Putting yourself down – The role of self-criticism, self-esteem and eating and shape concern for compensatory behavior in patients diagnosed with Bulimia Nervosa

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Master Thesis
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2021

Abstract

Aim: Investigation of the effect that self-criticism, self-esteem, shape and eating concern have on the frequency of compensatory behavior of patients with Bulimia Nervosa (BN).

Background: BN is a serious eating disorder (ED), and affected patients need better treatment. It is necessary to gain more insight into how the symptoms are associated and whether they are moderated by self-criticism and self-esteem. If self-criticism or self-esteem are regulating variables to symptom dynamic, they could be targeted in therapy and might improve treatment and remission rate.

Methods: A cross-sectional survey study was conducted among 240 patients diagnosed with BN. Correlation analyses and multiple regression analyses were conducted, followed by moderator analyses with the Process Macro tool by Hayes.

Results: Self-criticism, self-esteem, shape concern and eating concern were associated significantly with compensatory behavior. Inadequate self and eating concern were associated with compensatory behavior, however, no significant moderating effect of inadequate self was found. Shape concern was associated with eating concern. Inadequate self was a significant moderator in the relationship between shape concern and eating concern.

Conclusion: The findings underline the relevance of addressing self-criticism in form of inadequate self in BN treatment because it was indicated to strengthen the relationship between shape concern and eating concern. Despite not being a predictor of eating concern or compensatory behavior, self-esteem is an important trait linked to several ED symptoms and should stay a focus in psychological treatment. Practice recommendations are to identify specific self-critical thoughts relating to eating and shape concern and to replace them with more helpful and healthier thoughts.

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Introduction

The current study aims to investigate how self-criticism and self-esteem influence the severity of bulimia nervosa symptoms. Bulimia nervosa (BN) is a serious eating disorder (ED), characterized by repeated episodes of binge eating followed by compensatory behavior according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (APA, 2013). Especially girls and young women are affected by BN. The estimated lifetime prevalence in the US for women is 0,5% and for men 0,08% (Udo & Grilo, 2018). Normal weight or overweight is common in affected individuals (APA, 2013).

BN consists of cognitive as well as behavioral components. Cognitive components are the preoccupation with having the desired weight/shape or eating behavior and dietary restraint (Duarte, Ferreira, & Pinto-Gouveia, 2016; Fairburn, 2008). The wish to become extremely thin has been linked to the desire to feel socially accepted and valued, and research has shown that especially young women perceive strong social pressure and inner desire to fit into extremely thin body shape ideals that are not easy to reach and often not healthy (Pinto-Gouveia, Ferreira, & Duarte, 2012). Another cognitive symptom is eating concern. Eating has in general an increased role in the mind of patients with EDs (Fairburn & Beglin, 1994). Part of eating concern are the fear of losing control over the eating behavior, the preoccupation with eating and calories, and feelings of guilt about eating (Fairburn, Cooper, & O'Connor, 2014).

Behavioral aspects are binging and compensatory behavior (APA, 2013). In binge episodes, the individual consumes much more food within two hours than what is considered usual, and feels unable to stop or control the amount nor the type of food that is consumed. The binge eating episodes are often followed by inappropriate compensatory behavior to avoid weight gain, such as purging in the form of self-induced vomiting, taking medication, diuretics, laxatives, exercising excessively, or fasting (APA, 2013). The frequency of compensatory behavior determines the severity of BN (Stiles-Shields, Labuschagne,

Goldschmidt, Doyle, & Le Grange, 2012). The most common compensatory behaviors are vomiting and excessive exercising. The vomiting frequency numbers show a substantial variance between patients. The frequency ranges from 2 to 40 times per week with an average of around 6 times (Abbate-Daga, Pierò, Gramaglia, & Fassino, 2005). Results concerning the frequency of excessive exercise differ. According to Grave, Calugi, and Marchesini (2008), 39% of patients with BN are compulsive exercisers, while another study found that 66% percent of adolescents with BN exercised excessively (Stiles-Shields, Bamford, Lock, & Le Grange, 2015).

A widely used model to conceptualize how the symptoms of BN interact and manifest, is the Cognitive Model of the Maintenance of Bulimia Nervosa (Fairburn, 2008). According to Fairburn (2008), the core psychopathology of BN maintenance is a dysfunctional scheme for self-evaluation which is the assumed origin of typical weight control behavior and shape, weight and eating concern. In contrast to that, it is argued that binge eating results from very strict dietary restraint. Dietary restraint is explained as non-compensatory weight-control behavior characterized by very strict rules that are easily broken. These rules are created because the patients over-evaluate shape and weight and the ability to control their shape and weight. To control these, the rules are applied. When rule breaks happen, patients interpret this as lack of self-control and often abolish their rules and uncontrolled binge episodes occur. To compensate for those binge eating episodes, patients engage in compensatory behavior, such as self-induced vomiting and laxative misuse. A vicious cycle develops in which over-evaluation of shape and weight, dietary restraint, binge eating, and compensatory behavior maintain each other. Fairburn also accentuated that binge episodes occur as consequences of events or negative moods in which it is more difficult to follow the strict diet rules. The model is empirically supported and widely used in cognitive behavioral therapy (CBT) (Fairburn, 2008).

In summary, the increased shape concern in BN patients leads to compensatory behavior to avoid weight gain, and the assumed underlying core issue of the preoccupation with shape and eating is dysfunctional self-evaluation (Fairburn, 2008).

Successful treatments for BN are important because suffering from BN can have severe consequences. BN leads to increased risks for mortality and suicide, compared to healthy individuals (Crow, Swanson, le Grange, Feig, & Merikangas, 2014). The disturbed eating and compensatory patterns are related to several medical consequences such as cardiac arrhythmia or abnormalities in fluid and electrolytes (APA, 2013; Buchanan, Ngwira, & Amsha, 2011; Mehler & Rylander, 2015; Patel, Olten, Patel, Shah, & Mansuri, 2018). Comorbidity is often present with BN; 95% of patients with a BN diagnosis are diagnosed with one or more comorbid psychopathological disorders (Hudson, Hiripi, Pope, & Kessler, 2007). Frequent comorbid diagnoses are bipolar and depressive disorders, anxiety disorders, ADHD, substance abuse and personality disorders (APA, 2013; Bruce & Steiger, 2007; Duarte et al., 2016; Patel et al., 2018; Menatti, Weeks, Levinson, & McGowan, 2013).

