated	**0.751**	0.087
11. Bingeing distracts me from feeling pressured	**0.737**	0.145
12. When I get stressed bingeing calms me down	**0.821**	0.027
13. I have little control over my bingeing	0.175	**0.743**
14. I have no control over my bingeing	0.118	**0.786**
15. When start bingeing I cannot stop	0.158	**0.769**
16. Bingeing makes me feel guilty	−0.029	**0.751**
17. I cannot control my urge to binge	0.112	**0.833**
18. It is hard to control my desire to binge	0.127	**0.805**
19. Bingeing means I have low will power	−0.067	**0.707**
20. I cannot stop thinking about binge eating	0.060	**0.772**
21. Thoughts about binge eating often come to mind	0.182	**0.661**
22. Having the thought of wanting to binge is bad	−0.315	**0.734**
23. Having the thought of wanting to binge will make it happen	−0.190	**0.751**
24. My thoughts about bingeing are uncontrollable	0.058	**0.811**

metacognitions about binge eating as a first unique factor and negative metacognitions about binge eating as a second unique factor. The PCA of the MBEQ items yielded the two factors; the scree-plot clearly indicated a two-factor solution. All items loaded clearly on one of the two factors, with a minimum loading of 0.61. The two factors together accounted for 64.77% of variance, and the estimated correlation between the two factors was 0.69. The first factor referred to positive metacognitions about the usefulness of bingeing, we termed this factor 'Positive metacognitions about binge eating' (MBEQ-P; 12 items). The second factor referred to negative metacognitions about binge eating uncontrollability and bingeing-related thoughts. We termed this factor 'Negative metacognitions about binge eating' (MBEQ-N; 12 items). A summary of the PCA is displayed in Table 1.

Study 2: Confirmation of the Factor Structure and Preliminary Examination of the Concurrent and Incremental Validity of the MBEQ

We conducted a second study aimed to confirm the factor structure and test the concurrent and incremental validity of the MBEQ. In accordance with the metacognitive model of psychopathology positive metacognitions about binge eating should be involved in the initiation of bingeing, while negative metacognitions about binge eating may be involved in the propagation of a binge eating episode once it has started (Palmieri, Gentile, et al., 2021). In view of this, we chose a general severity index of binge eating (BES) as the dependent variable to test the incremental validity of the MBEQ factors. In order to test the concurrent validity of the MBEQ factors, we also administered the Irrational Food Beliefs Scale (IFB, Osberg et al., 2008), which assesses food-specific biased beliefs, and the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) to control for negative affect.

4 | METHOD

4.1 | Participants

A sample of individuals from the general population agreed to participate in the study which was approved by the Ethics Committee of the School of Applied Sciences (Division of Psychology) at London South Bank University. All procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Participants were eligible for inclusion in the study if they (1) were 18 years of age; (2) resided in Italy; (3) understood spoken and written Italian; (4) consented to participate; and (5) reported at least one episode of binge eating within the previous 3 months.

A total of 209 individuals participated in the study, 141 (67.5%) of which were females and 68 (32.5%) were males, and 0 (0%) was non-binary; the mean age was 35.84 ± 10.79 years. The sample reported their ethnic background as follows: 208 (99.5%) participants were White and one Latin American (0.5%). With regard to education level, 83 (39.7%) of participants had completed high school, 83 (39.7%) had graduated, and 43(20.6%) achieved a post-bachelor degree. With regard to civil status, 112 participants (53.4%) were unmarried, 52 (24.9%) were married, 39 (18.7%) were cohabiting, and 6 (2.9%) were divorced.

4.2 | Materials

Metacognitions about Binge Eating Questionnaire (MBEQ)

The MBEQ is the self-report measure developed in Study 1.

Binge eating Scale (BES, Gormally et al., 1982)

The BES is the self-report measure used is Study 1 (see Section 2.2). In the present study the BES showed good internal consistency (Cronbach's alpha = 0.94).

The Irrational Food Beliefs Scale (IFBS; Osberg et al., 2008).

The IFBS consists of 57 items, 16 of which are contained in the Rational Food Beliefs subscale and 41 of which are contained in the Irrational Food Beliefs subscale, assessing cognitive distortions and inappropriate attitudes and beliefs about food such as 'food is my only source of pleasure' and 'food is a good way to lift depression'. We administered only the Irrational Food Beliefs subscale. Participants indicate how much they agree with the statements using a four-point Likert scale, ranging from 1 'Strongly Disagree' to 4 'Strongly Agree'. The Irrational Food Beliefs subscale's total score (i.e., the sum of all of the item ratings) ranges from 41 to 164, with higher scores representing higher endorsement of irrational food beliefs. Overall, the scale possesses good validity and reliability (Lobera & Bolaños, 2010; Osberg et al., 2008). The Italian version of the scale, used in the present study has been back translated and used in a previous study (Spada et al., 2015) showing a good internal consistency. In the present study the IFBS showed good internal consistency (Cronbach's alpha = 0.96).

