

Trends

in Psychiatry and Psychotherapy

JOURNAL ARTICLE PRE-PROOF **(as accepted)**

Original Article

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<http://doi.org/10.47626/2237-6089-2023-0644>

Original submitted Date: 18-Mar-2023

Accepted Date: 21-Aug-2023

This is a preliminary, unedited version of a manuscript that has been accepted for publication in Trends in Psychiatry and Psychotherapy. As a service to our readers, we are providing this early version of the manuscript. The manuscript will still undergo copyediting, typesetting, and review of the resulting proof before it is published in final form on the SciELO database (www.scielo.br/trends). The final version may present slight differences in relation to the present version.

Relationship between psychopathology and binge size in binge eating spectrum Disorders

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Date of last literature review: August 2022

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ABSTRACT

Introduction: Food intake during binge eating episodes has been found to be associated with symptoms of depression and anxiety in individuals with eating disorders.

Objective: to evaluate the association between caloric intake during binge eating episodes (BEE) and psychopathology in individuals with binge eating spectrum disorders (BSD).

Methods: one-hundred and fourteen outpatients diagnosed with bulimia nervosa (BN) and binge eating disorder were sequentially assessed. MINI PLUS was used to assess psychiatric diagnoses. Validated self-report instruments were used to assess general and eating-related psychopathology. The assessment of caloric consumption during BEE was performed through Dietpro Clinical Program. Data analysis was performed with independent Student's t test, effect size (Cohen's d) and Pearson's correlation.

Results: Participants with BSD comorbid with a depressive disorder consumed significantly more calories during BEE than those without depression. Furthermore, participants with BSD and higher levels of impulsivity had a greater caloric intake during the episode. Specifically, regarding BN, participants with greater disease severity consumed more calories during the episode than those with less severity.

Conclusions: Overall, depression and high impulsivity were associated with a higher caloric intake during BEE in individuals with BSD. For those with BN, the disease

severity was associated with greater caloric consumption during the episode. Our results support the relevance of early identification of psychiatric comorbidities and the implementation of strategies to control mood and impulsivity aiming at a better prognosis in the treatment of BSD.

Keywords: Binge eating size, psychopathology, eating disorders, binge eating disorder, bulimia nervosa

1. Introduction

Binge eating is a cardinal symptom present in binge eating spectrum disorders (BDS) such as bulimia nervosa (BN) and binge eating disorder (BED) (1). Since early reports by Stunkard, two main features of binge eating were identified: the excessive consumption of food and an experience of loss of control over eating (2). However, while the loss of control over eating is currently accepted as an essential component of binge eating, the validity of the binge eating size criterion is less clear (3–6).

Some authors suggested that binge eating size could be a marker of severity along with other aspects of this phenomenon (7). Food intake during binge eating episodes is associated with symptoms of depression and anxiety in individuals with eating disorders (EDs) (6,8–10). Studies have suggested that binge eating may be used as a strategy to distract individuals from their negative emotions, such as sadness, anxiety, or anger. This relationship may be especially relevant in individuals with eating disorders, who often have emotional and affective regulation difficulties (11,12).

Eating disorders are associated with other mental health conditions. For instance, depression has been frequently diagnosed in individuals with eating disorders. In addition, studies have suggested a bidirectional relationship between binge eating and depression, with each of these conditions being able to influence and aggravate the other. Similarly, anxiety may precede binge episodes and increase the likelihood of recurrent

binge eating episodes (6,8–10). Moreover, impulsivity has been associated with binge eating symptoms and eating disorder diagnosis (13,14).

A systematic review of 43 studies assessing binge eating characteristics found a positive correlation between depressive mood and caloric intake during the binge episode. It is noteworthy that the meta-analysis considered only studies that assessed objective binge eating episodes (consumption of a large amount of food associated with the feeling of loss of control over eating) due to the lack of a consistent number of studies that considered the definition of subjective binge eating episode (the feeling of loss of control over eating associated with the consumption of small or moderate amounts of food). This review pointed out some limitations of the current literature about binge eating size: (1) few studies correlated caloric intake with the binge episode and/or other psychopathological measures, (2) the heterogeneity of methodologies, which limited the comparisons among the studies, and (3) a decline in the number of publications on this subject in recent years (15).

