

**Incorporating psychoeducation, mindfulness and self-compassion in a new program for binge eating (BEfree): exploring processes of change.**

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**Abstract**

This study explores the efficacy of BEfree, a 12-session group intervention that integrates psychoeducation, mindfulness, compassion and values-based action, in a sample of overweight and obese women with Binge Eating Disorder (N=31). We used repeated measures ANOVAs, and explored processes of change in binge eating and eating psychopathology. At post-intervention, participants decreased in binge eating severity, eating psychopathology, external shame, self-criticism, psychological inflexibility, body-image cognitive fusion, and increased self-compassion and engagement with valued actions. These results were maintained at 3-month and 6-month follow-up. Changes in binge eating were mediated by changes in the psychological processes promoted by BEfree.

## Introduction

The fifth edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-V) introduced Binge Eating Disorder (BED) as a formal diagnosis, characterized by the consumption of a large amount of food ( $\geq$  once per week for the last three months), with a sense of lack of control and accompanied by at least three of the following symptoms: eating more quickly than usual; eating a large amount of food until feeling uncomfortably full; eating in the absence of hunger; secretive eating because of feelings of embarrassment; followed by marked distress and guilt after eating (American Psychiatric Association, 2013).

BED is present in 2-5% of community samples (e.g. Spitzer et al., 1993) and 20-40% of people seeking weight loss treatments (e.g. Gormally et al., 1982; Spitzer et al., 1993). Moreover, individuals with BED are more likely to become obese earlier in life (Mussell et al., 1996) and present greater obesity severity (Picot and Lilenfeld, 2003). Additionally, obese individuals with BED are also more likely to have psychiatric comorbidities and medical problems when compared to those without BED (Bulik et al., 2002; Dingemans et al., 2002; Telch and Stice, 1998). In fact, research suggests that the treatment of obesity in individuals who binge eat is more successful when BED is treated before attempts to reduce weight begin (e.g. Dingemans et al., 2002).

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9 The development and maintenance of BED has been commonly conceptualized  
10 as the result of ineffective emotional regulation strategies (Leehr et al., 2015). Thus,  
11 binge eating can be viewed as an attempt to control and avoid negative internal  
12 experiences, such as difficult thoughts, painful emotions or urges perceived as  
13 uncontrollable (e.g. Lillis et al., 2011), which seems to be an inherent feature of  
14 psychological inflexibility, i.e., rigid rule following and attempts to control difficult  
15 internal experiences, leading to a decreased likelihood of engaging in values-based  
16 action (e.g. Hayes et al., 2006). Indeed, psychological inflexibility has been associated  
17 with disordered eating (Masuda et al., 2011; Masuda et al., 2010) and binge eating  
18 (Duarte and Pinto-Gouveia, 2014; Duarte et al., 2015). Additionally, a growing body of  
19 research has stressed the pervasive impact of shame (Duarte et al., 2014; 2015) and self-  
20 criticism (Gilbert, 2002; Goss and Allan, 2009; Goss and Gilbert, 2002) on binge eating  
21 and eating psychopathology, that goes beyond the overall negative affect. Another  
22 characteristic that seems to be an important feature of binge eating conceptualization is  
23 the dysregulation of satiety and hunger awareness (Sysko et al. 2007) as well as the  
24 reactivity to food related cues (Sobik et al., 2005).

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44 In this line, contextual-behavioural approaches applied to eating disorders have  
45 emerged, in which the focus of interventions is not in reducing or changing internal  
46 negative experiences, but rather in promoting change in the way one relates to those  
47 experiences. These approaches, such as the ones focused on mindfulness, self-  
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compassion and promotion of values-based action, seem to be particularly useful for eating psychopathology and BED. It seems that promoting eating awareness through mindfulness improves eating regulation, enhances awareness of satiety and hunger cues, and leads to an overall decrease of depression and anxiety in patients with BED (Kristeller and Wolever, 2010). In fact, recent research suggest that mindfulness interventions might impact on cortisol (e.g. O'Leary et al., 2016) and hypertension in females (Ahmadpanah et al., 2016). Additionally, interventions that target the reduction of shame and self-criticism through the development of a more self-compassionate and reassuring stance towards one's difficulties and perceived flaws (e.g. Gilbert and Procter, 2006; Hermanto and Zuroff, 2016) seem to be useful in treating several psychopathological symptoms (see Leaviss and Uttley, 2015 for a review). Although similarly conceptualized, self-compassion is defined as the ability to be kind to oneself, to see one's difficulties as part of the common human experience and to be mindful of one's distress, as opposed to being self-judgemental, feeling isolated and getting over-identified with personal difficulties (Neff, 2003), while self-reassurance is more narrowly defined as the ability to be kind, caring and supportive when things go wrong (Gilbert, 2005, 2009, 2010). Self-compassion seems to be positively linked to women's quality of life (Duarte et al., 2015; Marta-Simões et al., 2016) and health-promoting behaviours (Dunne et al., 2016). Self-compassion also seems to be useful for BED treatment (Kelly et al., 2014; Kelly and Carter, 2015) and for dealing with body