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)

The HADS consists of 14 items, seven assessing anxiety and seven assessing depression. The anxiety factor includes items such as 'I get a sort of frightened feeling as if something horrible is about to happen'. The depression factor includes items such as 'I feel as if I am slowed down'. Participants indicate how much they agree with the statements by choosing one of the four answer options in terms of how they have been feeling over the past week (e.g., from 0 = '*not at all*' to 3 = '*most of the time*'). Anxiety subscale's total score (i.e., the sum of all of the item ratings) and Depression subscale's total score (i.e., the sum of all of the item ratings) have four scoring categories

where higher scores represent higher levels of anxiety and depression: 7 or below (corresponding to normal value), 8–10 (corresponding to mild depression or anxiety), 11–14 (corresponding to moderate depression or anxiety) and 15 and higher (corresponding to severe depression or anxiety) (Zigmond & Snaith, 1994). Overall, the scale possesses good validity and reliability (Caci et al., 2003; Herrmann, 1997; Mykletun et al., 2001; Zigmond & Snaith, 1983). HADS was chosen as a measure of negative affect because it is widely used in both clinical and non-clinical research samples across a variety of domains in psychopathology including smoking (e.g., Alati et al., 2004; Wagena et al., 2005). The scale has been validated in Italian (Costantini et al., 1999). In the present study the HADS showed good internal consistency (Cronbach's alpha = 0.91).

The Barratt Impulsiveness Scale-11 (BIS-11, Patton et al., 1995)

The BIS-11 consists of 30 items divided in three subscales: attentional impulsiveness (rapid, unstable thoughts and lack of cognitive patience, e.g., 'I don't pay attention'), motor impulsiveness (motor impulsiveness and lack of perseverance, e.g., '*I act on the spur of the moment*') and non-planning impulsiveness (lack of self-control and future orientation, e.g., '*I am more interested in the present than the future*'). Each item is measured on a four-point Likert scale ranging from 1 '*rarely*' to 4 '*almost always/always*'; four usually indicates the most impulsive response excepted for the reverse items. The BIS-11 total score (i.e., the sum of all of the item ratings) ranges from 30 to 120 with higher scores indicate higher levels of impulsiveness. The scale has been validated in Italian (Fossati et al., 2001). In the present study the BIS-11 showed good internal consistency (Cronbach's alpha = 0.91).

4.3 | Procedure

The procedure used in Study 2 was the same as the one used in Study 1 (see Section 2.3). Participants provided the same socio-demographic details required in Study 1. They then completed the self-report measures.

4.4 | Statistical analyses

A Confirmatory Factor Analysis (CFA) using the Lavaan package (Rosseel, 2012) of software R (R Development Core Team, 2013) was implemented to evaluate the construct validity of the MBEQ. Weighted least estimation with robust standard errors and mean and variance estimator for ordinal items was adopted. The indices used to assess the fit of the model were the Chi-square (χ^2), the comparative fit index (CFI; acceptable fit ≥ 0.90), the goodness-of-fit index (GFI; acceptable fit ≥ 0.90), the root mean square error of approximation (RMSEA; acceptable fit ≤ 0.08) (Browne & Cudeck, 1993), the standardized root mean square residual (SRMR; good fit ≤ 0.08) (Hu & Bentler, 1999), the Tucker-Lewis Index (TLI), the normed fit index (NFI) and the incremental fit index (IFI).

Skewness and kurtosis were assessed and were considered adequate for a linear model of analysis in a range of ±2 (Gravetter & Wallnau, 2016). Bivariate correlation analyses were run to evaluate concurrent validity of the MBEQ, by observing whether the two factors of the MBEQ would significantly correlate with measures of food-specific biased beliefs (i.e., IFBS). Hierarchical linear regression analysis was also run to evaluate incremental validity of the MBEQ by observing whether the MBEQ would explain additional variance in BES scores when controlling for age and gender, impulsiveness, anxiety, depression and food-specific biased beliefs. Statistical assumptions for using hierarchical linear regression analyses were evaluated (Barbaranelli & D'Olimpio, 2006; Field, 2017; Myers, 1990).

5 | RESULTS

Table 2 presents the results of CFA, showing a comparison between the 2-factor model and 1-factor model. In the first model, we defined a two factors solution as emerged from the EFA in Study 1. In the second model, we defined a single latent variable with all 24 items as indicators. The two-factor model ($\chi^2 = 188.89$, $df = 251$, SRMR = 0.054, RMSEA = 0.000 [0.000–0.000], GFI = 0.994, CFI = 1.000, NFI = 0.992, TLI = 1.003, IFI = 1.003) had the best model fit. Therefore, the two dimensions of the MBEQ (i.e., 'Positive metacognitions about binge eating' and 'Negative metacognitions about binge eating') were used in the subsequent analyses.

Table 3 presents means, standard deviations, ranges, skewness and kurtosis, suggesting that the variables of interest were overall normally distributed. Concurrent validity was evaluated by examining the correlation between MBEQ and IFBS. Correlation analyses showed that both the MBEQ-Positive metacognitions about binge eating and the MBEQ-Negative metacognitions about binge eating were positively correlated with the IFBS. The data also showed that all variables correlated with each other.

TABLE 2 Model fit indices of confirmatory factor analysis for the MBEQ.

	χ^2	*DF*	χ^2/df	SRMR	RMSEA	GFI	CFI	NFI	TLI	IFI
Two-factor solution	188.89	251	0.75	0.054	0.000	0.994	1.000	0.992	1.003	1.003
One-factor solution	564.49	252	2.24	0.094	0.077	0.981	0.987	0.997	0.986	0.987

Note: All the models were estimated with zero cross-loadings and correlated errors; χ^2 = chi-square index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; GFI = goodness of fit; CFI = comparative fit index; NFI = normed fit index; TLI = Tucker-Lewis Index; IFI = incremental fit index.