Considering these gaps in the literature, there is a need for a better understanding of the relationship between binge eating size and psychopathology, especially symptoms of depression, anxiety, and impulsivity, which is of paramount importance for progress in this area of eating disorders. This relationship may provide valuable information for understanding the underlying mechanisms and developing more effective therapeutic interventions. Hence, the present study assessed the potential associations between caloric intake during objective binge eating episodes and general and eating-related psychopathology in patients with BSD.

2. Methods

2.1. Study design and setting

This is a cross-sectional study carried out in an outpatient eating disorders unit. The study was conducted between 2017 and 2019 with outpatients diagnosed with BSD seeking treatment for their conditions in the Obesity and Eating Disorders Group (GOTA), at the Psychiatry Institute of the Federal University of Rio de Janeiro, Brazil.

2.2. Participants

Participants were sequentially invited to participate in this study. Participants were adolescents (over 16 years) or adults meeting the criteria for BN, BED, and their subthreshold forms according to the Diagnostic and Statistical Manual of Mental Disorders – 5th edition (DSM-5). Children, pregnant and lactating women were excluded. The study protocol was approved by the Institutional Ethics Committee of the Institute of Psychiatry of the Federal University of Rio de Janeiro (CAAE: 65842817.9.0000.5263). Participants signed the informed consent before taking part in any study procedure.

2.3. Procedures

In the baseline assessment, participants were diagnosed through structured interview. In the sequence, sociodemographic and clinical information, including age, sex, ethnicity, marital status, schooling, occupation, age of disease onset, and its duration were collected. Next, anthropometric information were measured. Then, the nutritional evaluation was carried out, including an investigation of food consumption during the binge eating episode. General and eating-related psychopathology were investigated using validated psychiatric assessment instruments. The data collection was performed before the beginning of the treatment, in the initial screening of the service.

2.4.1. Psychiatric assessment

Diagnosis of Eating Disorders and Psychiatric Comorbidities

The diagnosis of BN, BED, and their subthreshold forms was confirmed by the Structured Clinical Interview for DSM-IV (SCID-I/P) adapted for DSM-5(1). Comorbid psychiatric conditions were assessed using the mood and anxiety schedule of the Mini International Neuropsychiatric Interview Plus (MINI PLUS) applied also by trained psychiatrists (16,17). The interviews were performed by trained psychiatrists, specialized in the eating disorders area.

Eating Disorder Severity

In the initial assessment, the clinician measured the ED severity using the Clinical Global Impression (CGI). The scores ranged from 0 to 7, in which higher values mean a greater severity (score 0 = unvalued / 1 = without symptoms / 7 = extremely sick). Severity levels were classified as follows: a) mild: 1-3 score; b) moderate: 4; c) severe: 5-7 (18).

General and Eating-Related Psychopathology

The severity of depressive symptoms was assessed by the 21-item Beck Depression Inventory-II (BDI-II), a self-report questionnaire in which the individual describes how has been feeling in the previous week (19). In general, the internal consistency of BDI-II has been described as good to excellent (20). The severity of the depressive symptoms was classified according to the following score levels: a) without symptoms: 0-9 points; b) mild: 10-18; c) moderate: 19-29; d) severe: 30-63. The internal consistency of the Portuguese version of BDI-II was 0.88 for subjects with depression (21).

Anxiety symptoms were evaluated using the 20-item State-Trait Anxiety Inventory (STAI) questionnaire. Anxiety was assessed as state (STAI-S), a transient reaction of the organism to a certain situation or moment, and as a trait (STAI-T), individual differences related to how a given individual deals with greater or lesser anxiety throughout life (22). Studies carried out in Brazil have indicated high internal consistency in both sub-scales(23). The score for each part of the instrument varies from 20 to 80 points. The severity of the anxiety symptoms was classified as: a) low: 0-32 points, b) moderate: 33-49; c) high: greater than or equal to 50 (21).

Impulsivity was assessed using the Barratt Impulsiveness Scale (BIS-11), a 30-item self-report instrument. Barratt's model proposes that impulsivity is a multidimensional construct that encompasses three factors/components expressed in the following subscales: (1) motor (ability to contain the act), (2) attentional (quick decision making), and (3) lack of planning (orientation to the present). (24,25). The instrument showed good internal consistency for the total score (26). Scores range from 30 to 120 points, and higher scores are associated with greater impulsivity. The instrument classifies individuals according to the following levels of severity: a) very controlled: less than 52 points; b) normal impulsivity: 52-71 points; c) highly impulsive: greater than 72 points (24).

