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PERCEPTIONS OF A LARGE AMOUNT OF FOOD BASED ON BINGE-EATING DISORDER DIAGNOSIS

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Abstract

Objective: This study examined what adults with binge-eating disorder (BED) and obesity perceived as the threshold for a large amount of food and how their evaluations compared to ratings by participants with obesity but without BED.

Method: This was a cross-sectional study of 150 participants with obesity. BED was assessed using the Questionnaire on Eating and Weight Patterns and confirmed via interview. Participants completed the Eating Patterns Questionnaire and Eating Inventory.

Results: Participants with BED had significantly higher thresholds for a large amount of food relative to those without BED. Compared to participants without BED, those with BED had significantly higher thresholds on 13 of the 22 food items. In the overall sample, being male and having higher hunger scores were associated with greater thresholds.

Discussion: Individuals with obesity and BED had larger portion standards than participants without BED. Individuals with BED may benefit from interventions targeted toward decreasing perceptions of portion sizes.

Keywords

Binge-eating disorder; obesity; feeding and eating disorders

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Data Availability: A deidentified data set will be made available to external investigators (upon request to the first author), once the research team has completed its analysis and reporting of secondary findings from the study. This is expected to be approximately 2 years after the publication of this report.

Introduction

Binge-eating disorder (BED) is characterized by eating an objectively large amount of food in a discrete period (i.e., 2 hours) and feeling a loss of control during the episode (American Psychiatric Association, 2013). To meet diagnostic criteria for BED, binge-eating episodes must occur at least once weekly for a minimum of 3 months and be associated with distress and three or more of the following features: eating much more rapidly than normal; eating alone because of embarrassment by how much one is eating; eating until uncomfortably full; eating large amounts when not physically hungry; or feeling disgusted with oneself, depressed, or very guilty after overeating. Additionally, the diagnostic criteria specify that these behaviors occur without inappropriate compensatory behaviors such as self-induced vomiting, laxative or diuretic use.

BED is the most common eating disorder, with a lifetime prevalence of 0.9% (Udo & Grilo, 2018)-2.6% (Kessler et al., 2013). Among those seeking weight loss, 15–20% of participants meet criteria for this disorder (Hudson, Hiripi, Pope Jr, & Kessler, 2007). BED can occur across the weight spectrum, though 42% of individuals with BED have obesity (Kessler et al., 2013). BED is associated with a number of medical and psychosocial conditions including lower health-related quality of life (Rieger, Wilfley, Stein, Marino, & Crow, 2005), higher risks of metabolic syndrome (Hudson et al., 2010), and more symptoms of depression (Kessler et al., 2013).

One challenging but clinically important aspect of diagnosing BED, as well as other eating disorders such as bulimia nervosa, is determining whether the size of an eating episode meets the criteria for a binge. There is no widely accepted delineation for what constitutes an objectively large amount of food (Goldschmidt, 2017). In a review of studies on caloric sizes of discrete binge-eating episodes in patients with BED, in laboratory settings, calories have ranged from a mean of 743 kcals in one study using a single-item, ice cream test meal to 2,963 kcals in a study using a multi-item buffet of 15 different food items such as bread, cookies, potato chips, and chocolate cake (Goldfein, Walsh, Devlin, Lachaussée, & Kissileff, 1993; Wolfe, Baker, Smith, & Kelly-Weeder, 2009; Yanovski et al., 1992). Calories from studies using self-reported binge episodes recorded in food diaries ranged from a mean of 606 to 1,258 kcals with individual episodes ranging from 30 to 4,931 kcals (Crowther, Lingswiler, & Stephens, 1984; Grilo, Shiffman, & Carter-Campbell, 1994). Some of the variability is likely due to differences in study methods and may also be attributed to differences in the caloric density of foods that could have skewed the calorie ranges (e.g., bingeing on a high quantity of low-calorie dense foods such as watermelon which may be a large amount of food but relatively low in calories). For example, one self-report study used what participants indicated were binge eating episodes (Crowther et al., 1984), while another defined a binge-eating episode as the consumption of greater than 500 kcals in a discrete episode coupled with a sense of loss of control (Grilo et al., 1994). One approach that has been used in attempting to establish thresholds for an objectively large amount of food has been to ask participants to categorize “a large amount of food” by demarcating the largest amount of food that a person would not consider unusually large to consume in a 2-hour period (Arikian et al., 2012; Forney, Holland, Joiner, & Keel, 2015). Self-reported binge eating frequency was associated with higher amounts of food (Arikian et al., 2012).

However, these findings are limited because binge-eating episodes were not assessed via interview, and the results did not distinguish between individuals who did and did not met criteria for BED. In addition, it is not clear whether weight may have confounded findings.