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9 dissatisfaction in woman (Albertson et al., 2014). Furthermore, promoting acceptance  
10 and values-based action is associated with subjective well-being (Xu et al., 2016), and  
11 can be useful when targeting weight and eating management (Juarascio et al., 2010;  
12 Lillis and Kendra, 2014; Juarascio, et al., 2013), and for BED treatment (Masuda et al.,  
13 2014). Although approaches based on mindfulness, compassion and values-based action  
14 seem to be useful individually for treating BED, attempts to integrate these potentially  
15 complementary approaches in theoretically coherent programs for BED are to our  
16 knowledge inexistent. In fact, there seems to be a recent interest in integrating different  
17 approaches, such as acceptance-based and compassion-based approaches for medical  
18 conditions (Skinta et al., 2015), but none targeting BED.

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31 Additionally, there is a general call for the study of mechanisms of change  
32 underlying psychological interventions. It is of paramount importance to identify which  
33 processes promoted by an intervention are responsible for treatment-induced change  
34 (McCracken and Martinez, 2011; Murphy et al., 2009), in order to further develop  
35 parsimonious interventions and establish the connection between what is targeted and  
36 promoted in an intervention and the observed outcomes (Kazdin, 2007).

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44 The goal of the current study is twofold: 1) to explore the efficacy of BEfree- a  
45 psychological group program for BED in overweight and obesity that integrates a  
46 psychoeducation component and new components aiming at developing mindfulness,  
47 self-compassion and promoting values-based action, at 3-month and 6-month follow-up;  
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9 and 2) To explore which psychological processes mediate the therapeutic changes in  
10 binge eating and eating psychopathology at post-intervention. We expect that BEfree  
11 will be efficacious in reducing binge eating severity and eating psychopathology, as  
12 well as in diminishing maladaptive psychological processes (psychological inflexibility,  
13 body image cognitive fusion, self-criticism, external shame) and in improving more  
14 useful ones (engage with valued living, mindfulness – particularly the ability to act with  
15 awareness, non-reacting and non-judging – and self-compassion). We also expect that  
16 the psychological processes promoted by BEfree will mediate changes at post-  
17 intervention.  
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## Method

### Participants

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35 The current study was conducted in a sample of women (N=31) between 18 and  
36 55 years old who met criteria for binge eating disorder (BED) and overweight or obesity  
37 (BMI  $\geq$  25). Participants were excluded from treatment if they presented at least one of  
38 the following: 1) medical conditions that affect weight; 2) severe psychiatric problems  
39 (current severe major depressive episode, bipolar disorder, substance abuse, and  
40 borderline personality disorder); 3) cognitive impairment or significant difficulties in  
41 understanding the contents and questionnaires; 4) medication intake that may cause  
42 changes in weight or appetite; 5) unavailability to attend weekly sessions.  
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### Procedure

Participants were recruited both at the Endocrinology Service (n = 18; 58.1%), XXX, and through advertisements in national newspapers (n = 13; 41.9%). BED diagnosis was carried out using Eating Disorders Examination interview as well as resorting to the scores of Binge Eating Scale as a complimentary criterion [assuming BES > 17 as the threshold for binge eating (Duarte et al., 2015; Marcus et al., 1985)]. BMI was assessed using a Body Mass Analyzer (TANITA-SC-330) accurate to 0.1kg. Exclusion criteria were assessed through SCID-I and SCID-II interviews (using exclusively the sections that assess the exclusion criteria). All clinical interviews were conducted by clinical psychologists who were part of the research team and not responsible for delivering the intervention. In order to assess changes as a result of the intervention, participants completed a battery of self-report questionnaires at pre-intervention, post-intervention, 3-month and 6-month after the intervention. BED criteria were also assessed at these different time moments, through EDE interview.

----- insert Figure 1 here -----

### Measures

*Binge Eating Scale* (BES; Gormally et al., 1982; Duarte et al., 2015) comprises 16 item and is a self-report measure of binge eating symptomatology. Respondents are asked to choose the statements that best describe their experience. BES total score



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9 ranges from 0 to 46 and higher scores reflect higher severity of binge eating symptoms.

10 Both the original and Portuguese versions revealed good internal consistencies. The  
11 current study presented an internal consistency of  $\alpha = .85$ .