In participants with BN, bulimic behaviors were assessed by the Bulimic Investigatory Test of Edinburgh (BITE). This self-report instrument is composed of two sub-scales, one focusing on the symptoms and the other on their severity (frequency of binge eating and compensatory behaviors). The symptoms subscale classifies individuals into the following groups: a) low (normal limits): < 10 points; b) medium (unusual eating pattern): 10 to 19 points; c) high (compulsive eating behavior): \geq 20 points. The severity

subscale is divided into three categories: a) low: up to 5 points; b) moderate: between 5 to 9 points; c) high: score ≥ 10 points (27,28).

In participants with BED, the severity of binge eating was assessed using the Binge Eating Scale (BES), a 16-item self-report instrument that considers the frequency, the amount of food eaten, and the degree of emotion involved in a binge eating episode. BES scores are classified into the following levels of severity: a) < 17 : no binge eating; b) between 18 and 26: moderate binge eating; c) ≥ 27 : severe binge eating (29,30).

2.4.2. Energy intake (kcal)

For the assessment of energy intake, participants were instructed to recall a representative binge eating episode according to DSM-5 (objectively large amount of food plus loss of control) that occurred in the last month (31). In the nutritional interview, after the description of the food items consumed during the binge eating episode, the quantities reported were reviewed by a registered dietitian (CM), using images of portion sizes for greater accuracy of the description. Furthermore, the foods consumed were characterized according to their brands and cooking methods to provide a detailed description of the food consumption during the episode. In the sequence, we checked if any other product was added to the preparations (e.g., sugar/sweeteners or condiments) and if any drink or other food was not mentioned (32). Finally, all information regarding the foods and beverages consumed during binge eating episodes were imputed in Dietpro Clinical Program®, version 5.8 (33).

2.4.4 Anthropometric Measurements

Participants' weight and height were measured using a WELMY® electronic beam scale and a TONELLI® wall stadiometer. These measurements were performed with the

participant barefoot and wearing light clothing. The weight and height measurements were used for the calculation of BMI (kg/m^2).

2.5. Statistical Analysis

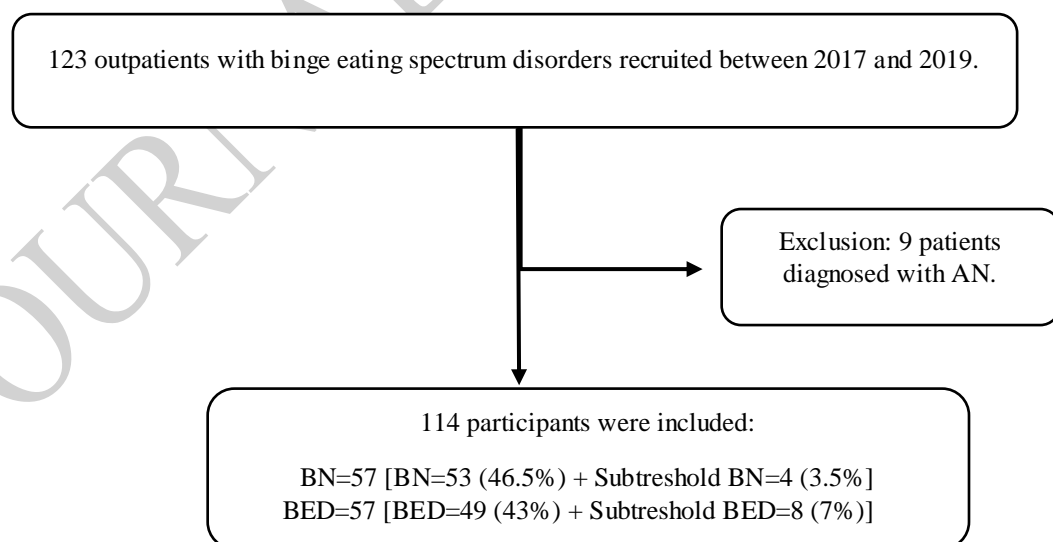
First, the characteristics of the participants were presented descriptively, in which the continuous variables were displayed by means and standard deviation and the categorical variables using absolute and relative frequencies. In addition, the median, minimum, maximum, and interquartile range of the dependent variable (caloric intake during the episode) were described. Data were inspected for normality.