In addition to the importance of examining size thresholds for diagnostic purposes, perceptions of a large amount of food also have potentially important clinical implications for BED prevention and treatment. The Boundary Model, which was adapted from the Restraint Theory, has been used to describe the etiology and maintenance of different eating behaviors, including binge-eating behaviors (Herman & Mack, 1975; Herman & Polivy, 1984; Polivy & Herman, 1985). The central premise of the Boundary Model is that consumption is regulated within boundaries with the lower boundary representing hunger and the upper boundary representing satiety. The model suggests that in some individuals, food intake is regulated by self-imposed diet and satiation boundaries that specify how much food and/or calories people allow themselves (Herman & Polivy, 1984). There are individual differences in boundary placements and there have been several extensions of the Boundary Model to help us understand different types of eating behaviors (e.g., dieting and disinhibited eating). Boundaries may be disrupted by cognitive and social pressures or events such as emotional distress, consumption of forbidden foods, or other dietary violations. Once the boundary is broken, it may lead to additional overeating and binge eating. Individuals with BED may have a higher upper satiety boundary because they may be more accustomed to eating larger amounts of food.

Engaging in regular episodes of binge eating may also distort a person's perceptions of normal serving sizes. In laboratory-based studies, relative to participants without BED, those with BED tend to consume more food even during non-binge eating episodes (Walsh & Boudreau, 2003; Yanovski et al., 1992). In another laboratory-based study, participants were asked to eat as much as they would in a normal meal. Compared to participants who were obese without BED and those of normal weight, those with BED consumed significantly more food to reach a similar level of fullness (Sysko, Devlin, Walsh, Zimmerli, & Kissileff, 2007). Individuals with obesity and binge eating also have increased gastric capacity compared those with obesity without binge eating (Geliebter & Hashim, 2001). Thus, individuals with BED may perceive that they need larger amounts of food to reach satiation.

The purpose of this study was to examine how participants with obesity and BED delineated a "large amount of food" that would be considered normal for them to eat, and how their evaluations compared to those of persons with obesity but not BED. We hypothesized that participants with clinical BED would have higher thresholds for the upper limit of normal food consumption relative to those without clinical/subclinical BED. We also explored whether individuals with subclinical BED differed in their ratings compared to individuals with BED and to those without BED, and whether demographic and clinical factors (i.e., gender, age, race, body mass index [BMI], dietary restraint, disinhibition, and hunger) were associated with threshold determinations of a large amount of food.

Methods

Study Design

This was a cross-sectional study of baseline data from 150 participants enrolled in a randomized controlled trial for weight reduction (Wadden et al., 2019). This study was approved by the University of Pennsylvania Institutional Review Board. Participants were recruited from newspaper, internet, and radio advertisements, and flyers.

Participants and Procedures

Eligibility was assessed using a phone screen and in-person screening visit. Major inclusion criteria were: BMI≥30 kg/m^2 and ≤55 kg/m^2; age ≥21 and ≤70 years; and having a primary care provider who was responsible for providing routine medical care. Major exclusion criteria were: clinically significant medical or psychiatric conditions that would contraindicate weight loss or use of the study medication (liraglutide); diabetes; pregnant or nursing; recent history of cardiovascular disease; current major depressive episode, active suicidal ideation, or history of suicide attempts; loss of ≥10 lb (4.5 kg) in the past 3 months; history or plans for bariatric surgery; or inability to walk 5 blocks.

During the screening visit, individuals completed an informed consent interview, behavioral evaluation, and medical history and physical exam. Screening visits were conducted at our clinic in the morning after an overnight fast of at least 8 hours. The behavioral evaluation, conducted by one of two study psychologists, included a review of the participants' responses to the Weight and Lifestyle Inventory (Wadden & Foster, 2006), which contains the Questionnaire on Eating and Weight Patterns (QEWP) (Yanovski, Marcus, Wadden, & Walsh, 2015) and was used to assess the presence of BED using DSM-5 criteria. The psychologist queried participants on their responses to the QEWP to determine whether they: consumed an objectively large amount of food in a 2-hour period; experienced loss of control and marked distress related to their eating; and met frequency criteria for BED (≥1 binge episode per week, on average, for the past 3 months), as well as at least 3 of 5 associated features (e.g., eating faster than usual, eating in secret). Participants were classified as either meeting diagnostic thresholds for BED or for subclinical BED (<1 binge eating episode a week or <3 associated features) or as not having BED. Weight was measured on an electronic scale (Detecto, model 6800A), with applicants dressed in light clothing, and height was assessed using a wall-mounted stadiometer (Veeder-Root, Elizabethtown, NC). These measures were used to calculate BMI.