TABLE 3 Means, standard deviations, and inter-correlations of variables among general population.

		Mean ± S.D.	Skewness	Kurtosis	1	2	3	4	5	6	7	8	9	10
1	Age	35.84 ± 10.78	0.698	−0.562	1	0.190**	0.352***	0.198**	−0.183**	−0.006	0.508***	−0.009	0.189**	0.168*
2	BES	19.77 ± 11.98	0.133	−0.999		1	0.671***	0.882***	0.501***	0.538***	0.647***	0.519***	0.618***	0.517***
3	MBEQ-P	27.94 ± 10.47	0.122	−0.927			1	0.745***	0.256***	0.287***	0.846***	0.406***	0.589***	0.544***
4	MBEQ-N	30.19 ± 10.52	−0.046	−1.002				1	0.505***	0.519***	0.639***	0.494***	0.611***	0.512***
5	HADS-A	8.94 ± 4.67	0.570	−0.230					1	0.735***	0.169*	0.592***	0.249***	0.215**
6	HADS-D	6.38 ± 3.89	−0.036	−0.230						1	0.251***	0.488***	0.181*	0.141*
7	IFBS	91.57 ± 20.66	0.192	−0.389							1	0.379***	0.601***	0.585***
8	BIS-A	16.47 ± 3.83	0.152	−0.606								1	0.671***	0.650***
9	BIS-M	22.50 ± 4.70	0.242	−0.645									1	0.810***
10	BIS-NP	27.53 ± 5.22	−0.803	−0.774										1

Note: BES = Binge Eating Scale; MBEQ-P = Positive metacognitions about binge eating; MBEQ-N = Negative metacognitions about binge eating; HADS-A = Hospital Anxiety and Depression Scale–Anxiety; HADS-D = Hospital Anxiety and Depression Scale–Depression; IFBS = Irrational Food Beliefs Scale; BIS-A = Barratt Impulsiveness Scale-11–Attentional Impulsiveness; BIS-M = Barratt Impulsiveness Scale-11–Motor Impulsiveness; BIS-NP = Barratt Impulsiveness Scale-11–Non Planning.
***$p < 0.001$. **$p < 0.01$. *$p < 0.05$.

Table 4 shows the hierarchical linear regression examining the incremental validity of the MBEQ in the prediction of BES. Before analysing data, assumptions were tested. For the current model the Variance Inflation Factor (VIF) values were all below 10 and the Tolerance Indexes were all above 0.20; therefore, we can conclude that there is no collinearity within our data (Bowerman & O'Connell, 1990; Field, 2017; Myers, 1990). Furthermore, the Durbin–Watson test (1.84), showed that there were no significant correlations between standardized residuals and independent variables (Barbaranelli & D'Olimpio, 2006; Field, 2017).

The dependent variable in the hierarchical regression model was the BES. The entry order of predictor variables (i.e., independent variables) was the following: age and gender on step 1; BIS-attentional, BIS-Motor, BIS-Non Planning on step 2; HADS-Anxiety on step 3; HADS-Depression on step 4; IFBS on step 5; MBEQ-positive metacognitions about binge eating on step 6; MBEQ-negative metacognitions about binge eating on step 7. Results indicated that MBEQ-Positive metacognitions about binge eating contributed an additional 0.7% variance to that explained by all other variables and that MBEQ-Negative metacognitions about binge eating contributed an additional 14.3% variance to that explained by all other variables. The final equation indicates that BIS-Motor, HADS-Depression, IFBS, MBEQ-Positive metacognitions about binge eating and MBEQ-Negative metacognitions about binge eating were significant predictors of BES accounting for a total of 80% of the variation in BES ($F = 77.34$, $df = 10$, $p < 0.001$).

Study 3. Examination of the MBEQ among Participants with a Diagnosis of BED. Comparison between Participants with a Diagnosis of BED and those from the General Population.

We conducted a third study aimed to explore the relationship between the variables of interest in a clinical population. Moreover, we also explored the differences between participants with a diagnosis of BED and of participants from the general population.

6 | METHOD

6.1 | Participants

A sample of individuals with BED diagnosis agreed to participate in the study which was approved by the Ethics Committee of the School of Applied Sciences (Division of Psychology) at London South Bank University. All procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Participants were eligible for inclusion in the study if they (1) were 18 years of age; (2) satisfied the diagnostic criteria of BED in accordance with the DSM-5; (3) resided in Italy; (4) understood spoken and written Italian; (5) consented to participate; and (6) reported at least one episode of binge eating within the previous 3 months.

TABLE 4 Hierarchical regression analyses predicting Binge Eating Scale (BES) scores among general population.