In the next step, caloric intake during the episode was compared with psychiatric diagnoses and measures of general and eating related psychopathology. The severity of psychopathological symptoms was categorized according to the literature, as described previously in "Measures". Associations with binge eating size were performed based on the classifications of high severity. The independent Student's t-test and effect size (Cohen's d) were used to compare the two means. The effect size was considered small when was Cohen's d less than 0.2, medium 0.4, and large 0.6 (34). Categorical variables were compared using the Chi-square test. Differences between the groups were considered statistically significant when $p \leq 0.05$. The degree of association between continuous variables was analyzed using Pearson's correlation. Correlations were considered statistically significant when set at $p \leq 0.05$ and a moderate or strong degree of correlation. Statistical analysis was performed using the SPSS / 21.0 - Statistical Package for the Social Sciences program.

3. Results

The study included 114 participants with BSD. Fifty percent had a diagnosis of BN ($n=57$) and 50% ($n=57$) had BED (Figure 1). The mean age of participants with BSD

was 30.3 (SD=9.9) years, significantly higher in participants with BED 36.4 (SD=13.1) than in those with BN 33.4 (SD=12) ($p = 0.006$). Eighty-eight percent of the participants were women. The BMI was significantly lower in participants with BN than in those with BED [28.5 (SD=7.5) *versus* 40.6 (SD=8.9) kg/m², $p = 0.000$], as well as the age of disease onset [16.6 (SD=6.1) *versus* 21.2 (SD=10.5) years, $p=0.005$]. There were no differences in the illness duration and disease severity between groups. It is noteworthy that patients with BN tend to be considered more severe according to the CGI [4.5 (SD=1.2) *versus* 4.1 (SD=0.9) years, $p=0.054$] and have higher impulsivity scores [75.2 (SD=12.9) *versus* 70.2 (SD=12.6) years, $p=0.049$] (Supplementary material – Table 4). Overall, participants with BSD consumed a mean of 2106.6 (SD=1327.3) Kcal during binge eating episodes. In addition, we did not observe statistically significant differences between participants with BN [2263.8 (SD=1353.4) Kcal] and BED [1949.4 (SD=1293.5) Kcal, $p=0.207$ (Table 2).



Footnote: * AN: Anorexia nervosa; BN: Bulimia nervosa; BED: Binge eating disorder.

Figure 1 - Recruitment flow chart

Table 2 - Caloric intake during binge eating episodes in participants according to eating disorder status.

	<i>Binge Eating Spectrum Disorders (n=114)</i>			<i>Bulimia Nervosa (n=57)</i>			<i>Binge Eating Disorders (n=57)</i>			<i>p-value</i>
	<i>Mean (SD)</i>	<i>Median (Min-Max)</i>	<i>IQR</i>	<i>Mean (SD)</i>	<i>Median (Min-Max)</i>	<i>IQR</i>	<i>Mean (SD)</i>	<i>Median (Min-Max)</i>	<i>IQR</i>	
<i>Caloric Intake (Kcal)</i>	2106.6 (1327.3)	1859.8 (339.1 - 8944.3)	(1143.3 / 2600.2)	2263.8 (1353.4)	2075.6 (339.1 - 5850.8)	(1243.3 / 2789.1)	1949.4 (1293.5)	1665.2 (652.1 - 8944.3)	(1100.3 / 2322.9)	0.207

Note: *Test t; SD - Standard deviation; Min – Minimum; Max – Maximum; IQR - Interquartile range; Kcal – Calories.

Depressive [68% (n=68)] and anxiety disorders [60.2% (n=62)] were the most prevalent psychiatric diagnoses associated with BSD. However, there were no statistically significant differences when comparing participants with BN and BED. Conversely, individuals with a BSD and depressive disorders had a higher caloric intake during binge eating episodes than those without a diagnosis of depression [2323.6 (SD=1490.8) *versus* 1770 (SD=965.4), $p = 0.02$] Kcal with a moderate effect size in this group (0.41) as well as for those with BED and depression (0.48). Conversely, in the group with BN and depression, the effect size was small (0.35). Regarding patients with BN, those with comorbid anxiety disorders showed a trend towards a higher caloric intake during the episode [2612.3 (SD=1478.1) *versus* 1929.9 (SD=1143.6), $p = 0.06$] Kcal with a moderate effect size (0.51) (Table 3).