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15 *Eating Disorders Examination 16.0D* (EDE 16.0D; Fairburn et al., 2008;  
16 validation for Portuguese by Ferreira et al., in preparation) is a semi-structured clinical  
17 interview developed to assess the frequency and intensity of disordered eating  
18 behaviours and attitudes. Although comprised of four subscales (restraint, eating  
19 concern, shape concern and weight concern), it provides a global score for overall  
20 eating psychopathological severity. The interview evaluates the presence of BED as  
21 well as general eating psychopathology. EDE has consistently demonstrated good  
22 psychometric properties (e.g., Fairburn, 2008), and in the current study presented an  
23 internal consistency of  $\alpha = .87$ .

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35 *The Acceptance and Action Questionnaire-II* (AAQ-II; Bond et al., 2011;  
36 translation and adaptation: Pinto-Gouveia et al., 2012) is a 7-item self-report measure of  
37 psychological inflexibility. This instrument assesses tendencies to make negative  
38 evaluations of private events and the unwillingness to be in contact with private events  
39 (e.g., 'I'm afraid of my feelings' and 'my painful memories prevent me from having a  
40 fulfilling life'). Respondents analyze how each statement applies to them, using a 7-  
41 point Likert response format type (1, never true; 7, always true), and the total score is  
42 attained by summing the items, with higher results indicating higher levels of  
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9 psychological inflexibility. The original version has good psychometric qualities,  
10 including an internal consistency of  $\alpha = 0.84$  (Bond et al., 2011). The Portuguese  
11 version had an internal consistency of  $\alpha = 0.89$  (Pinto-Gouveia et al., 2012). Results in  
12 the current study found an internal consistency of  $\alpha = 0.92$ .  
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18 *Cognitive Fusion Questionnaire-Body Image* (CFQ-BI; Ferreira et al., 2015) is a  
19 self-report questionnaire based on the original Cognitive Fusion Questionnaire  
20 (Gillanders et al., 2014). It comprises 10 items that measure cognitive fusion related to  
21 body image. Participants are asked to rate the extent to which each statement (e.g., ‘My  
22 thoughts relating to my body image cause me great distress or emotional pain’) is true  
23 regarding their own experience, using a 7-point Likertscale (1 = ‘Never true’ to 7 =  
24 ‘Always true’). The original study presented good internal consistency, retest reliability,  
25 discriminant, convergent, and divergent validities (Ferreira et al., 2015). The current  
26 study found an internal consistency of  $\alpha = .97$ .  
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38 *The Engage Living Scale* (ELS; Trompetter et al., 2013) is a self-report measure  
39 developed to assess engagement with values-driven behaviour. The original version is  
40 comprised by 16 items which respondents should rate according to their personal  
41 experience on a 5-point Likert Scale (1: completely disagree; 5: completely agree).  
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60 Higher scores express increased clarity and engagement with personal values, and  
greater life fulfilment. Recently, a shorter 9-items version of ELS has been used,