									95% confidence interval for *B*	
Predictor	***B***	**Std. error**	***β***	***t***	***R***	***R²***	***Adjusted R²***	**ΔR^2**	**Lower bound**	**Upper bound**
Model										
Step 1					0.18	0.03	0.22	0.03*		
Age	0.18	0.08	0.17*	2.29					0.03	0.34
Gender	1.01	1.84	0.04	0.55					−2.63	4.65
Step 2					0.65	0.43	0.41	0.39***		
Age	0.14	0.06	0.13*	2.15					0.01	0.27
Gender	−3.64	1.53	−0.14*	−2.38					−6.67	−0.62
BIS-A	0.86	0.25	0.27***	3.36					0.35	1.36
BIS-M	1.19	0.25	0.47***	4.68					0.69	1.69
BIS-NP	−0.09	0.22	−0.04	−0.39					−0.52	0.35
Step 3					0.74	0.54	0.53	0.12***		
Age	0.19	0.06	0.17**	3.19					0.07	0.30
Gender	−1.99	1.39	−0.08	−1.43					−4.73	0.76
BIS-A	−0.33	0.28	−0.10	−1.14					−0.89	0.24
BIS-M	1.30	0.23	0.51***	5.69					0.85	1.75
BIS-NP	0.13	0.20	0.06	0.65					−0.26	0.53
HADS-A	1.15	0.17	0.45***	6.90					0.82	1.48
Step 4					0.78	0.60	0.59	0.06***		
Age	0.13	0.06	0.12*	0.228					0.02	0.24
Gender	−2.17	1.30	−0.09	−1.67					−4.74	0.40
BIS-A	−0.54	0.27	−0.17*	−1.98					−1.07	−0.003
BIS-M	1.35	0.21	0.54***	6.33					0.93	1.78
BIS-NP	0.22	0.19	0.09	1.17					−0.15	0.59
HADS-A	0.51	0.20	0.20**	2.56					0.18	0.90
HADS-D	1.12	0.21	0.37***	5.23					0.70	1.55
Step 5					0.81	0.66	0.64	0.06***		
Age	−0.03	0.06	−0.03	−0.51					−0.15	0.09
Gender	−2.21	1.21	−0.09	−1.83					−4.60	0.17
BIS-A	−0.34	0.25	−0.11	−1.33					−0.84	0.16
BIS-M	1.05	0.21	0.41***	5.07					0.64	1.45
BIS-NP	−0.05	0.18	−0.02	−0.28					−0.41	0.31
HADS-A	0.47	0.18	0.18*	2.53					0.10	0.83
HADS-D	0.91	0.20	0.30***	4.47					0.51	1.31
IFBS	0.21	0.04	0.37***	5.55					0.14	0.29
Step 6					0.82	0.67	0.65	0.007*		
Age	−0.02	0.06	−0.02	−0.35					−0.14	0.09
Gender	−2.09	1.20	−0.08	−1.74					−4.46	0.28
BIS-A	−0.33	0.25	−0.11	−1.30					−0.82	0.17
BIS-M	0.99	0.21	0.39***	4.79					0.58	1.40
BIS-NP	−0.04	0.18	−0.02	−0.23					−0.40	0.32
HADS-A	0.43	0.18	0.17*	2.35					0.07	0.80
HADS-D	0.90	0.20	0.30***	4.47					0.50	1.30
IFBS	0.14	0.05	0.24*	2.56					0.03	0.24
MBEQ-P	0.18	0.09	0.16*	1.97					0.000	0.37

TABLE 4 (Continued)

Predictor	*B*	Std. error	*β*	*t*	*R*	R^2	*Adjusted* R^2	ΔR^2	95% confidence interval for *B*	
									Lower bound	Upper bound
Step 7					0.90	0.82	0.80	0.14***		
Age	−0.03	0.04	−0.03	−0.69					−0.12	0.06
Gender	−0.84	0.92	−0.03	−0.91					−2.65	0.98
BIS-A	0.06	0.19	0.02	0.30					−0.32	0.44
BIS-M	0.38	0.16	0.15*	20.29					0.05	0.70
BIS-NP	−0.10	0.14	−0.04	−0.75					−0.37	0.17
HADS-A	0.04	0.14	0.01	0.26					−0.24	0.32
HADS-D	0.36	0.16	0.12*	2.26					0.05	0.68
IFBS	0.14	0.04	0.24***	3.45					0.06	0.22
MBEQ-P	−0.19	0.08	−0.16*	−2.39					−0.34	−0.03
MBEQ-N	0.81	0.07	0.70***	11.68					0.67	0.94

Note: BES = Binge Eating Scale; BIS-A = Barratt Impulsiveness Scale-11–Attentional Impulsiveness; BIS-M = Barratt Impulsiveness Scale-11–Motor Impulsiveness; BIS-NP = Barratt Impulsiveness Scale-11–Non Planning; HADS-A = Hospital Anxiety and Depression Scale–Anxiety; HADS-D = Hospital Anxiety and Depression Scale–Depression; IFBS = Irrational Food Beliefs Scale; MBEQ-P = Positive metacognitions about binge eating; MBEQ-N = Negative metacognitions about binge eating.
***$p < 0.001$.**$p < 0.01$.*$p < 0.05$.

A total of 100 individuals participated in the study, 71 (71%) of which were females and 29 (29%) of which were males, and 0 (0%) was non-binary. The mean age was 36.68 ± 12.85 years. The sample reported their ethnic background as follows: 208 (99.5%) participants were White and one Black (1%). With regard to education level, 3 (3%) of participants completed middle school, 60 (60%) completed high school, 29 (29%) had graduated, and 8 (8%) achieved a post-bachelor degree. With regard to civil status, 51 (51%) of participants were unmarried, 19 (19%) were married, 23 (23%) were cohabiting, 5 (5%) were divorced, and two (2%) were widower. The sample derived from Study 2 was used to compare participants with a diagnosis of BED and participants from the general population.