Measures

Demographic information.

Demographic data included age, gender, race/ethnicity, weight, height, and weight loss history.

Eating Patterns Questionnaire.

Thresholds for an objectively large amount of food were evaluated using the Eating Patterns Questionnaire (Forney et al., 2015). The 22-item questionnaire used semi-closed questions,

and individuals were asked to select "the largest quantity of the given food you would eat within a 2-hour period that would NOT be an unusually large amount of food for you to eat" (i.e., the upper limits of normal food consumption). The response options for each food differed per item but were anchored from a single serving size (e.g., 1 cup of macaroni and cheese) to a very large serving size (e.g., 8 cups of macaroni and cheese). Participants were also instructed to type in their own response if the amount of the specific food was not listed. Examples of food items include burgers, popcorn, bagels, cake, and ice cream. The measure has been used previously to demarcate an objectively large amount of food in individuals with and without eating disorders (Arikian et al., 2012; Forney et al., 2015). In this sample, the Cronbach's alpha for the scale was 0.86.

Eating Inventory.

The 51-item Eating Inventory (also referred to as the Three Factor Eating Questionnaire) was used to measure dietary restraint, disinhibition, and hunger (Stunkard & Messick, 1985). The dietary restraint scale contains 21 items with higher levels indicating greater awareness of one's eating and success in attempts to restrict food intake for weight control. The Cronbach's alpha for the scale was 0.65. The disinhibition scale has 16 items and greater scores indicate more overeating tendencies. The Cronbach's alpha was 0.71. The hunger scale has 14-items and higher scores evaluate more perceived hunger. In this sample, the Cronbach's alpha for the scale was 0.80.

Statistical Analysis

Analyses were conducted using SPSS version 25.0. Means and standard deviations were used to describe the study characteristics. Differences in demographic characteristics among the three groups were assessed using one-way ANOVAs with Tukey post-hoc comparisons or chi-square tests. Effect size estimates were also computed using η^2 or Cramer's V. Effect sizes were classified as small (0.01), medium (0.06), and large (0.14) for $\eta^2$and small (0.1), medium (0.3), and large (0.5) for Cramer's V (Cohen, 1988). The study's primary outcome was a composite score of responses on the modified version of the Eating Patterns Questionnaire, which was computed by averaging the z-scores of each item (Song, Lin, Ward, & Fine, 2013). The primary analyses consisted of an independent samples t-test between those with BED and those without subclinical or clinical BED. Exploratory analyses were conducted to assess item-level differences based on the presence of a diagnosis of BED, and to compare those with subclinical BED to participants with clinical BED and those without subclinical/clinical BED. Hedges' *g* was used as a measure of effect size with sizes classified as small (0.2), medium (0.5), and large (0.8) (Cohen, 1988). The relationship of a large amount of food with demographic factors (i.e., age, sex, race), BMI, BED diagnosis, and eating behaviors was investigated through hierarchical linear regression. Separate analyses were conducted using the composite score and calories. In step 1, demographic characteristics and BMI were entered (Model 1). In Model 2, meeting a clinical or subclinical BED diagnosis was added. In Model 3, dietary restraint, disinhibition, and hunger were included. Statistical significance was considered as a two-sided p-value <. 05.

Results

Participant Characteristics

As reported previously, participants had a mean age of 47.6±11.8 years and BMI of 38.2±4.9 kg/m^2 (Wadden et al, 2019). The majority of the sample was female (79.3%); 54.0% of participants self-identified as white, 44.7% as black, and 1.3% as other race/ethnicity. Eighteen of the 150 (12.0%) participants were diagnosed with BED and another 18 (12.0%) were determined to have subclinical BED. The most common reasons participants were diagnosed with sub-threshold BED were having <1 binge eating episode per week (n=14), subthreshold levels of distress (n=3), and <3 of the 5 associated features (n=1). Average scores on the dietary restraint, disinhibition, and hunger scales were 10.0±3.4, 9.4±3.1, and 6.2±3.5, respectively. Groups differed significantly in age (p=.03). In Tukey post-hoc analyses, participants with subclinical BED were found to be significantly younger than those without BED (p=.02). Groups did not differ in other demographic characteristics (ps>.05; Table 1). Participants with subclinical or clinical BED had significantly higher disinhibition and hunger scores than those without BED (ps<.05). The two BED groups did not differ in disinhibition or hunger (ps>0.05).