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8 showing good internal consistency ( $\alpha = .88$ ) (Trindade et al., 2015). The current study  
9 found similar internal consistency ( $\alpha = .86$ ).  
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13 *Other as Shamer Scale* (OAS; Goss et al., 1994; Matos et al., 2011) is 5-point  
14 Likert scale composed of 18 items that assess the perception of being negatively  
15 evaluated by others. Higher scores indicate higher external shame (Goss et al., 1994).  
16 OAS has consistently showed high internal consistency, both in clinical and non-clinical  
17 samples ( $\alpha = .96$  and  $.92$ , respectively) (Goss et al., 1994). Similar results were found  
18 for the Portuguese version ( $\alpha = .91$ ; Matos et al., 2011). The current study found  
19 internal consistency of  $\alpha = .96$ .  
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29 *Forms of Self-Criticising/Attacking & Self-Reassuring Scale* (Gilbert et al.,  
30 2004) is a 22-item self-report measure of forms of self-criticism [*inadequate-self*, which  
31 focuses on a sense of personal inadequacy ('I am easily disappointed with myself'); and  
32 *hated-self*, which measures the desire to hurt or persecute the self ('I call myself  
33 names')], and the ability to *self-reassure* when things go wrong ('I find it easy to  
34 forgive myself'). Cronbach's alphas in non-clinical samples ranged from  $.89$  to  $.91$  for  
35 inadequate-self,  $.82$  to  $.89$  for hated-self, and  $.82$  to  $.88$  for reassured-self. In clinical  
36 samples, Cronbach's alphas ranged from  $.87$  to  $.89$  for inadequate-self,  $.83$  to  $.86$  for  
37 hated-self, and  $.85$  to  $.87$  for reassured-self. The current study found internal  
38 consistencies of  $\alpha = .91$  for inadequate-self,  $\alpha = .67$  for hated-self and  $\alpha = .93$  for  
39 reassured-self.  
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9            *Self-Compassion Scale* (SCS; Neff, 2003; Portuguese version by Castilho et al.,  
10 2015) is composed of 26 items distributed in 6 subscales: three positive (self-kindness,  
11 common humanity and mindfulness) and three negative (self-judgment, isolation and  
12 over-identification). Although the factor structure of SCS is an ongoing topic of  
13 research (Neff, 2016; López et al., 2015), it has been recently shown that SCS might  
14 also present a two-factor structure: one factor that assess *self-compassion* attitude (a  
15 composite of self-kindness, common humanity and mindfulness) and one factor of a  
16 *self-criticism* attitude (that results from the sum of self-judgment, isolation and over-  
17 identification). Participants respond according to a 5 point Likert scale (1 = almost  
18 never; to 5 = almost always). Previous studies found adequate model fit and good  
19 internal consistency ( $\alpha = .91$  for self-compassion and  $\alpha = .89$  for self-criticism) (Costa  
20 et al., 2015). The current study presented good internal consistencies for both the self-  
21 compassion factor ( $\alpha = .94$ ) and the self-criticism factor ( $\alpha = .91$ ).  
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37            *Five Facet Mindfulness Questionnaire - 15* (FFMQ-15, Baer et al., 2006,  
38 Portuguese version by Gregório et al., in preparation) is composed of 15 items and is  
39 the shorter version of the original 39 items questionnaire. FFMQ measures the  
40 dispositional and multifaceted mindfulness characteristics. Participants are asked to rate  
41 how mindful they feel in daily life in a 5-points Likert scale (1 = “never or very rarely  
42 true” to 5 “very often or always true”). FFMQ-15 presents the same 5-factor structure as  
43 the original version, as well as good internal consistency (ranging from .65 to .86). In  
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9 the current study, the internal consistencies of the subscales were below the  
10 recommended: Observing ( $\alpha = .26$ ), Describing ( $\alpha = .20$ ), Act with awareness ( $\alpha = .50$ ),  
11 Nonjudgment ( $\alpha = .45$ ), Non-Reacting ( $\alpha = .26$ ). The total scale also presented a poor  
12 internal consistency ( $\alpha = .37$ ).  
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### 20 **The intervention: what is BEfree?**

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22 BEfree is a psychological program carried out in a group format that integrates a  
23 psychoeducation component with new contextual-behavioural approaches such as  
24 mindfulness, self-compassion, and values-based committed action. It is composed of 12  
25 sessions, 2h30 each, and runs in small groups (minimum of 10 and maximum of 15  
26 participants). In the current study, sessions were carried out by three cognitive-  
27 behavioural clinical psychologists, who had previous training in contextual-behavioural  
28 therapies. All sessions were structured as follows: 1) an initial moment of sharing  
29 personal experience; 2) a 5-minute mindfulness exercise; 3) the session theme; 4) an  
30 eating mindfulness exercise; 5) summary of the session content and homework  
31 assignments. Psychoeducation sessions focused on the evolutionary foundations of  
32 emotions and binge eating as an emotional regulation strategy. Experiential exercises,  
33 such as loving-kindness, safe-place and compassionate image, were used to promote  
34 self-compassion and diminish self-criticism and shame. Sessions focusing on  
35 mindfulness included different exercises, such as mindfulness breathing meditations,  
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9 body-scan, mindfulness of thoughts, as a way of promoting acceptance and decentering  
10 of internal difficult experiences. Finally, sessions focused on values and committed  
11 action promoted clarification of participants' meaningful life directions, particularly  
12 related to health and self-to-self relating. This engagement with personal values is also  
13 the basis for establishing new goals, dealing with setbacks, and preventing relapse.  
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### 20 21 22 **Statistical analyses**