Several risk factors for BN have been identified. BN was observed to appear often in impulsive people and people who are unstable in behavioral, affective, and interpersonal perspectives (Bruce & Steiger, 2007). Other risk factors include being female, dieting, having negative self-evaluations, peer pressures to be thin, family difficulties, stress, desire for control and perfection, and lack of self-acceptance (Binford & le Grange, 2005; Duarte et al., 2016; Fairburn, Welch, Doll, Davies, & O'Connor, 1997; Patel et al., 2018; Rossotto, Rorty-Greenfield, Yager, 1996; Stice & Agras, 1998).

Due to the seriousness of BN, it is important to help affected patients. Various treatments have been developed, among which individual CBT-ED is most efficient to reach abstinence of bulimia-related symptoms over a period of at least two weeks after the treatment ended (Slade et al., 2018). CBT-ED is an enhanced form of CBT, specialized for EDs. It includes the adoption of regular eating habits, and the identification of dysfunctional thoughts

and feelings triggering binge-eating, and shape and weight concern, and relapse prevention (NICE, 2020). Although CBT-ED is the most efficient treatment so far, its remission rates are not convincing, and the relapse rates are high. The full remission rate of individual CBT-ED is 32% (NICE, 2017) and 60% of treatment completers do not stay abstinent from the core behavioral symptoms, binge eating and/or purging, despite completing highly empirically supported therapies (Linardon & Wade, 2018). Hence, improvement of BN treatment is necessary. Fairburn (2008) stated that binge eating and compensatory behavior are often the main aspects that patients want to work on, but in order to be successful, strict dieting, over-evaluation of shape and weight and changes in eating behavior as responses to triggers need to be considered. In conclusion, it may be crucial to identify the factors that increase the intensity of compensatory behavior, shape concern and eating concern and strengthen the relationships between those variables to improve treatment.

Several maintaining factors for BN have been identified, such as low self-esteem, perfectionism, self-criticism, mood intolerance, interpersonal difficulties, negative affect, adoption of maladaptive emotion regulation strategies, guilt, shame, and negative social comparisons based on physical appearance (Duarte et al., 2016; Fairburn et al., 1997; Fairburn et al., 2003; Fairburn, 2008; Kelly & Carter, 2012; Mond & Calogero, 2009; Rossotto et al., 1996; Stice & Agras, 1998). For instance, low self-esteem was linked to the relationship between self-criticism and over-evaluation of shape and weight through depressive symptoms in patients with binge eating disorder (Dunkley & Grilo, 2007). Moreover, it was found that compensatory behavior was associated with higher shape and eating concern, and with higher general ED psychopathology in adolescents (Stiles-Shields et al., 2012). Shape concern was directly linked to the frequency of exercising in patients with BN (Garner, Davis-Becker, & Fischer, 2014; Grave et al., 2008). A close variable to shape concern, drive for thinness, was connected to vomiting behavior, however, the results were not significant (Abbate-Daga et al., 2005).

While these studies and the Cognitive Model of Maintenance of BN demonstrated a connection between shape concern and compensatory behavior, between shape concern and eating concern, and between eating concern and compensatory behavior, little is known about additional factors that strengthen or weaken these relationships. Since Fairburn (2008) proposed that dysfunctional self-evaluation is a maintaining factor in BN, two important influential factors to compensatory behavior, eating concern, and shape concern could be self-criticism and self-esteem which are types of self-evaluation (Fairburn et al., 2003; Fennig, Hadas, Itzhaky, Roe, Apter, & Shahar, 2008; Gilbert, 2004; Rosenberg, 1965).

Self-criticism refers to judging or evaluating oneself negatively, which can be activated when one does not fulfill one's personal standards (Gilbert, Clarke, Hempel, Miles, & Irons, 2004). Gilbert sees self-criticism as a trait (Gilbert, Baldwin, Irons, Baccus, & Palmer, 2006), that has different purposes (Gilbert et al., 2004): to help people to correct behavior (inadequate self) or to express self-hate or -dislike actively (hated self). The inadequate self entails rumination about mistakes and the own inadequacy, feeling not good enough/being disappointed in the self, being unable to accept one's mistakes. A large part is the wish to change the things that one doesn't like (Gilbert et al., 2004). A pronounced inadequate self leads to a lot of anger and frustration at oneself and the wish to change for the (perceived) better. The hated self includes attacking or hurting the self as punishment or revenge for failures; it further includes self-disgust, not liking or taking care of oneself, and insulting oneself. As with inadequate self, a prominent part of hated self is anger towards oneself. However, here the anger leads to the wish to harm oneself (Gilbert et al., 2004).

Self-criticism seems important in ED pathology (Fairburn et al., 2003) and is a variable that might have a strengthening effect on the relationship between eating and shape concern with compensatory behavior. Individuals with BN are often highly self-critical and compare themselves negatively with others, and self-criticism was associated with BN (Duarte et al., 2016; Fennig et al., 2008; Kelly & Carter, 2012; Pinto-Gouveia et al., 2012).

An ecological momentary assessment study showed that within-subjects self-criticism is highly associated with vomiting and restriction behaviors in patients with binge eating pathology (Mason, Smith, Crosby, Engel & Wonderlich, 2019). In a meta-analysis, Zelkowitz and Cole (2019) found that self-criticism is associated with disordered eating and that purging strengthens this relationship. They suggested that self-critical thoughts trigger purging behavior. According to Duarte et al. (2016), the hated self, as well as inadequate self, were both significantly associated with overvaluation of weight, shape, and eating in patients with BN. Duarte, Pinto-Gouveia, and Ferreira (2014) argued that self-criticism could be a self-monitoring strategy to reach the desired body shape. In this respect, both components of self-criticism, the inadequate self and the hated self, might be relevant. The inadequate self, which has the function to correct behavior, might lead to increased compensatory behavior and increased thoughts about eating to influence body shape. The hated self, which wants to harm the self, might also be connected to increased compensatory behavior or restrictive eating as a way to take revenge on the self for not fitting into the high expectations of body shape. Noordenbos, Aliakbari, and Campbell (2014) investigated the occurrence of critical inner voices that scold the individuals with BN for behaviors that are not in line with becoming skinnier such as eating or not vomiting immediately after eating foods. The inner voices were strongly associated with self-criticism in patients with BN. These findings indicate that self-criticism increases thoughts about shape, eating and compensatory behavior.