Table 3 - Associations between caloric intake during binge eating episodes and psychiatric comorbidities, general, and eating-related psychopathology according to eating disorder diagnosis

	Total			DIAGNOSIS					
	<i>n</i>	Media (SD)	<i>p-value</i> (<i>D Cohen</i>)	<i>n</i>	Media (SD)	<i>p-value</i> (<i>D Cohen</i>)	<i>n</i>	Media (SD)	<i>p-value</i> (<i>D Cohen</i>)
Associated psychiatric comorbidities (MINI-PLUS)									
Depressive disorders									
No Depression	35	1770.0 (965.4)	<i>p=0.025</i> (0.41)	18	1981.3 (1167.1)	<i>p=0.234</i> (0.35)	17	1546.3 (655.7)	<i>p=0.117</i> (0.48)
Depression	68	2323.6 (1490.8)		36	2453.9 (1443.8)		32	2177.0 (1551.8)	
Anxiety disorders									
No anxiety	41	2026.7 (1534.0)	<i>p=0.511</i> (0.13)	25	1929.9 (1143.6)	<i>p=0.062</i> (0.51)	16	2177.9 (2035.4)	<i>p=0.546</i> (0.24)
Anxiety	62	2207.5 (1233.1)		29	2612.3 (1478.1)		33	1851.7 (841.33)	
Psychopathological symptoms (specific symptom scales)									
Symptoms of Depression (BDI)									
No-Severe depression	66	2075.5 (1413.1)	<i>p=0.745</i> (0.07)	34	2228.8 (1327.6)	<i>p=0.551</i> (0.17)	32	1912.5 (1502.6)	<i>p=0.952</i> (0.02)
Severe depression	38	2166.8 (1297.2)		18	2474.8 (1548.6)		20	1889.6 (908.1)	
Severity anxiety state (IDATE-S)									
No-High anxiety	87	2055.2 (1358.5)	<i>p=0.238</i> (0.32)	46	2193.4 (1325.3)	<i>p=0.108</i> (0.66)	41	1900.1 (1394.7)	<i>p=0.795</i> (0.10)
High Anxiety	16	2496.7 (1416.0)		7	3096.9 (1614.9)		9	2029.8 (1115.0)	
Severity anxiety trace (IDATE-T)									
No-High anxiety	51	2110.6 (1273.4)	<i>p=0.923</i> (0.02)	25	2391.7 (1571.9)	<i>p=0.699</i> (0.11)	26	1840.3 (846.3)	<i>p=0.652</i> (0.13)
High Anxiety	52	2136.7 (1470.8)		28	2242.3 (1217.9)		24	2013.5 (1739.5)	
Impulsiveness (BIS-11)									
No-High impulsivity	48	1859.8 (1049.7)	<i>p=0.056</i> (0.38)	20	2198.4 (1257.9)	<i>p=0.669</i> (0.12)	28	1618.1 (811.7)	<i>p=0.064</i> (0.58)
High impulsivity	57	2370.5 (1559.2)		34	2366.1 (1450.7)		23	2376.9 (1741.2)	

Eating psychopathology
(specific symptom scales)

Severity clinical global (CGI-S)									
Non-Severely ill	80	1971.7 (1117.8)	$p=0.358$	38	2130.7 (1233.3)	$p=0.393$	42	1827.8 (995.2)	$p=0.582$
Severely ill	19	2255.6 (1533.1)	(0.24)	14	2499.2 (1696.1)	(0.27)	5	1573.4 (652.5)	(0.26)
Symptoms of bulimia nervosa (BITE-S)									
Not high				5	1276.3 (\pm 795.5)	$p=0.092$			
High		NA		39	2401.4 (\pm 1420.0)	(0.82)		NA	
Severity of bulimia nervosa (BITE-G)									
Not high				15	1709.3(\pm 907.9)	$p=0.052$			
High		NA		29	2574.3 (\pm 1534.3)	(0.64)		NA	
Severity of binge eating (BES)									
No-Severe binge eating							12	1586.8 (653.9)	$p=0.315$
Severe binge eating		NA			NA		30	1882.6 (914.1)	(0.35)

Note: independent test t; SD - Standard deviation; BN - Bulimia Nervosa; BED - Binge Eating Disorder; MINI PLUS: Mini International Neuropsychiatric Interview Plus; BDI: Beck Depression Scale (BDI > 30 points - High severity); STAI-S: State Anxiety Inventory; STAI-T: Trait Anxiety Inventory (STAI > 50 points - High severity); BIS-11 - Barrat Impulsivity Scale (BIS-11 > 72 points - High severity); CGI-S: Global Clinical Impression Scale (CGI-S > 5 points - High severity); BITE: Bulimic Investigatory Test of Edinburgh (BITE - Symptoms subscale > 20 points - High level of symptoms); (BITE - Severity Subscale > 10 points - High level of severity); BES - Binge Eating Scale (BES > 27 points - High severity); NA: Not applicable