23 All statistical procedures were conducted using IBM SPSS (version v.23).

24 To test whether there were significant differences between pre and post-  
25 intervention variables, paired samples t-test were calculated.  
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29 To explore whether the therapeutic gains were maintained at 3- and 6-month  
30 follow-up, repeated measures ANOVA were carried out. A post-hoc power analysis  
31 conducted using G power showed that at a significance level of  $p < .05$ , with 4 different  
32 measurement moments and an effect size of  $f = 0.25$ , the power analysis was 91%. Post-  
33 Hoc analyses using Fisher's Least Significant Difference (LSD) test were further  
34 computed to explore pairwise differences (post-to-3 months; post-to-6 months). The  
35 effect sizes for the paired samples t-tests were calculated using Cohen's  $d$ , with 0.2  
36 indicating a small effect, 0.5 a medium effect and 0.8 a large effect (Cohen, 1988).  
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48 In order to explore which psychological processes promoted by BEfree mediated  
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9 SPSS (Montoya and Hayes, in press). This novel statistical procedure allows to test  
10 mediation effects in two-condition within-participants' designs. In these models, the  
11 mediator and the outcome are the calculated change between post and pre-intervention,  
12 and the independent variable "X" is the mere passage of time from pre to post-  
13 intervention, that is, the effect of the intervention. MEMORE generates percentile  
14 bootstrap confidence intervals (CI) for inference about the indirect effect, based on 5000  
15 bootstrap samples. A significant indirect effect occurs when the interval between the  
16 lower and upper bound of CI does not include zero.

## 26 **Results**

### 28 **Sample's characteristics**

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30 Participants who attended BEfree intervention were **on average** 39.68 years old  
31 (SD=10.29), and had a mean of 14.93 (SD = 2.48) years of schooling. Concerning  
32 marital status, 63.3% of participants were married and the majority had a medium socio-  
33 economic status (48.3%). Participants had a mean BMI ( $\text{Kg/h}^2$ ) of 35.35 (SD= 6.07).  
34 Moreover, no differences were found between participants recruited at Endocrinology  
35 Service and through national newspapers in all variables in study.  
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### 46 **Pre- to Post-intervention Differences**

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48 Results from paired-samples t-test are presented in Table 1. Participants showed a  
49 decrease in binge eating and eating psychopathology. There was also a decrease in BMI  
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9 after intervention, even though weight loss was not identified as BEfree's primary  
10 outcome. Regarding psychological processes promoted by BEfree, there was a  
11 significant decrease in psychological inflexibility, body image cognitive fusion, external  
12 shame, and self-criticism (both in its toxic forms – inadequate and hated self – as well  
13 as the more general self-judgment), and an increase in **engagement** with valued living,  
14 self-compassion, self-reassurance, and mindfulness facets (acting with awareness, non-  
15 judging and non-reacting). Effect sizes were medium to large in both outcome and  
16 process measures.  
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### 30 **Durability of Change: 3-month and 6-month Follow-ups**

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32 To explore the maintenance of therapeutic gains, we conducted a repeated measures  
33 ANOVA comparing results from post-intervention, 3-month follow-up and 6-month  
34 follow-up. Results are presents in Table 2, and suggest there are no significant  
35 differences between the three time points. Pairwise comparisons post-hoc analyses  
36 confirm these results, indicating that post-intervention therapeutic gains were  
37 maintained at 3 and 6-month follow-up in all variables.  
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### 50 **Mechanisms of change: processes underlying BEfree**



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9 To explore possible mediators of the effect of the intervention on the outcomes, we  
10 conducted two-condition within-subjects' mediation analyses, with each mediator tested  
11 separately in the model.  
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#### 14 Binge eating

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17 Results showed significant indirect effects of the intervention on binge eating.  
18 Specifically, we found that psychological inflexibility ( $B = -3.30$ ,  $BootSE = 1.34$ , 95%  
19 CI [-6.40 to -1.04]), body image cognitive fusion ( $B = -5.14$ ,  $BootSE = 1.41$ , 95% CI [-  
20 8.35 to -2.71]) and engaged with valued living ( $B = -2.89$ ,  $BootSE = 1.18$ , 95% CI [-  
21 5.66 to -0.90]) significantly mediated the effect of intervention on binge eating.  
22 Additionally, changes in external shame ( $B = -3.39$ ,  $BootSE = 1.36$ , 95% CI [-6.98 to -  
23 1.30]), inadequate self ( $B = -2.77$ ,  $BootSE = 1.29$ , 95% CI [-6.08 to -0.85]), hated self  
24 ( $B = -2.85$ ,  $BootSE = 1.26$ , 95% CI [-5.67 to -0.74]), reassured self ( $B = -1.61$ ,  $BootSE$   
25 = 1.03, 95% CI [-4.26 to -0.08]), self-judgement ( $B = -5.54$ ,  $BootSE = 1.72$ , 95% CI [-  
26 9.92 to -3.00]), and in self-compassion ( $B = -1.68$ ,  $BootSE = 1.16$ , 95% CI [-5.01 to -  
27 0.17]) mediated the decrease in binge eating from pre to post intervention.  
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#### 42 Eating psychopathology