Another variable that is considered a maintaining factor for BN is low self-esteem (Fairburn et al., 2003). Self-esteem refers to one's evaluation of the self which includes a positive or negative attitude to the self and how one evaluates the own thoughts and feelings about oneself and self-worth (Rosenberg, 1965). Therefore, low self-esteem could be a negative and dysfunctional scheme of self-evaluation, for example the self-worth of people with BN depends on their evaluation of their eating habits, weight, shape, and their ability to control these (APA, 2013; Fairburn, Cooper, & Shafran, 2003). According to Fairburn et al.

(2003), people with BN often show low self-esteem; they tend to think of themselves negatively in general, the negative evaluations are unconditional and pervasive of reality and not solely dependent on their body shape and weight or eating habits. Like self-criticism, self-esteem might also have a regulating effect on the relationships between eating and shape, between eating concern and compensatory behavior and between shape concern with compensatory behavior. In a study with patients with BN and subthreshold BN, self-esteem was associated with shape/weight concern but not with purging (Watson, Steele, Bergin, Fursland, & Wade, 2011). However, self-esteem was linked to the relationship between body dissatisfaction and compensatory behavior and between body image importance and compensatory behavior in a population of students (Brechan, & Kvalem, 2015).

This study

Since BN is a severe risk for physical and psychological health and treatments have only modest effects, it is of high relevance to get more insight into variables that determine symptom severity. The aim of this study was to identify relevant variables that influence how strongly BN symptoms are associated with each other. Self-criticism and self-esteem are known to be associated to BN symptoms and were proposed to be maintaining variables and might moderate between different BN symptoms. Identification of moderators influencing associations between symptoms is important to understand how to improve treatment. Following a recommendation to use symptom-focused therapies (Bruce & Steiger, 2007), promising variables to investigate are the BN symptoms of shape concern, eating concern, compensatory behavior, and their relation to self-criticism and self-esteem. Apart from the studies conducted by Mason et al. (2019) and Zelkowitz and Cole (2019), Brechan and Kvalem (2015), and Watson et al. (2011), little research is available about self-criticism or self-esteem in connection with compensatory behavior and shape and eating concern.

Mason et al. (2019) study did not distinguish between hated self and inadequate self and treated self-criticism as a momentary state. In contrast to that, this study will take into account two components of self-criticism: hated self and inadequate self, in line with the findings of Gilbert et al. (2004). The study will also treat self-criticism as a trait in accordance with Gilbert's description (Gilbert et al., 2006), and it will include self-esteem, shape and eating concern.

The current study tries to investigate the associations between cognitive BN components shape and eating concern and compensatory behavior, and whether these relationships might be influenced by self-criticism or self-esteem.

Research questions:

RQ1: Are shape concern, eating concern, self-esteem, and the two components of self-criticism associated with compensatory behavior in patients with BN?

It is expected that shape and eating concern are related to compensatory behavior due to prior theoretical and empirical support (Fairburn, 2008; Garner et al., 2014; Grave et al., 2008; Stiles-Shields et al., 2012). Since self-criticism was connected with BN pathology and, more specifically, with compensatory behavior, body dissatisfaction, body image shame (Duarte et al., 2014), and critical inner voices (Fairburn et al., 2003; Noordenbos, et al., 2014), it is expected that self-criticism is associated with compensatory behavior in patients with BN. Because self-esteem was also associated with BN pathology, precisely, with shape/weight concern, body dissatisfaction, body image importance, and compensatory behavior (Brechan & Kvalem, 2015; Fairburn et al., 2003; Watson et al., 2011), it is expected that self-esteem is associated with symptoms of BN. Since findings about a possible association between self-esteem and compensatory behavior were contradictory, it is of relevance to investigate this in another clinical population.

RQ2: Does self-criticism moderate the relationship between shape concern and compensatory behavior?

Prior research showed that shape concern, self-criticism and compensatory behavior are associated with each other (Garner et al., 2014; Grave et al., 2008; Stiles-Shields et al., 2012). It is expected that the relationship between shape concern and compensatory behavior is stronger in BN patients who highly engage in self-criticism. Research supported that people who overvalue an ideal body shape are more self-critical than others. Moreover, research supported that self-critical people are more at risk of using compensatory behaviors. As shape concern is associated with self-criticism, and compensatory behavior is a mean to control body shape after binging (Fairburn, 2008), it is reasonable to assume that BN patients with high shape concern who often over-evaluate their body shape show more compensatory behavior as response and that this effect is increased by self-criticism.

RQ3: Does self-criticism moderate the relationship between eating concern and compensatory behavior?

According to Stiles-Shields (2012), eating concern is associated with compensatory behavior. It is assumed in this study that the preoccupation with thoughts about eating might increase the perceived need to use compensatory behavior to cancel out eating behavior. Further, Fairburn stated that eating concern and compensatory behavior stem from dysfunctional self-evaluation and that self-criticism maintains BN (Fairburn et al., 2003; Fairburn, 2008). Since self-criticism is a form of negative self-evaluation (Gilbert, 2004), self-criticism is expected to strengthen the relationship between eating concern and compensatory behavior. Since compensatory behavior is a way to avoid weight gain following the loss of control of eating (binging) and eating concern was linked to self-evaluation, it is reasonable to assume that self-critical people with BN criticize their eating behavior more than others, have higher eating concern and respond to that with more compensatory behavior.

If the expectations of RQ2 and RQ3 are verified, self-criticism might be a further factor indicating why compensatory behavior is so high in some patients. Targeting self-criticism in treatment could be a new useful focus to reduce a maintaining effect of shape and eating concern on compensatory behavior and might reduce relapse.

RQ4: Does self-esteem moderate the relationship between shape concern and compensatory behavior?