6.2 | Materials

Metacognitions about Binge Eating Questionnaire (MBEQ).

The MBEQ is the self-report measure developed in Study 1. In the present study the MBEQ showed good internal consistency (Cronbach's alpha = 0.96).

Binge eating Scale (BES, Gormally et al., 1982)

The BES is the self-report measure used in Study 1 (see Section 2.2). In the present study the BES showed acceptable internal consistency (Cronbach's alpha = 0.67).

The Irrational Food Beliefs Scale (IFB, Osberg et al., 2008)

The IFB is the self-report measure used in Study 2 (see Section 4.2). In the present study the IFB showed good internal consistency (Cronbach's alpha = 0.91).

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)

The HADS is the self-report measure used in Study 2 (see Section 4.2). In the present study the HADS showed good internal consistency (Cronbach's alpha = 0.83).

The Barratt Impulsiveness Scale-11 (BIS-11; Patton et al., 1995)

The BIS-11 is the self-report measure used in Study 2 (see Section 4.2). In the present study the BIS-11 showed good internal consistency (Cronbach's alpha = 0.92).

6.3 | Procedure

Participants were recruited in clinical settings in Italy: diagnostic criteria (in accordance with the DSM-5, APA, 2013) were verified by clinicians who also provided the option to participate in the study and given the link to complete the online questionnaires. The web link directed the participants to the study website. The first page of the study explained the purpose of the study Participants were then directed, if consenting to participate in the study, to a second page containing basic demographic questions (age, gender, educational level, marital status, height, weight and ethnicity) and the self-report measures. On completion participants were asked to click on the 'Submit' button. Once participants had clicked on 'Submit' button,

TABLE 5 Means, standard deviations and inter-correlations of variables among clinical sample.

		Mean ± S.D.	Skewness	Kurtosis	1	2	3	4	5	6	7	8	9	10
1	Age	36.68 ± 12.85	0.406	−0.710	1	−0.247*	−0.086	−0.092	−0.092	−0.115	0.272**	−0.275**	−0.205*	−0.300**
2	BES	34.07 ± 4.97	−0.700	−0.710		1	0.522***	0.602***	0.382***	0.370***	0.253*	0.379***	0.279**	0.392***
3	MBEQ-P	41.60 ± 7.70	−0.735	0.543			1	0.701***	0.117	0.128	0.401***	0.335***	0.309**	0.450***
4	MBEQ-N	42.41 ± 4.77	−0.639	−0.268				1	0.222*	0.180	0.254*	0.380***	0.298**	0.336***
5	HADS-A	9.91 ± 4.14	0.003	−0.440					1	0.529***	−0.057	0.492***	0.410***	0.298**
6	HADS-D	8.23 ± 3.73	0.193	−0.695						1	−0.097	0.279**	0.201*	0.171
7	IFBS	106.82 ± 9.42	0.256	−0.386							1	0.150	0.161	0.287**
8	BIS-A	17.71 ± 3.11	0.026	−0.085								1	0.772***	0.659***
9	BIS-M	24.98 ± 3.84	0.128	−0.803									1	0.843***
10	BIS-NP	31.54 ± 4.25	0.069	−0.577										1

Note: BES = Binge Eating Scale; MBEQ-P = Positive metacognitions about binge eating; MBEQ-N = Negative metacognitions about binge eating; HADS-A = Hospital Anxiety and Depression Scale–Anxiety; HADS-D = Hospital Anxiety and Depression Scale–Depression; IFBS = Irrational Food Beliefs Scale; BIS-A = Barratt Impulsiveness Scale-11–Attentional Impulsiveness; BIS-M = Barratt Impulsiveness Scale-11–Motor Impulsiveness; BIS-NP = Barratt Impulsiveness Scale-11–Non Planning.

***$p < 0.001$. **$p < 0.01$. *$p < 0.05$.

their data were forwarded to a generic postmaster account in order to guarantee the anonymity of the responses. A second submission from the same IP address was not allowed so as to avoid multiple submissions from the same participant.

6.4 | Statistical analyses

Skewness and kurtosis were assessed and were considered adequate for a linear model of analysis in a range of ±2 (Gravetter & Wallnau, 2016). Bivariate correlation analyses were run to evaluate the association between MBEQ and impulsiveness, anxiety and depression, food-specific biased beliefs. A hierarchical linear regression analysis was also run to evaluate incremental validity of the MBEQ by observing whether the MBEQ would explain additional variance in BES when controlling for age and gender, impulsiveness, anxiety, depression and food-specific biased beliefs. Statistical assumptions for using hierarchical linear regression analyses were evaluated (Barbaranelli & D'Olimpio, 2006; Field, 2017; Myers, 1990). Finally, a series of *t*-test and Chi square analyses were used to compare participants with a diagnosis of BED and participants from the general population on the study variables.

7 | RESULTS

Table 5 presents means, standard deviations, ranges, skewness, and kurtosis, suggesting that the variables of interest were overall normally distributed. Correlation analyses showed that both the MBEQ-Positive metacognitions about binge eating and the MBEQ- Negative metacognitions about binge eating were positively correlated with the IFBS.