Participants with BSD and high level of impulsivity had a higher caloric intake during the binge eating episode when compared to those without high impulsivity [2370.5 (SD=1559.2) *versus* 1859.8 (SD=1049.7) Kcal, $p = 0.05$] with a small effect size (0.38). In patients with BED, there was a trend towards a greater caloric intake during the episode in the presence of high impulsivity [2376.9 (SD=1741.2) *versus* 1618.1 (SD=811.7) Kcal, $p = 0.06$] with a moderate effect size (0.58). The symptoms of depression (BDI-II), and anxiety (STAI) and the disease severity (CGI) showed no association with caloric intake during the episode. However, when comorbid anxiety was assessed using STAI-S, it had a strong effect size on binge eating size (0.66) (Table 3).

Among participants with BN, there was a trend towards a greater caloric consumption of those with high levels of bulimic symptoms [2401.4 (SD=1420) *versus* 1276.3 (SD=795.5) kcal, $p = 0.09$] with a large effect size (0.82). Moreover, individuals with high disease severity consumed significantly more calories during binge eating episodes [2574.3 (SD=1534.3) *versus* 1709.3 (SD=907.9) Kcal, $p = 0.05$] with a large effect size (0.64). Conversely, among participants with BED, there was no statistically significant differences in the caloric consumption during binge eating according to the disease severity (Table 3).

Analysis of the Pearson's correlation to assess whether caloric intake during the binge eating episode correlates with the symptoms of general and eating psychopathology found a moderate correlation between caloric intake during the episode and the severity of BN symptoms (BITE-Symptoms) ($r=0.438$, $p = 0.03$) (Supplementary material – Table 2). In the participants with BED, no correlation was observed between caloric intake during a binge eating episode and the other variables.

4. Discussion

The current study aimed to investigate the associations between caloric intake during binge eating episodes and general and eating-related psychopathology in outpatients with BSD. To the best of our knowledge, this study was the first to assess the association of the calories consumed during the episodes with categorical diagnoses of psychiatric comorbidities. Participants with BSD comorbid with depressive disorders consumed a significantly greater amount of calories during binge eating episodes and, in BN those diagnosed with anxiety disorder had a higher caloric intake in the episode. In addition, high levels of impulsivity were associated with a higher caloric consumption in people with BSD. Furthermore, the severity of BN was positively associated with the caloric intake during binge eating.

These findings were partly consistent with a recent systematic review which found a positive association between binge eating size and the severity of depressive symptoms (15). Although we did not observe associations with depressive symptoms dimensionally, we found an association between the diagnosis of depression and a higher caloric intake during the episode in individuals with BSD. Conversely, the relationship between anxiety and binge eating size is still controversial (15). We observed a trend in the association between anxiety state and caloric intake during the episode in participants with BN with a moderate effect size. Latner et al. found that although objective and subjective binge eating episodes were similarly related to general and eating psychopathology, mood-related psychopathology was exclusively associated with the consumption of large amounts of food during the episodes (6). Similarly, in the present study, individuals with BSD and depressive disorders consumed a greater amount of food during the episode. On the other hand, Brownstone et. al. found that individuals with BN

had similar levels of eating disorder symptoms and negative affect (symptoms of depression and anxiety) regardless of the amount ingested during the episode (35).

These findings have several possible explanations. First, an increase in caloric intake may be a consequence of the eating disorder symptomatology. Therefore, those with the disease use binge eating to relieve or escape from symptoms of depression and anxiety. Second, some features of eating disorders, such as distress and loss of control over eating, increase the internalization of symptoms, and then depression increases food intake by increasing appetite. Finally, the presence of binge eating episodes and elevated symptoms of depression and anxiety, synergistically influence food intake (10).

We found a positive association between high impulsivity traits and the amount of food eaten during binge eating episodes in participants with BSD. This is consistent with previous studies that showed an association between impulsivity and eating disorders (13,14,36). In a systematic review of 12 studies assessing impulsivity in adults with eating disorders using self-report instruments, Waxman found that high impulsivity was mainly associated with binge eating and purgative behaviors (13). Another recent systematic review investigated the relationship between impulsivity and food consumption and involved studies with participants with BED. Some of the included studies showed a positive correlation between impulsivity and the food consumed (36). A potential explanation for these findings is that impulsivity is linked to a deficient inhibitory process, then highly impulsive individuals can therefore make hasty decisions about food (14).