Prior research showed that low self-esteem is associated with shape concern and compensatory behavior in patients with BN (Brechan & Kvalem, 2015; Fairburn et al., 2003; Watson et al., 2011). Per definition, self-esteem refers to the way how one evaluates the self, including thoughts and feelings, and it can be positive and negative (Rosenberg, 1965). Further, self-worth of patients with BN is dependent on shape and eating (Fairburn et al., 2003). Following, self-esteem may consist of negative and dysfunctional self-evaluations in patients with BN and people with low self-esteem likely have higher shape concern and might use more compensatory behavior. Therefore, it is expected that low self-esteem strengthens the relationship between shape concern and compensatory behavior.

RQ5: Does self-criticism moderate the relationship between shape concern and eating concern?

According to prior research, self-criticism is associated with shape concern (Fairburn et al., 2003) and eating concern and shape concern maintain each other (Fairburn, 2008). As described above (see RQ3), there is reason to assume that self-criticism affects eating concern (Stiles-Shields et al., 2012) and there is support that self-criticism affects shape concern (Duarte et al., 2016). According to Fairburn (2008), increased overevaluation of body shape is

connected to thoughts about eating and changes in eating behavior. It is expected that the relationship between shape concern and eating concern is stronger in self-critical people.

Methods

Design

A cross-sectional survey was conducted. The current study was approved by the Behavioral, Management and Social Sciences Ethics committee of the University of Twente.

Participants and procedure

The participants were patients at Human Concern, a foundation with treatment centers for EDs in the Netherlands. The data was collected during the intake procedures between January 2015 and July 2020. During these procedures, the participants had an intake interview where they received a DSM-5 BN diagnosis by a psychiatrist and an intake team consisting of multiple professionals (de Vos, Radstaak, Bohlmeijer, & Westerhof, 2018). Inclusion criteria were (1) a BN diagnosis according to DSM-5 criteria, and (2) patients had to be at least 16 years old. The participants further filled out questionnaires.

Participants were excluded if (1) they did not sign the informed consent that the data may be used for research purposes and be shared with students under the obligation of anonymity and confidentiality and if (2) they did not report using compensatory behavior in form of vomiting, exercising, laxative or diuretic use. Because only three participants were male, (3) these were excluded from the dataset.

The data was anonymized by sorting participants into age groups, and specific co-morbid disorders were changed into disorder groups, height and weight were comprised to a body mass index (BMI, kg/m^2), and any dates or patient codes were excluded as well as results from open-ended questions.

Initially, 1397 patients with different EDs were included, 1334 of these patients gave consent that their data may be used for research purposes. Three hundred of these patients were diagnosed with BN, 297 of the BN patients were female and 57 of those did not use the

requested compensatory behavior and were removed from the dataset. The analysis was conducted with the 240 participants.

The majority of the patients were aged between 21 and 25 years (see Table 1). Most of the patients had a higher education level and lived with a partner or their family. The average age of onset of BN was 16.7 years (*SD*=5.2) and the average ED duration was 9.5 years (*SD*=7.6).

Table 1

Background variables of the participants

	Variable	Frequency (%)
Age group (in years)	16-20	40 (16,7)
	21-25	85 (35.4)
	26-30	56 (23.3)
	31-35	20 (8.3)
	36-40	14 (5.8)
	41-45	17 (7.1)
	46-60	8 (3.3)
Educational level	Higher	123 (51.2)
	Secondary	91 (37.9)
	Primary	2 (0.8)
Living situation	With partner, family	105 (41.3)
	Single	99 (43.8)
	other	12 (5.0)
Treatment before	Yes	149 (62.1)
	No	91 (37,9)

Instruments

The questionnaires included questions about demographic data, background information about the patients, self-criticism, self-esteem and ED psychopathology. The patients were asked to indicate their gender, age, educational level, and their living situation. Further, data was collected about the start age of the BN, duration of BN, co-morbid psychiatric disorders, earlier treatment for a psychiatric disorder and BMI.

Self-criticism was measured with the Forms of Self-Criticizing/Attacking and Self-Reassuring scale (FSCRS) (Gilbert et al., 2004). The scale consists of 22 items measuring self-criticism and self-reassurance and has satisfactory convergent validity (Sommers-Spijkersman, Trompetter, ten Klooster, Schreurs, Gilbert, & Bohlmeijer (2017). Response options are based on a Likert-scale ranging from 0 (not at all like me) to 4 (extremely like me). Self-criticism is measured as a bivariate variable with two components: the hated self and the inadequate self. The scale hated self is measured with five items. An example item is: "I have become so angry with myself that I want to hurt or injury myself". The subscale inadequate self is measured with nine items (e.g. "I am easily disappointed with myself"). The internal consistency of the hated self scale is good (α =.81) and the inadequate self scale (α =.83). The subscales were computed by summing the item scores.

Self-esteem was measured with the Rosenberg Self-Esteem Scale (RSES) (Rosenberg, 1965). The scale consists of 10 items measuring global self-worth, and the convergent validity was evaluated good (Robins, Hendin, & Trzesniewski, 2001). Response options are based on a Likert-scale ranging from 1 (strongly agree) to 4 (strongly disagree). An example item is: "On the whole, I am satisfied with myself.". Five items are reverse scored. The internal consistency in this scale was good (α=.83). The items were summed to create the self-esteem score.

Shape concern, *compensatory behavior*, *eating concern* and *BN psychopathology* were measured with the original version of the Eating Disorder examination questionnaire (EDE-Q) (Fairburn, & Beglin, 1994). The EDE-Q consists of 36 items. The items ask about ED psychopathology during the past 28 days. The questionnaire has four scales to measure cognitive symptoms (shape concern, weight concern, eating concern and eating restraint), it measures behavioral symptoms (binge eating, compensatory behavior like self-induced vomiting, exercising, laxative use, diuretic use) and it can be used to compute a global ED psychopathology score. The EDE-Q has acceptable criterion validity and good concurrent

validity (Mond, Hay, Rodgers, Owen, & Beumont, 2004). The response options for the cognitive symptoms are a Likert scale from 0=not at all to 6=markedly, corresponding to increasing symptom severity.