Table 6 shows the hierarchical linear regression examining the predictors of BES among patients. Before analysing data, assumptions were tested. For the current model the VIF values were all below 10 and the Tolerance Indexes were all above .20; therefore, we can conclude that there is no collinearity within our data (Bowerman & O'Connell, 1990; Field, 2017; Myers, 1990). Furthermore, the Durbin–Watson test (1.53), showed that there were no significant correlations between standardized residuals and independent variables (Barbaranelli & D'Olimpio, 2006; Field, 2017).

The dependent variable in the hierarchical regression model was the BES. The entry order of predictor variables (i.e., independent variables) was the following: age and gender on step 1; BIS-attentional, BIS-Motor, BIS-Non Planning on step 2; HADS-Anxiety on step 3; HADS-Depression on step 4; IFBS on step 5; MBEQ-Positive metacognitions about binge eating on step 6; MBEQ-Negative metacognitions about binge eating on step 7. Results indicated that MBEQ-positive metacognitions about binge eating contributed an additional 7.6% variance to that explained by all other variables and that MBEQ-negative metacognitions about binge eating contributed an additional 6.9% variance to that explained by all other variables. The final equation indicates that age, HADS-Anxiety, HADS-Depression, IFBS and MBEQ-Negative metacognitions

TABLE 6 Hierarchical regression analyses predicting Binge Eating Scale (BES) scores among clinical sample.

									95% confidence interval for *B*	
Predictor	***B***	**Std. error**	***β***	***t***	***R***	***R²***	***Adjusted R²***	**ΔR^2**	**Lower bound**	**Upper bound**
Model										
Step 1					0.25	0.06	0.04	0.06*		
Age	0.73	1.22	0.07	0.60					−1.69	3.16
Gender	−0.11	0.04	−0.28*	−2.49					−0.19	−0.02
Step 2					0.49	0.24	0.20	0.18***		
Age	−0.05	0.04	−0.13	−1.25					−0.13	0.03
Gender	1.14	1.16	0.10	0.99					11.42	3.45
BIS-A	0.58	0.23	0.37*	2.54					0.13	1.04
BIS-M	−0.62	0.27	−0.48*	−2.34					−1.15	−0.09
BIS-NP	0.62	0.21	0.53**	3.01					0.21	1.04
Step 3					0.56	0.31	0.27	0.07**		
Age	−0.06	0.04	−0.16	−1.52					−0.133	−0.14
Gender	1.49	1.11	0.14	1.34					−0.72	3.70
BIS-A	0.36	0.23	0.22	1.55					−0.10	0.82
BIS-M	−0.72	0.26	−0.56**	−2.82					−1.23	−0.21
BIS-NP	0.70	0.20	0.60***	3.50					0.30	1.09
HADS-A	0.38	0.12	0.31**	3.14					0.14	0.61
Step 4					0.58	0.34	0.29	0.03		
Age	−0.05	0.04	−0.14	−1.38					−0.17	−0.13
Gender	1.37	1.10	0.13	1.25					−0.81	3.56
BIS-A	0.34	0.23	0.21	1.49					−0.11	0.80
BIS-M	−0.68	0.25	−0.53**	−2.70					−1.19	−0.18
BIS-NP	0.68	0.20	0.58***	3.45					0.29	1.07
HADS-A	0.25	0.13	0.21	1.89					−0.01	0.52
HADS-D	0.25	0.13	0.19	1.90					−0.01	0.52
Step 5					0.63	0.40	0.34	0.06**		
Age	−0.11	0.04	−0.27*	−2.54					−0.19	−0.02
Gender	1.57	1.06	0.14	1.48					−0.53	3.67
BIS-A	0.23	0.22	0.14	1.00					0.32	−0.22
BIS-M	−0.52	0.25	−0.40*	−2.10					−1.02	−0.03
BIS-NP	0.46	0.20	0.39*	2.24					0.05	0.86
HADS-A	0.30	0.13	0.25*	2.28					0.04	0.55
HADS-D	0.29	0.13	0.21*	2.12					0.03	0.54
IFBS	0.15	0.05	0.29**	2.98					0.05	0.25
Step 6					0.70	0.47	0.42	0.09***		
Age	−0.09	0.04	−0.24*	−2.35					−0.17	−0.01
Gender	0.98	1.01	0.09	−0.97					−1.02	2.98
BIS-A	0.13	0.21	0.08	0.62					0.54	−0.29
BIS-M	−0.37	0.24	−0.28	−1.54					−0.84	0.11
BIS-NP	0.24	0.20	0.21	1.22					−0.15	0.64
HADS-A	0.30	0.12	0.25*	2.47					0.06	0.54
HADS-D	0.25	0.12	0.18*	2.02					0.004	0.49
IFBS	0.10	0.05	0.18	1.93					−0.003	0.20
MBEQ-P	0.29	0.08	0.34***	3.61					0.13	0.46

(Continues)

TABLE 6 (Continued)

Predictor	*B*	Std. error	*β*	*t*	*R*	R^2	*Adjusted* R^2	ΔR^2	95% confidence interval for *B*	
									Lower bound	Upper bound
Step 7					0.74	0.54	0.49	0.07***		
Age	−0.08	0.04	−0.20*	−2.09					−0.15	−0.004
Gender	0.23	0.97	0.02	0.24					0.81	−1.69
BIS-A	0.03	0.20	0.02	0.16					−0.36	0.43
BIS-M	−0.35	0.22	−0.27	−1.58					−0.79	0.09
BIS-NP	0.28	0.19	0.24	1.48					−0.09	0.65
HADS-A	0.26	0.11	0.21*	2.31					0.03	0.48
HADS-D	0.24	0.11	0.18*	2.08					0.01	0.46
IFBS	0.09	0.05	0.18*	1.98					−0.001	0.19
MBEQ-P	0.07	0.10	0.08	0.71					−0.13	0.26
MBEQ-N	0.41	0.11	0.39***	3.68					0.19	0.63