Forney et al. (7) carried out a study with 243 women with BN and purgative disorder to assess the validity of the DSM-5 size criterion, regardless of the effect of loss of control. Their results suggested that binge eating size can provide information about

the severity of the ED due to its relationship with disinhibition, depressive symptoms, and anxiety, which is not explained only by the presence or severity of the loss of control. The frequency of purging and depressive symptoms was higher in the presence of larger binge eating episodes. Although this study did not include individuals with BED, some of its results are similar to what we have found.

We found an association between the BN severity, assessed by the BITE severity subscale, and a greater caloric intake during the episode. The BITE severity subscale quantifies the severity of BN using the frequency of binge eating episodes and the number of compensatory behaviors (28). Thus, our findings may suggest an association between the frequency of binge eating and the use of compensatory behaviors with the size of the episode. Similarly, Latner et al. found that eating large amounts of food during binge eating episodes was related to the frequency of self-induced vomiting (6). These findings reinforce the importance of characterizing the binge eating size, which may be valuable as a severity specifier criterion (7).

It is noteworthy that the assessment of the caloric intake during binge eating episodes provides an imperfect measure of the amount of food eaten. This can introduce a bias in studies investigating the relationship between binge eating size and psychopathology (37). Additional limitations in the present study include the lack of a sample size estimation and the use of self-report scales for the assessment of psychopathology. However, these instruments have been validated in the Brazilian context and showed satisfactory internal consistency. The small sample size weakened the analysis of the data. Thus, we considered the discussion of the statistical significance and the effect sizes. Due to this limitation, we were also unable to perform regression analysis and control multiple tests.

As this is an exploratory study, we have not analyzed possible confounders that may have influenced food intake, such as physical activity and eating restriction. This study considered binge eating episodes defined according to DSM-5, which may end up excluding subjective binge eating episodes. However, the last review on this topic also considered in its meta-analysis only objective episodes and likewise verified the correlation of binge eating size with depressive symptoms (15). Nevertheless, the strengths of this study were: (1) the use of standardized interviews performed by psychiatrists specialized in eating disorders for the diagnosis of psychiatric comorbidities; (2) the assessment of binge eating episodes by a specialized and trained dietitian; and (3) the participants included in the study were assessed before the beginning of the ED treatment.

Our findings are relevant in clinical settings as psychopathological variables such as depression and impulsivity, as well as the severity and frequency of bulimic behaviors in BN may be related to a higher caloric intake during the episode, impacting the nutritional status and the clinical course of individuals with BSD. Therefore, the early identification of psychiatric comorbidities and implementation of strategies to reduce impulsive behaviors may represent potential approaches to treat and prevent BSD.

Our results support the relevance of binge eating size in the combination of loss of control as currently described in the DSM-5 criteria. Longitudinal studies are needed to provide a better understanding of the similarities and differences between those who exhibit objective and subjective binge eating episodes in terms of diet and psychopathology, as well as understanding the relationship between the food consumption during the episode (i.e., food portions and caloric intake), psychopathology and loss of control eating. Although the ICD-11 omits the requirement of the size criterion

for the characterization of binge eating episodes, our findings support the clinical utility and further study of this feature as a diagnostic specifier.

4.1 Conclusion

The presence of a depressive disorder and high impulsivity was associated with a higher caloric intake during binge eating episodes in individuals with BSD. In addition, for those with BN, disease severity may play an additional role in the caloric consumption during the episode.

Conflict of interest: Jose Carlos Appolinario receives/has received research grants, consultancy fees, and advisory board fees from Takeda Pharmaceuticals. He receives/has received royalties/honoraria from Artmed Panamericana Editora. He also received a research grant from the Brazilian National Research Council (CNPq).

Funding sources: This research did not receive any specific grant from funding agencies in the public or commercial. This work is part of the doctoral thesis at the Federal University of Rio de Janeiro and was presented at the International Conference on Eating Disorders (ICED) in 2022.

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Table 1 - Sociodemographic and clinical characteristics of the participants with binge eating spectrum disorders.