Eight items are used to measure *shape concern* (e. g. “Has your shape influenced how you think about (judge) yourself as a person?”). The *shape concern* score is calculated by summing the item scores. Five items are used to measure *eating concern* (e.g. “Have you had a definite fear of losing control over eating?”). The *eating concern* score is calculated by summing the item scores. ED psychopathology score is calculated by summing the scores of the scales eating concern, eating restraint, weight concern, and shape concern. ED psychopathology had an excellent internal consistency (α =.90), shape concern had a good internal consistency (α=.89), but eating concern had a poor internal consistency (α=.54)

For the *compensatory behavior*, the patients were asked to fill in the number of times that they have done the separate behaviors during the past 28 days (e. g. “Over the past 28 days, how many times have you made yourself sick (vomit) as means of controlling your shape or weight?”). The compensatory behavior measure was computed by summing the frequencies of self-induced vomiting, excessive exercising, diuretic and laxative use.

Data Analysis

The data analysis was conducted with IBM SPSS Statistics 27. To explore the demographics and background variables, descriptive statistics were calculated. The variables eating concern, shape concern, ED psychopathology, inadequate self, hated self, self-esteem, compensatory behavior, age of BN onset, duration of the BN, and BMI were not normally distributed according to the Kolmogorov-Smirnov test.

Because the data was not normally distributed, non-parametric Spearman correlations were used to test for associations. Two-tailed Spearman correlation analyses were conducted between demographics and background variables (age group, starting age of the BN, BN

duration, and BMI), and study variables (shape concern, eating concern, BN psychopathology, self-criticism, and compensatory behavior). The Spearman correlations were done with both components of self-criticism, *inadequate self* and *hated self*, respectively.

To identify which self-criticism component is more likely to be involved in a moderator analysis, a multiple regression analysis was conducted with compensatory behavior as outcome variable before the moderator analyses. For the same reason a second multiple regression analysis was conducted with eating concern as outcome variable.

The analyses were conducted stepwise. The assumptions were tested during the multiple regression analysis. It was checked that the relationships between compensatory behavior and self-criticism, shape concern, and eating concern, and the relationships between eating concern, self-criticism and shape concern are linear using scatterplots. The data did not show multicollinearity as the VIF scores were <10, and tolerance scores were >.2 The residuals were independent, as Durbin-Watson values were between 0 and 4, and the data was homoscedastic. In the first multiple regression analysis, the VIF score was 1.14, the tolerance was 0.88, and Durbin-Watson statistic was 2.08. In the second multiple regression analysis, the VIF score was 1.00 and the tolerance was 1.00, and Durbin-Watson statistic was 2.01.

The residuals of compensatory behavior were not normally distributed, but they did not deviate extremely in the P-P plot (see the Supplements). The residuals of eating concern were normally distributed. No influential cases showed to bias the models since the maximum Cook's Distance statistics were <1.

In the first multiple regression analysis, both components of self-criticism, eating concern and shape concern were included to identify which variables determine compensatory behavior. In the second multiple regression analysis, both components of self-criticism, and shape concern were included to identify which of the variables predicts eating concern.

To examine how strongly self-criticism affects the relationship between shape and the compensatory behavior, a moderator analysis was conducted with the self-criticism type that had the highest beta value and produced a significant multiple regression model. The moderator analysis was conducted using the moderator analysis tool PROCESS macro v3.5.3 by Andrew Hayes (Hayes, 2021), with shape concern as independent variable, compensatory behavior as dependent variable and self-criticism as moderator variable.

To examine how strongly self-criticism affects the relationship between shape concern and eating concern, a second moderator analysis was conducted, with shape concern as independent variable, eating concern as dependent variable and self-criticism as moderator variable.

Results

Participants

The mean BMI of the participants was 23.4 (*SD*=4.5). The average compensatory behavior frequency over the past 28 days was 22.4 (*SD*=16.3), with 13.3 times self-induced vomiting (*SD*=15.7), 7.3 times excessive exercise (*SD*=8.3), 1.6 diuretic uses (*SD*=3.6), and 1.8 laxative uses (*SD*=5.1). The average shape concern was 38.2 (*SD*=10.3) and eating concern was 14,3 (*SD*=4.8). The mean ED psychopathology was 98.8 (*SD*=23.1). See Table 2 for an overview of the background variables.

Table 2

Descriptives of ED, self-esteem, and self-criticism variables (N=240)

Variable	Mean (SD)	Minimum	Maximum
Age of onset of ED	16.7 (5.2)	7.0	43.0
Duration of ED	9.5 (7.6)	0.5	36.0
BMI	23.4 (4.5)	17.0	47.8
Shape concern	38 (10.3)	2.0	48.0
Eating concern	14.3 (4.8)	2.0	24.0
ED psychopathology (EDE-Q global score)	98.8 (23.1)	14.0	128.0
vomiting over 28 days	13.3 (15.7)	0.0	100.0
laxative use over 28 days	1.8 (5.1)	0.0	28.0
excessive exercise over 28 days	7.3 (8.3)	0.0	35.0
Diuretic use over 28 days	1.6 (3.6)	0.0	8.0
compensatory behavior over 28 days	22.4 (16.2)	1.0	104.0
Inadequate self	26.0 (6.3)	8.0	36.0
Hated self	8.4 (4.8)	0.0	20.0
Self-esteem	12.3 (5.0)	0.0	29.0

Research Question 1: *Are shape concern, eating concern, self-esteem, and the two components of self-criticism associated with compensatory behavior in patients with BN?* Compensatory behavior was statistically significantly associated with inadequate self (*rho*=.19, *p*<.01), hated self (*rho*=.24, *p*<.01), shape concern (*rho*=.26, *p*<.01), eating concern

(*rho*=.27, *p*<.01), general ED psychopathology (*rho*=.32, *p*<.01), and self-esteem (*rho*=-.10, *p*<.01). For further correlation results see Table 3.