Note: BES = Binge Eating Scale; BIS-A = Barratt Impulsiveness Scale-11–Attentional Impulsiveness; BIS-M = Barratt Impulsiveness Scale-11–Motor Impulsiveness; BIS-NP = Barratt Impulsiveness Scale-11–Non Planning; HADS-A = Hospital Anxiety and Depression Scale–Anxiety; HADS-D = Hospital Anxiety and Depression Scale–Depression; IFBS = Irrational Food Beliefs Scale; MBEQ-P Positive metacognitions about binge eating; MBEQ-N = Negative metacognitions about binge eating.
***$p < 0.001$.**$p < 0.01$.*$p < 0.05$.

TABLE 7 Differences between participants with a diagnosis of BED and of participants from general population on self-report measures.

	Participants with a diagnosis of BED		Participants from general population				
	M	*DS*	*M*	*DS*	*Df*	*t*	*p*
BES	34.07	4.97	19.77	11.98	307	−14.80	$p < 0.001$
MBEQ-P	41.60	5.70	27.94	10.47	307	−14.82	$p < 0.001$
MBEQ-N	42.41	4.77	30.19	10.52	307	−14.04	$p < 0.001$
HADS-A	9.91	4.14	8.94	4.67	294	−1.76	$p = 0.080$
HADS-D	8.23	3.73	6.38	3.89	294	−3.92	$p < 0.001$
IFBS	106.82	9.42	91.58	20.66	298	−8.77	$p < 0.001$
BIS-A	17.71	3.11	16.47	3.83	292	−2.99	$p = 0.003$
BIS-M	24.98	3.84	22.50	4.70	292	−4.85	$p < 0.001$
BIS-NP	31.54	4.25	27.53	5.22	292	−7.10	$p < 0.001$

Note: BES = Binge Eating Scale; MBEQ-P = Positive metacognitions about binge eating; MBEQ-N = Negative metacognitions about binge eating; HADS-A = Hospital Anxiety and Depression Scale–Anxiety; HADS-D = Hospital Anxiety and Depression Scale–Depression; IFBS = Irrational Food Beliefs Scale; BIS-A = Barratt Impulsiveness Scale-11–Attentional Impulsiveness; BIS-M = Barratt Impulsiveness Scale-11–Motor Impulsiveness; BIS-NP = Barratt Impulsiveness Scale-11–Non Planning.

about binge eating were significant predictors of BES accounting for a total of 49.2% of the variation in BES ($F = 10.61$, df = 10, $p < 0.001$).

When comparing participants with a diagnosis of BED to participants from the general population no differences were found for gender ($\chi^2 = .39$, $df = 1$, $p = 0.53$), civil status ($\chi^2 = 8.36$, $df = 5$, $p = 0.14$) and age (participants with a diagnosis of BED, mean ± SD = 36.68 ± 12.85 versus general population, mean ± SD = 35.84 ± 10.79; $t_{(df)} = -0.57_{(307)}$, $p = 0.57$). Significant differences between participants with a diagnosis of BED and participants from general population were found on educational level ($\chi^2 = 22.09$, df = 7, $p = 0.002$).

Comparing participants with a diagnosis of BED and of participants from general population on self-report measures (Table 7), significant differences were found for MBEQ-Positive metacognitions about binge eating, MBEQ-Negative metacognitions about binge eating, IFBS, HADS-Depression, BIS-Attentional Impulsiveness, BIS-Motor Impulsiveness, BIS-Non Planning and BES, while no differences were found for HADS-Anxiety.

8 | DISCUSSION

Within the framework of the S-REF model (Wells & Matthews, 1994, 1996) we have conducted three studies aimed at developing and

validating a self-report questionnaire on metacognitions about binge eating in BED (i.e., the Metacognitions about Binge Eating Questionnaire, MBEQ).

A PCA on a community sample of participants with binge eating episodes was ran in Study 1 and identified a two-factor solution for the MBEQ comprising of: MBEQ-Positive metacognitions about binge eating and MBEQ-Negative metacognitions about binge eating. The CFA, ran in Study 2, confirmed the factor structure of the MBEQ where the two-factor solution model outperformed the one-factor solution model. Overall, these findings are consistent with the S-REF perspective (Wells & Matthews, 1994, 1996).

Concerning concurrent validity, our results revealed that positive and negative metacognitions about binge eating were positively correlated with food-specific biased beliefs both in the general population and in participants with a diagnosis of BED. From a clinical point of view, these findings suggest that food-specific biased beliefs may, at least in part, result from metacognitive knowledge (Caselli et al., 2018; Wells & Matthews, 1994, 1996). It is plausible to assume that positive metacognitions about binge eating are linked to the generation or strengthening of food-specific biased beliefs by selecting cognitive strategies like the monitoring of potential reasons for starting to binge eat or reducing the impact of its negative effects. Moreover, negative metacognitions may reduce the appropriate monitoring of goal progress that in turn may prevent the disconfirmation of food-specific biased beliefs. However, it should be noted that a high correlation does not indicate similar clinical validity: indeed, rating scales may have a common content that ensures a positive association, but they may display differential validity (Carrozzino et al., 2021). Moreover, correlation coefficients are often of statistical but not of clinical significance (Carrozzino et al., 2021). Thus, it is necessary to pay caution in interpreting these results.