Sociodemographic and Clinical Characteristics	Binge Eating Spectrum Disorders (<i>n</i> =114)
	Mean (SD)
Age	33.4 (12.0)
BMI (Kg/m ²)	34.6 (10.2)
Age onset disease (years)	18.9 (8.9)
Time illness (months)	171.9 (128.0)
	N (%)
Self reported gender	
Male	14 (12.3%)
Female	100 (87.7%)
Self reported race	
White	72 (63.2%)
Mixed	22 (19.3%)
Black	20 (17.5%)
Marital status	
Single	81 (71.1%)
Married	21 (18.4%)
Separated / Widower	12 (10.5%)
Education	
Elementary	17 (14.9%)
High school	13 (11.4%)
Undergraduate	31 (27.2%)
Graduated	40 (35.1%)
Postgraduate	13 (11.4%)
Work status	
Never worked	21 (18.4%)
Employee	51 (44.7%)
Unemployed	27 (23.7%)
Licensed / Retired	15 (13.2%)
Eating Disorders Diagnosis	
Bulimia Nervosa	57 (50%)
Binge Eating Disorder	57 (50%)

Note: M – Mean; SD - Standard deviation; BMI – Body Mass Index.

Supplementary material

Table 1 - Pearson's correlation and level of significance between caloric intake of binge eating episode and levels of general psychopathology in eating disorders

DIAGNOSIS	Caloric intake	BDI	STAI-S	STAI-T	BIS-11	
Caloric intake	ρ	1	-,028	,028	-,005	,160
	<i>p-value</i>		,778	,776	,963	,102
	n	114	105	103	103	105

Note: BDI: Beck Depression Scale); STAI-S: State Anxiety Inventory; STAI-T: Trait Anxiety Inventory; BIS-11 - Barrat Impulsivity Scale.

Table 2 - Pearson's correlation and level of significance between caloric intake of binge eating episode and levels of general and eating related psychopathology in bulimia nervosa

DIAGNOSIS	Caloric intake	BITE-S	BITE-G	BITE Total	BDI	STAI-S	STAI-T	BIS-11	
Caloric intake	ρ	1	,438**	-,030	,137	-,034	,162	-,064	,081
	<i>p-value</i>		,003	,846	,364	,812	,247	,651	,560
	n	57	44	44	46	52	53	53	54

Note: BITE: Bulimic Investigatory Test of Edinburgh – S: Symptoms subscale and G: Severity Subscale; BDI: Beck Depression Scale); STAI-S: State Anxiety Inventory; STAI-T: Trait Anxiety Inventory; BIS-11 - Barrat Impulsivity Scale.

Table 3 - Correlation of Pearson and level of significance between caloric intake of binge eating episode and levels of general and eating related psychopathology in binge eating disorder

DIAGNOSIS	Caloric intake	BES	BDI	STAI-S	STAI-T	BIS-11	
Caloric intake	ρ	1	,130	-,004	-,111	,047	,205
	<i>p-value</i>		,411	,975	,443	,748	,149
	n	57	42	53	50	50	51

Note: BES – Binge Eating Scale; BDI: Beck Depression Scale); STAI-S: State Anxiety Inventory; STAI-T: Trait Anxiety Inventory; BIS-11 - Barrat Impulsivity Scale.

Table 4 – Severity the symptoms of general and eating related psychopathology according to eating disorder state.

	Total	DIAGNOSIS		<i>p-value</i>	
		BN n Media (SD)	BED		
Symptoms depression (BDI)	105	26.3 (±12.4)	52 25.5 (±11.0)	53 27.2 (±13.7)	<i>p=0.490</i>
Severity anxiety state (STAI-S)	103	42.9 (±8.9)	53 42.6 (±9.2)	50 43.3 (±8.8)	<i>p=0.687</i>
Severity anxiety trace (STAI-T)	103	49.0 (±9.1)	53 49.5 (±9.2)	50 48.6 (±9.0)	<i>p=0.622</i>
Impulsiveness (BIS-11)	105	72.8 (±12.9)	54 75.2 (±12.9)	51 70.2 (±12.6)	<i>p=0.049</i>
Symptoms bulimia nervosa (BITE-S)			44 24.7 (±3.8)		
Severity of bulimia nervosa (BITE-G)			44 12.9 (±6.8)		
Severity of binge eating (BES)				42 31.9 (±8.5)	
Clinical global impression (CGI-S)	99	4.3 (±1.1)	52 4.5 (±1.2)	47 4.1 (±0.9)	<i>p=0.054</i>

Note:BDI: Beck Depression Scale); STAI-S: State Anxiety Inventory; STAI-T: Trait Anxiety Inventory; BIS-11 - Barrat Impulsivity Scale; BITE: Bulimic Investigatory Test of Edinburgh – S: Symptoms subscale and G: Severity Subscale; BES – Binge Eating Scale; CGI-S: Global Clinical Impression Scale