Table 3

Two-tailed Spearman Correlations of study variables and ED background variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Compensatory behavior	-								
2. Inadequate self	.19**	-							
3. Hated self	.24**	.68**	-						
4. Shape concern	.26**	.42**	.58**	-					
5. Eating concern	.27**	.35**	.40**	.65**	-				
6. ED psychopathology	.32**	.41**	.56**	.88**	.76**	-			
7. BMI	-.10	.08	-.09	.29**	.16*	.22**	-		
8. Onset ED Age	-.06	-.09	-.13*	-.09	-.05	-.14*	-.03	-	
9. Duration ED	.11	-.01	.00	-.05	-.02	.02	.01	-.39**	
10. Self-esteem	-.19**	-.69**	-.76**	-.45**	-.35**	-.44**	-.16*	.12	-.04

** sig. < .01; * sig. <.05

Research Question 2: *Does self-criticism moderate the relationship between shape concern and compensatory behavior?*

The first multiple regression analysis with compensatory behavior as dependent variable and eating concern, inadequate self, hated self, and shape concern as independent variables, indicated that compensatory behavior is significantly associated with eating concern and inadequate self ($F(2,234)=9.13$, $p\leq.001$) with a proportion of variance of $R^2=.072$, which indicates that 7,2% of compensatory behavior is predicted by eating concern and inadequate self. Eating concern (*B*=.57, *p*=.01) contributed more to the model than inadequate self (*B*=.41, *p*=.02) (see Table 4). Hated self and shape concern were no significant predictors of compensatory behavior. The assumptions for multiple regression analysis were checked.

Since the multiple regression analysis indicated that inadequate self predicts compensatory behavior, while hated self does not, the moderator analysis was conducted with

inadequate self as a moderator. The analysis did not show a significant interaction effect between inadequate self and shape concern (*B*=.01, *p*>.05), which means that no moderating effect was found of inadequate self on the relationship between shape concern and compensatory behavior (*F*(3,263)=2.97, *R*=.18, R^2=.03, *p*<.05).

Table 4

Coefficients multiple regression model with compensatory behavior and eating concern

		Unstandardized Coefficients		Standardized Coefficients		
Variable		B	Std. Error	Beta	t	Sig.
Compensatory behavior	(Constant)	3,80	4,66			
	Eating concern	.57	.23	.17	2.55	**.012**
	Inadequate self	.41	.17	.16	2.34	**.020**
	Hated self	.09	-	-	1.06	.289
	Shape concern	-.03	-	-	-.29	.772
Eating concern	(Constant)	2.72	.92	-	2.95	**.004**
	Shape concern	.30	.02	.65	13.07	**<.001**
	Inadequate self	.09	-	-	1.71	.089
	Hated self	.05	-	-	.83	.408

Research Question 3: *Does self-criticism moderate the relationship between eating concern and compensatory behavior?*

In accordance with the results of the first multiple regression analysis model, the moderator analysis that investigated RQ3 was conducted with inadequate self as moderator. The analysis did not show a significant interaction effect between inadequate self and eating concern (*B*=.04, *p*>.05), which means that no moderating effect of self-criticism on the relationship between eating concern and compensatory behavior was found (*F*(3,263)=6.36, *R*=.26, R^2=.07, *p*<.001). For further information see Table 5.

Table 5

Moderator analyses with self-criticism and self-esteem moderating the relationships between shape concern and compensatory behavior and between eating concern and compensatory behavior.

Predictors	*B*	*SE*	*t*	*p*
Constant	13.82	13.09	1,06	.29
Shape concern	-.12	.36	-.34	.73
Inadequate self	.04	.57	.07	.95
Interaction (shape concern x inadequate self)	.01	.01	.65	.52
Constant	15.80	11.66	1.36	.18
Eating concern	-.31	.86	-.35	.72
Inadequate self	-.25	.47	-.53	.60
Interaction (eating concern x inadequate self)	.04	.03	1.20	.23
Constant	14.36	13.86	1.04	.30
Shape concern	.25	.33	.75	.46
Self-esteem	-.02	.82	-.02	.98
Interaction (shape concern x self-esteem)	-.01	.02	-.48	.63

Research Question 4: *Does self-esteem moderate the relationship between shape concern and compensatory behavior?*

The moderator analysis did not show a significant interaction effect between shape concern and self-esteem (B=-.1, p>.05), which means that no moderating effect of self-esteem was found on the relationship between shape concern and compensatory behavior (F(3,236)=1.94, R=.16, R^2=.02, p>.05). For further information see Table 5.

Research Question 5: *Does self-criticism moderate the relationship between shape concern and eating concern?*

The second multiple regression analysis with eating concern as dependent variable and shape concern, inadequate self, and hated self indicated that eating concern is significantly predicted by shape concern ($F(1,235)=170,80$, $p=.001$) with a proportion of variance of $R^2=.42$, which indicates that 42 % of eating concern is predicted by shape concern ($B=.30$). Inadequate self and hated self were no significant predictors of eating concern. The beta-value was higher for inadequate self ($B=.09$, $p>.05$) than for hated self ($B=.05$, $p>.05$). For more information see Table 4. The assumptions for multiple regression analysis were checked.

Because the results of the second multiple regression analysis model showed that inadequate self had a higher association with eating concern than hated self and was close significant ($p=.089$), the moderator analysis that investigated RQ5 (*Does self-criticism moderate the relationship between shape concern and eating concern?*) was conducted with inadequate self as moderator. The analysis showed a significant interaction effect ($B=.01$, $p<.05$) between shape concern and inadequate self, which means that a moderating effect of inadequate self on the relationship between shape concern and eating concern was found ($F(3,233)=60.92$, $R=.66$, $R^2=.44$, $p<.0001$) (for further information see Table 6). The model shows that shape concern and inadequate self explain 44% of variance in eating concern in this dataset. The interaction is visualized in Figure 1. As shown in the graphic visualization, higher self-criticism seemed to determine large eating concern differences. The graphs show the relationship between shape and eating concern at different self-criticism levels. The relationship between shape concern and eating concern in people with above average inadequate self (1 SD above mean), is represented by the red graph, the relationship in people with average inadequate self is visualized by the green graph and the relationship in people with below average inadequate self (1 SD below mean), is pictured with the blue graph. It is obvious that the slope in the red graph is the steepest which shows that the association

between shape concern and eating concern is the strongest, and with lower self-criticism, the association becomes weaker as the slope of the green and the blue graphs are flatter.