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44 Results showed that only general psychological inflexibility ( $B = -0.23$ ,  $BootSE = 0.13$ ,  
45 95% CI [-0.54 to -0.02]) and the non-reacting facet of mindfulness ( $B = -0.25$ ,  $BootSE$   
46 = 0.16, 95% CI [-0.08 to -0.02]) significantly mediated the decrease in eating  
47 psychopathology as a result of the intervention.  
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9 In sum, several psychological processes targeted by BEfree mediated the effect  
10 of the intervention on the outcome measures, particularly on binge eating severity.  
11 However, mindfulness was not a significant mediator of change in the outcomes, with  
12 the exception of the facet non-reacting that mediated changes in eating  
13 psychopathology.  
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## 22 Discussion

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24 There is growing evidence for the efficacy of psychological approaches focused  
25 on the development of mindfulness (Kristeller and Wolever, 2010), self-compassion  
26 (Kelly et al., 2014; Kelly and Carter, 2015) and the promotion of action congruent with  
27 personal values (Masuda, et al., 2014) for eating psychopathology and BED.  
28 Nevertheless, although there is a recent interest in integrating these approaches in  
29 complimentary interventions for medical condition (Skinta, et al., 2015), this was yet to  
30 be accomplished for BED.  
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39 This study explored the efficacy of a psychological group intervention for BED  
40 that integrates psychoeducation, mindfulness, compassion and values-based action, in a  
41 sample of 31 overweight and obese women. Results suggested that BEfree was able to  
42 diminish binge eating symptoms. In fact, after the intervention, none of the participants  
43 met criteria for a BED diagnosis, according to the EDE interview conducted by  
44 experienced clinical psychologists. Additionally, after the intervention participants  
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9 presented lower levels of eating psychopathology. Although BEfree was not developed  
10 to target weight itself, there was also a decrease in BMI. Regarding the psychological  
11 processes that BEfree was designed to tackle, there was a medium to large effect in the  
12 reduction of external shame, psychological inflexibility, body-image cognitive fusion  
13 and self-criticism (both the most toxic forms – inadequate and hated self – and the more  
14 general self-judgmental attitude towards oneself). Results also showed that BEfree had  
15 medium to large effects in increasing valued actions, self-compassion and in the ability  
16 to act with awareness, non-judge and non-react (mindfulness facets). Nevertheless,  
17 results from mindfulness should be interpreted with caution, as the internal  
18 consistencies of FFMQ did not reach recommended values at baseline. There is, in fact,  
19 an ongoing discussion on the limitations of measuring mindfulness. Particularly,  
20 FFMQ's factor structure seems to vary depending on whether respondents are  
21 meditators or non-meditators (Baer et al., 2008). Indeed, it is suggested that non-  
22 meditators might interpret items related to paying attention as undesirable awareness of  
23 intruding internal experiences (Grossman, 2011). Interestingly, when calculating the  
24 internal consistency of FFMQ at post-intervention, Chronbach's alphas yielded higher  
25 reliability (.49 for observing facet, .92 for describing, .72 for acting with awareness, .74  
26 for non-judging, .64 for non-reacting and .82 for total scale), which seems to  
27 corroborate the suggestion that the items may be differently interpreted by individuals  
28 with different degrees of meditation experience.  
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We have also conducted repeated measures ANOVAs in order to explore if the results obtained from pre- to post-intervention were maintained at 3-month and 6-month follow-up. In fact, results showed that the effectiveness of BEfree was maintained beyond the period of the program, up to 6-months. Results showed that there were no significant differences from post-intervention to 3- and 6-month after the intervention, neither in the outcome measures nor in the psychological processes promoted by BEfree. In spite of these promising results, a careful interpretation is advised given the number of dropouts.

In addition to studying the efficacy of BEfree, we set out to explore which psychological processes promoted by the intervention led to changes in the outcome measures. In fact, although it is crucial to develop empirically-based psychological interventions for BED, it is not less important to explore the mechanisms through which therapeutic change occurs (Kazdin, 2007; McCracken and Martinez, 2011; Murphy et al., 2009). Results showed that the decrease of binge eating severity from pre-intervention to post-intervention was mediated by the diminishing of external shame and self-criticism. This is in line with previous research that suggested that shame and self-criticism are pervasive processes that maintain binge eating symptomatology (Duarte et al., 2014; 2015; Gilbert, 2002; Goss and Allan, 2009; Goss and Gilbert, 2002). Our results suggest that diminishing shame and self-criticism is a crucial goal when targeting binge eating. Previous research suggested that one way of decreasing