Concerning incremental validity, hierarchical linear regression analyses conducted in the general population showed that positive and negative metacognitions about binge eating added significant variance in the prediction of the general severity index of binge eating, over and above age, gender, impulsiveness, anxiety, depression and irrational food beliefs. Among the sample of participants with a diagnosis of BED, although positive metacognitions about binge eating added significant variance in the prediction of the general severity index of binge eating, only negative metacognitions about binge eating were found to predict the general severity index of binge eating over and above age, gender, impulsiveness, anxiety, depression and irrational food beliefs. Starting from the results among general and clinical participants, it may be assumed that positive metacognitions are related to the usefulness of engaging in binge eating as a strategy for interrupting perseverative thinking about concerns, feeling well-being and happiness, releasing tension and relax, compensating for boredom (Palmieri, Gentile, et al., 2021). Thus, positive metacognitions may be involved in the initiation of binge eating (Palmieri, Gentile, et al., 2021). With regard to negative metacognitions, they appear to have a role in the perseveration of binge eating once it has been initiated: according to the S-REF model (Wells, 2000) negative metacognitions may be involved in the propagation of negative emotions and in the persistence of a binge eating episode that is harmful and uncontrollable (Palmieri, Gentile, et al., 2021). These results are comparable with those of previous studies which were run in different samples (i.e., general population, participant with addictive behaviours) suggesting that positive metacognitions and negative metacognitions may play a role respectively in the initiation and the propagation of problematic behaviours (Fernie & Spada, 2008; Hamonniere & Varescon, 2018).

Exploring the differences between participants with a diagnosis of BED and the general population, the clinical sample reported significantly higher scores on positive and negative metacognitions about binge eating compared to the general population sample. These results are consistent with previous studies exploring generic metacognitions in eating disorders (i.e., Anorexia Nervosa, Bulimia Nervosa, Eating Disorders Not Otherwise Specified) and healthy controls (Palmieri, Mansueto, et al., 2021). Moreover, these findings may suggest that the MBEQ could be able to discriminate between individuals with and without BED, suggesting good clinical validity, although further studies are required.

Clinical implications arise from the present study: firstly, in terms of assessment, information about metacognitions about binge eating may be collected during the anamnesis process of eating problems in both the general population and individuals with a diagnosis of BED. Secondly, the S-REF model (Wells, 2011; Wells & Matthews, 1994, 1996) could be used to define a case conceptualization of BED, as well as to socialize individuals to the idea that metacognitions could contribute to the initiation and persistence of binge eating. Thirdly, starting from the association between metacognitions and the severity of binge eating, it could be supposed that the metacognitions could be a suitable therapeutic target to reduce the severity of BED symptoms. In this vein, the techniques, and principles, of Metacognitive Therapy (MCT; Wells, 2011) could be considered in supporting individuals with binge eating in modifying metacognitions related to the binge eating and discontinuing it.

The present results have different limitations that need to be considered. One important limitation is the absence of a longitudinal study design, which means that inferences as to whether, or not, metacognitions play a causal role in predicting binge eating episodes should be taken with caution. Second, data were based on self-report questionnaires, which may be subject to social desirability and self-report errors. Third, the participants in this study may not have been representative of the general population given that there was a higher level of female participants and Caucasians. However, it should be considered that BED is more prevalent in females than males (1.6% and 0.8% respectively) (APA, 2013). Fourth, the presence of a concurrent psychological disorder was not assessed, although controlling for both anxiety and depression provides a degree of confidence in the specificity of the results. Finally, though it may appear that metacognitions about binge eating (Palmieri, Gentile, et al., 2021) and eating expectancies (Hohlstein et al., 1998) overlap as constructs, metacognitions are specifically operationalized within a metacognitive framework for understanding psychopathology. Hence, future studies are needed to explore the associations between metacognitions and

expectations in BED and determine their potential overlap. Future studies are also needed to confirm the psychometric properties of the MBEQ as well as to explore the sensitivity of the two factors of the MBEQ to the effects of the treatment (Carrozzino et al., 2021).

9 | CONCLUSIONS

These studies confirm the presence of specific metacognitions about binge eating. The MBEQ appears to be a valid and reliable measure that may enable clinicians and practitioners to identify specific positive and negative metacognitions about binge eating. Positive and negative metacognitions about binge eating could be a potential therapeutic target to reduce the severity of binge eating episodes.

AUTHOR CONTRIBUTION

S. Palmieri: Conceptualization; data curation; formal analysis; methodology and writing–original draft. **G. Mansueto:** Methodology and writing–original draft. **A. P. Marchant, S. Sassaroli, G. Caselli and G. M. Ruggiero:** Supervision and writing–review and editing. **M. M. Spada:** Conceptualization; methodology and writing–original draft. All authors revised the manuscript critically and given final approval.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

Data will be made available on request.

ETHICS STATEMENT

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by Ethics Committee of the School of Applied Sciences (Division of Psychology) at London South Bank University.

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