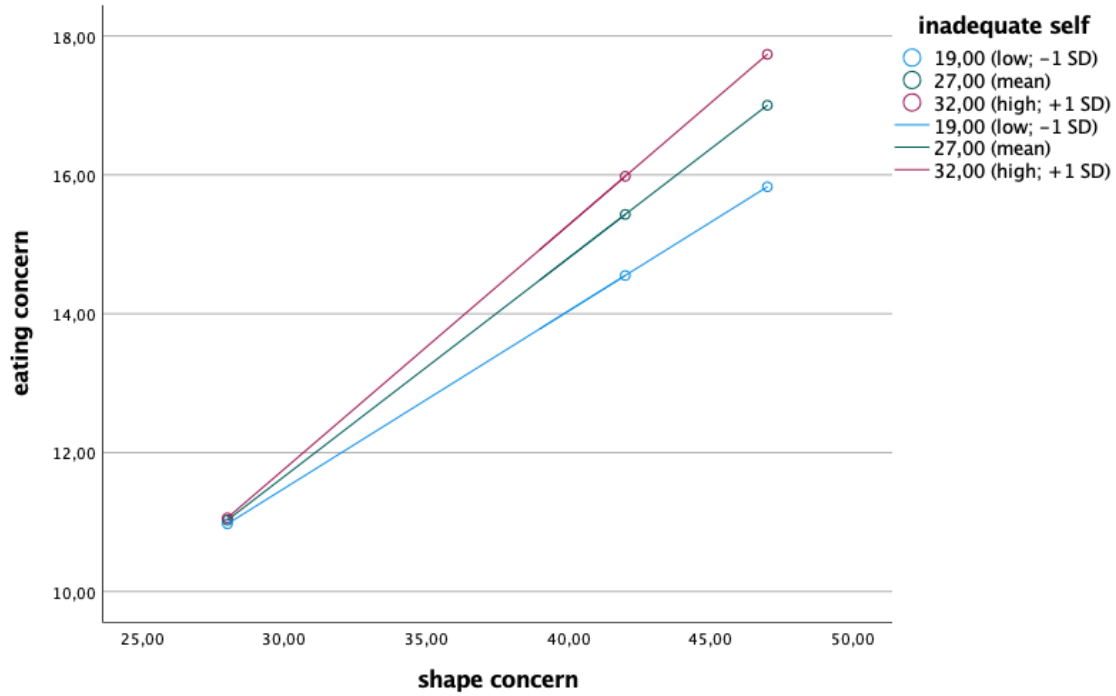
Table 6

Moderator analysis including model summary for the relationship between shape concern and eating concern moderated by inadequate self

Predictors	*B*	*SE*	*t*	*p*
Constant	7.61	2.99	2.54	.01
shape concern	.12	.08	1.41	.16
inadequate self	-.20	.13	-1.53	.13
Interaction effect (shape concern concern x inadequate self)	.01	.00	2.19	.03

Figure 1

Graphical visualization of the conditional effects of shape concern on eating concern, dependent on inadequate self



Discussion

The current study aimed to gain insight into associations between cognitive components of BN and compensatory behavior in a clinical population of BN patients and the potential influence of self-criticism and self-esteem. It adds more knowledge about the role of eating concern and self-criticism in BN and how the variables interact with other BN symptoms.

Findings

The first research question was whether shape concern, eating concern, self-esteem, and the two components of self-criticism are associated with compensatory behavior in patients with BN. It was expected that the variables are all associated with BN compensatory behavior, as indicated by prior research (Brechan & Kvalem, 2015; Duarte et al., 2016; Mason et al., 2019; Noordenbos et al., 2014; Watson et al., 2011; Zelkowitz & Cole, 2019). As expected, findings indicated that shape concern, eating concern, self-esteem, inadequate self and hated self were associated with compensatory behavior.

The second research question was whether self-criticism moderates the relationship between shape concern and compensatory behavior. It was expected that shape concern predicts compensatory behavior, and that this relationship is strengthened by self-criticism. The finding that shape concern did not predict compensatory behavior was not expected and contrasts the connection between the symptoms as described by Fairburn (2008). Fairburn (2008) described in the cognitive model of BN maintenance, that shape concern maintains compensatory behavior and that compensatory behavior has the purpose to control weight gain. Therefore, it was argued that people with higher shape concern, which is the preoccupation of thoughts about body shape and the relevance that body shape has to the individual, feel the need to use more compensatory behavior since the desired body shape more prevalent in their mind than in others'. A potential explanation for this finding might be that this study did not include the binge eating intensity, which is the reason for compensatory

behavior; perhaps do patients with BN with higher shape concern have more control over binging, and as a consequence, binge less compared to patients with less shape concern, and therefore, patients with less binging behavior could feel less need to use compensatory behavior.

The third research question was whether self-criticism moderates the relationship between eating concern and compensatory behavior. It was expected that self-criticism strengthens the relationship between eating concern and compensatory behavior. Eating concern and inadequate self predicted compensatory behavior in a multivariate regression. The finding that inadequate self predicted compensatory behavior, while hated self did not, indicates that the purpose of compensatory behavior is rather to correct oneself than to take revenge and express self-harm. As stated above, inadequate self is about being dissatisfied with oneself and wanting to change or remove the things one doesn't like about oneself (Gilbert et al., 2004). Since eating concern consists of the preoccupation with thoughts about eating (Fairburn, 2008) the results suggested that patients with BN feel a higher need to get rid of eaten calories/food by using compensatory behavior, the more they think about eating.

The results also indicated that the desire to use compensatory behavior is triggered by self-criticism, more precisely, by inadequate self. This finding is in line with the findings by Mason et al. (2019) and Noordenbos et al. (2014), who both investigated the role of general self-criticism on compensatory behavior. Mason et al. (2019) found that self-criticism is a momentary trigger for vomiting behavior, while Noordenbos et al. (2014) found that self-criticism appears in the form of criticizing voices which shame patients with BN for eating and order the individual to use more compensatory behavior. The present study findings specify that inadequate self seems to be involved self-critical component, while Noordenbos et al. (2014) and Mason et al. (2019) investigated general self-criticism. In contrast to Mason et al. (2019) the current study shows that self-criticism is not necessarily a state that is momentarily triggering compensatory behavior, instead, self-critical people seem to show

more severe compensatory behavior in general, since this study asked for the frequency of compensatory behavior in the past four weeks.

Despite the theoretical connection and the findings of the regression analysis, the moderator analysis did not show a significant interaction effect of eating concern and inadequate self on compensatory behavior. This means that the expected strengthening effect of self-criticism was not found. Following, while eating concern and inadequate self were both indicated to predict compensatory behavior, these associations seem to be independent from each other.