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9 shame and self-criticism is by promoting a more self-compassionate and self-reassuring  
10 stance towards the self (Gilbert, 2005, 2009, 2010). In accordance to this, our results  
11 also suggested that the effectiveness of BEfree in diminishing binge eating was  
12 mediated by an increase in self-compassion and self-reassurance. One way of making  
13 sense of the role of self-compassion is through the affect regulation systems. The self-  
14 compassionate exercises throughout BEfree might have helped to develop a positive  
15 soothing system that activates feelings of caring and warmth towards the self (e.g.  
16 Hermanto and Zuroff, 2016). On the other hand, this counteracts and helps to deactivate  
17 the threat-focused system that is responsible for negative emotions such as shame and  
18 self-criticism (e.g. Gilbert, 2005; Gilbert and Procter, 2006). Additionally, results also  
19 suggested that diminishing psychological inflexibility, and specifically decreasing the  
20 entanglement with internal experiences focused on body image (i.e., body image  
21 cognitive fusion) as well as promoting action that is congruent with personal values, are  
22 important therapeutic goals when targeting BED. In fact, our results showed that  
23 changes in psychological inflexibility, body image cognitive fusion and engagement  
24 with values-based action mediated changes in binge eating severity. Recent studies  
25 highlighted the pervasive role of psychological inflexibility in disordered eating  
26 (Masuda et al., 2011; Masuda et al., 2010), and only one study, to our knowledge, has  
27 suggested the pervasive role of body-image cognitive fusion in the maintenance of  
28 binge eating severity (Duarte et al., 2015). Additionally, although some interventions  
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9 aimed at promoting values-based action yielded beneficial results for binge eating  
10 (Masuda, et al., 2014), the specific role of values-based action in therapy for BED has  
11 never been empirically shown. To our knowledge, this study is the first to do so. Indeed,  
12 the mediational role of psychological inflexibility, body image cognitive fusion, and  
13 **engagement** with valued living corroborates theoretical literature that suggests that  
14 binge eating is a way of controlling unwanted internal experiences (in this case, content  
15 related to one's body image), at the expense of living a valued life (Lillis et al., 2011).  
16 By promoting a more flexible and disentangled way of relating to personal thoughts and  
17 emotions related to body image, as well as by promoting an action guided by personal  
18 values, despite negative internal experiences, BEfree was effective in diminishing binge  
19 eating severity. Contrarily to our hypothesis, mindfulness did not mediate changes in  
20 binge eating. Two possible explanations might be raised: one is that mindfulness  
21 practices between sessions were not as intensively promoted as could have been.  
22 Another possible explanation is the aforementioned difficulties in measuring  
23 mindfulness, and specifically the low internal consistencies of FFMQ in the current  
24 study, particularly at baseline.

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44 **Regarding** eating psychopathology, changes were only mediated by  
45 psychological inflexibility and the non-reacting facet of mindfulness, even though this  
46 result for mindfulness should be viewed with caution. Nevertheless, these results show  
47 that almost none of the psychological processes (except psychological inflexibility)  
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9 promoted by BEfree mediated changes in eating psychopathology. In fact, BEfree was  
10 designed to target specifically binge eating behaviours, whereas EDE interview (which  
11 was used to assess eating psychopathology) was developed to assess disordered eating  
12 attitudes and behaviours in general. Since BED was just recently recognized as a  
13 specific eating disorder, there are not many items in EDE that focus on BED  
14 symptomatology, specifically in obesity. The fact that reductions in psychological  
15 processes such as external shame, self-criticism and body-image cognitive fusion did  
16 not mediate changes in eating psychopathology might suggest that in our sample these  
17 processes are highly related to binge eating, and that eating psychopathology as  
18 measured by EDE **does** not properly reflect binge eating symptomatology. Therefore,  
19 changes in these variables did not yield changes in eating psychopathology.  
20 Interestingly, psychological inflexibility, which is a general measure of unwillingness to  
21 have difficult thoughts (not exclusively related to binge eating), **mediated** changes in  
22 eating psychopathology, which seems to be aligned with this hypothesis that eating  
23 psychopathology assessed by EDE encompass other aspects of disordered eating  
24 attitudes and behaviours that might not reflect what binge-eaters tend to experience.  
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44 In sum, BEfree seems to be an effective program for diminishing binge eating  
45 and overall eating psychopathology, with positive results maintained up to 6-month  
46 after the end of the intervention. Additionally, reductions in binge eating **were** mediated  
47 by the decreases in external shame, self-criticism, psychological inflexibility, and body-  
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9 image cognitive fusion, as well as increases in self-compassion and values-based action.  
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11 These results seem to provide evidence for the efficacy of BEfree and it corroborates  
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13 the effectiveness of integrating different yet complimentary psychological approaches  
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15 when targeting BED.  
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17 Several limitations should be taken into consideration when interpreting our  
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19 results. First, the relatively small sample limits the generalizability of these results to  
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21 the wider population. These results should be replicated in a larger sample.  
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23 Additionally, the sample comprised only women, which does not allow us to extrapolate  
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25 these results to a sample of men. In fact, the relative impact of the processes promoted  
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27 by BEfree might be different in a sample of males. Not less important is the fact that the  
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29 current study did not compare results with a control group, which calls for caution when  
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31 interpreting the current results. Finally, as stated throughout this study, it is important to  
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33 consider the low reliability of FFMQ when interpreting all results related to  
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35 mindfulness. This study used a shorter 15-items version of FFMQ, in which each  
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37 subscale was composed of only 3 items. Future studies that aim to explore the impact of  
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39 BEfree in the different facets of mindfulness should use the longer 39-items version.  
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44 Nonetheless, the current study is the first to integrate complimentary  
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46 components of different but theoretically coherent approaches in a psychological  
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48 program for women with BED and obesity. This study is also a valid contribution as it  
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50 provides data for the efficacy of BEfree up to a follow-up period of 6-months. Finally,  
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9 we explored the mediational role of several psychological processes promoted by  
10 BEfree in the reduction of binge eating severity and eating psychopathology, therefore  
11 contributing for a better understanding of which processes should be targeted in BED  
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For Peer Review