The fourth research question was whether self-esteem moderates the relationship between shape concern and compensatory behavior. Since low self-esteem was connected to frequent compensatory behavior and higher shape concern in the past (Brechan & Kvalem, 2015; Watson et al., 2011), it was expected that shape concern affects compensatory behavior, and that self-esteem increases this effect. Despite being negatively associated with compensatory behavior and shape concern, the findings indicated that self-esteem does not have a regulating effect on the relationship between shape concern and compensatory behavior. A possible explanation is that since self-esteem is a more general type of self-evaluation than self-criticism as posed by Fairburn et al. (2003), and that it is an independent important construct that is indicated to influence compensatory behavior and shape concern separately.

The fifth research question was whether self-criticism moderates the relationship between shape concern and eating concern. It was expected that one of the two components of self-criticism strengthens the relationship between shape concern and eating concern. The findings indicated that while shape concern predicts eating concern, self-criticism did not. Additionally, the results supported the expectation that inadequate self strengthens the relationship between shape concern and eating concern. The finding that shape concern is associated with eating concern was expected due to description of the Cognitive Model of the

Maintenance of Bulimia Nervosa by Fairburn (2008). In his explanation, Fairburn described that the preoccupation with thoughts about shape and eating maintain each other and stem from dysfunctional self-evaluation. These findings support the assumption that eating concern stems from the preoccupation with shape and that eating concern is closely tied to the increased value and overevaluation that body shape has for people with BN.

Since self-criticism as well as self-esteem are forms of self-evaluation (Gilbert et al., 2004; Rosenberg, 1965), and since Fairburn et al. (2003) identified the variables as maintainers for BN, it was expected that self-criticism would predict eating concern. A possible explanation that this connection was not found in this study is that while self-criticism can be dysfunctional, it was not tested whether the self-critical notions of the participants in this study where dysfunctional in the sense that Fairburn (2008) referred to. In a future longitudinal study, it could be investigated how dysfunctional self-critical thoughts reported by patients with BN are. Similarly, to the study by Noordenbos et al. (2014), this study could identify the exemplary thoughts, but in addition, it could categorize typical self-critical thoughts according to the BN symptoms they are related to and whether and how dysfunctional they are.

Although self-criticism was not indicated to predict eating concern significantly, the findings indicated that inadequate self increases the effect of shape concern on eating concern. As visible in the graphic visualization of the moderator relationship (see Figure 1), participants with high self-criticism in form of inadequate self had a stronger association between shape and eating concern. This indicates that people who ruminate frequently about the things that they do not like about themselves, consider not good enough or want to change (Gilbert et al., 2004) seem to have more intense cognitive BN symptoms, at least stronger preoccupation with thoughts about shape and eating.

Strengths and Limitations

The current study had several strengths. First, based on the large sample size of patients diagnosed with BN, it was possible to focus on BN patients as a separate target group, while other studies often grouped patients with different EDs together (Kelly & Carter, 2012; Mond & Calogero, 2009). Next, the participants were diagnosed with BN by multiple professionals in a careful procedure. Due to this, the diagnoses are reliable and unlikely biased. An additional strength is that since the data is retrieved from inpatient women who are right before the start of their treatment, it is highly generalizable to the majority of the affected population who seeks BN treatment.

The study had several limitations. First, it was cross-sectional; therefore, the associations that were found in this study are not necessarily a sign of causality. Next, 57 participants of the study had to be excluded because they did not report to have used one of the compensatory behaviors that were asked in this study (vomiting, exercise, laxative use, diuretic use) despite being professionally diagnosed with BN. A possibility is that they used different compensatory behaviors such as fasting or enema use (Mitchell, Steffen, Ertelt, & Marino, 2012). Another limitation is that the study used a self-report questionnaire which might also be a second reason for the issue with the compensatory behavior. Since self-report relies on honest responses and a good understanding of the questions and response options, the reliability of self-report questionnaires is always questionable and since the compensatory behavior was not measured with multiple items, inter-item reliability cannot be checked.

The next limitation is that the correlations of compensatory behavior with self-criticism, self-esteem, and eating disorder variables were surprisingly low (*rho* between -.19 and .32). It would be interesting to investigate whether this would change in a study that looks more advanced at compensatory behavior, by testing associations between self-criticism, self-esteem, and eating disorder variables with different methods of compensatory behavior like

Stiles-Shields et al. (2012), who examined separate compensatory behaviors and the use of multiple methods.

Another limitation is that findings about eating concern in this study need to be treated with special caution due to the low internal consistency of the scale (α =.54). This poor internal consistency indicates that the items measuring eating concern might be too different and could measure different constructs. The last limitation is that the data consisted only of women, therefore, it is not generalizable to men who suffer from BN.

In addition to a more extensive study that investigates whether separate compensatory behaviors and the use of multiple methods lead to different results, future research could also include more compensatory behaviors such as fasting and enema use. Additionally, a relevant addition could be to include an investigation of the relationship between binge eating and compensatory behavior and test whether self-criticism, eating concern, or shape concern moderate this relationship. Another possible addition would be including the effect of eating concern and shape concern on dietary restraint and whether moderators can be found for these relationships.

Conclusion

This study indicated that compensatory behavior is predicted by inadequate self and eating concern and that eating concern is predicted by shape concern. Furthermore, the results showed that inadequate self moderates the relationship between shape concern and eating concern. These results support the importance of addressing self-criticism, specifically inadequate self, in the psychotherapeutic treatment of BN and indicate an important effect of shape concern on eating concern. Despite an association, self-esteem did not have a moderating influence on the relationship between shape concern and compensatory behavior, therefore it seems to have less direct influence on BN symptoms than expected.

As an implication for practice, it is recommended that therapists help patients to identify specific self-critical thoughts concerning eating and shape concern. If those thoughts are identified, the patient and the therapist can collaboratively try to replace or modify those thoughts. Since self-criticism seemed to strengthen the relationship between preoccupation of shape and eating, working on specific thoughts might weaken the maintenance. Identifying and unhelpful thought patterns and replacing them with more helpful and rational thoughts is a core technique in CBT (Kennerly et al., 2017), which is the base of CBT-ED therapy approach of choice for BN (NICE, 2020).

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Supplements

Supplement 1: P-P-plot compensatory behavior