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**Table I.** Mean, Standard Deviation and Effect Size of the Pre- to Post-intervention Differences in Outcomes and Process Variables (N = 31)

Variables	Pre-intervention		Post-intervention		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Outcome Variables							
Body Mass Index	35.35	6.07	34.71	6.19	2.84	.008	.52
Binge eating	28.66	8.04	11.66	8.62	10.49	<.001	1.95
Eating psychopathology	3.74	1.11	2.22	0.84	6.71	<.001	1.34
Process Variables							
Psychological inflexibility	30.60	8.85	25.43	8.47	3.84	.001	.70
Body image cognitive fusion	43.14	15.82	31.21	13.44	4.53	<.001	.84
Engaged with valued living	27.82	5.89	30.75	6.55	-2.91	.007	.55
External shame	32.53	17.61	24.63	16.59	3.80	.001	.69
Inadequate self	21.13	8.22	16.50	7.80	3.32	.002	.61
Hated self	6.24	3.95	4.07	3.65	2.71	.011	.50
Reassured self	14.25	7.32	16.18	7.47	-2.05	.05	.39
Self-judgement	10.15	2.29	8.13	2.07	2.74	<.001	1.09
Self-compassion	8.12	2.12	9.15	2.12	-3.13	.004	.58
Mindfulness							
Observe	9.40	1.92	9.77	2.11	-1.06	.300	.19
Describe	8.62	1.99	9.48	3.12	-1.71	.098	.32
Act awareness	8.47	1.93	9.40	1.92	-2.51	.018	.46
Non judge	8.60	1.98	10.73	2.15	-3.35	.002	.61
Non react	8.90	1.63	9.07	2.03	-2.50	.019	.46
Total	43.24	4.43	48.59	7.61	-3.85	.001	.71

**Table II.** Means and Standard Deviations for the 3- (n = 19) and 6-Month (n = 20) Follow-Up Assessments, and Repeated-Measures ANOVA Results for the Comparison Between Post-intervention, 3- and 6-Month Follow-Up

Variable	3-month		6-month		<i>F</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Outcome Variables						
Body Mass Index	33.81	4.92	34.02	5.33	0.47	.630
Binge eating	12.33	7.90	14.67	12.40	1.97	.159
Eating psychopathology	2.17	0.90	2.33	1.08	0.22	.818
Process Variables						
Psychological inflexibility	26.69	8.65	25.31	10.13	0.59	.561
Body image cognitive fusion	30.27	15.21	30.33	17.85	0.16	.852
Engaged with valued living	28.57	6.38	25.36	6.71	0.33	.721
External shame	23.69	18.05	24.13	17.90	0.80	.460
Inadequate self	16.20	8.36	15.73	8.30	0.49	.619
Hated self	3.80	3.78	4.07	4.00	0.13	.880
Reassured self	16.43	8.21	16.36	8.34	0.50	.614
Self-judgement	8.18	2.75	8.61	3.13	0.64	.535
Self-compassion	8.80	2.25	8.54	2.59	0.32	.727
Mindfulness						
Act awareness	9.31	1.92	8.63	2.55	1.30	.288
Non judge	9.81	1.76	9.69	2.60	1.28	.293
Non react	8.93	2.38	8.81	1.57	0.66	.525
Total	46.81	8.16	45.69	8.64	0.36	.702

**Figure I.** Participants enrolment diagram