Differences based on BED

In the primary analysis, participants with BED reported a mean±SD standardized composite score for a large amount of food of 0.4±0.7, which was significantly higher than the composite score of −0.1±0.5 reported by participants without BED (p<.001; Hedges' *g*=0.94). Participants with subclinical BED had a composite score of 0.2±0.5, which was significantly greater compared to those without BED (p=.02; Hedges' *g*=0.60). Participants with subclinical and clinical BED did not differ in their assessment of a large amount of food (p=.31; Hedges' *g*=0.33).

Item-level analyses for the upper limits of normal food consumption for an adult to eat within a 2-hour period based on BED are presented in Table 2. The upper limit of normal calorie consumption in a two-hour period for participants with BED was 1417.6±831.6 kcal, which was not significantly higher than participants without BED who reported 1048.6±471.6 kcal (p=.09). Participants with subclinical BED reported 1247.1±404.8 kcal, which did not differ significantly from those without BED (p=.10) or those with BED (p=.46).

Participants with BED reported larger thresholds across 13 of the 22 food items. The groups differed significantly on ratings of the upper limits of normal consumption for burgers, popcorn, bagels, cake, ice cream, chocolate, cereal, pizza, macaroni and cheese, pastries, chips, vegetables, and mashed potatoes (Table 2). For example, the threshold among participants with BED was 1.9±0.9 burgers compared to 1.3±0.6 burgers for those without BED (p<.001). For pizza, the threshold was 3.9±2.1 slices for individuals with BED compared to 2.7±1.1 slices for those without BED (p=.001). Participants with subclinical BED scored higher on 3 of the 22 items (chips, vegetables, and pastries) than participants without BED. Participants with subclinical and clinical BED did not differ significantly on any of the item-level ratings except for mashed potatoes (p=.02).

Participant Correlates of Large Amount of Food

Table 3 presents differences in thresholds for a large amount of food based on demographic variables, BMI, BED diagnosis, and eating behaviors. Of the total sample, males endorsed higher thresholds for a large amount of food than females (p=.01). After adjusting for age, gender, race, and BMI, BED status accounted for an additional 9% of variance in thresholds for a large amount of food. Participants with BED and those with higher hunger scores also had higher thresholds for a large amount of food (p=.01, .002). Those with subclinical BED had higher thresholds in models adjusted for demographic and BMI (p=.045); however, this result was not significant after adjusting for dietary restraint, disinhibition, and hunger (p=.10). Age, race, BMI, dietary restraint, and disinhibition were not significantly associated with thresholds for a large amount of food.

In models that included demographic factors, BMI, BED, and eating behaviors, every 1 unit increase in BMI was associated with a 23.9±9.1 increase in the upper limit of normal calorie consumption (p=.01). Compared to those without BED, participants with BED endorsed a 357.1±147.1 higher threshold for calories that constituted a large amount of food (p=.02). Other factors were not statistically significant in any of the models (ps>.05).

Discussion

This study found that participants with obesity and BED had significantly higher thresholds for what comprises a large amount of food than did participants of similar weight but without BED. A large effect size was found between participants with and without BED for the composite score on the modified Eating Patterns Questionnaire. Additionally, those with BED scored significantly higher on over half of the individual items, with medium-to-large effect sizes for those items. Individuals with subclinical BED also had higher ratings on the composite score than those without BED. Addressing these large portions of what constitutes normal food consumption would appear to be an important target for weight management in people with BED.

Our findings that individuals with BED and obesity have overall larger food norms are supported by the Boundary Model, as well as previous results that demonstrated that individuals with binge eating behaviors had higher perceptions of what constituted a large amount of food compared to participants without binge eating recruited from the community (Arikian et al., 2012; Herman & Polivy, 1984). Our findings also are congruent with laboratory-based findings that relative to participants without BED, those with BED tend to consume more food even during non-binge eating episodes (Walsh & Boudreau, 2003; Yanovski et al., 1992). In addition, as compared to participants who were obese without BED and those of normal weight, those with BED consumed significantly more food to reach a similar level of fullness (Sysko et al., 2007). Taken together, these findings suggest that the higher weight gain propensity seen among individuals with BED is related to both caloric consumption during binge-eating episodes and to greater food intake during non-binge-eating episodes (Ivezaj, Kalebjian, Grilo, & Barnes, 2014; Mustelin, Kaprio, & Keski-Rahkonen, 2018). It is possible that norms of general food consumption may shift upward as a result of engaging in binge eating, which may result in impairments in satiation. However,

prospective research is needed to examine the directionality between variables and mechanisms underlying these relationships.

While behavioral weight loss treatment and cognitive behavioral therapy for BED include some strategies for portion control, interventions that target and focus on portion sizes could be effective for weight management for patients with BED. Examples of interventions include increasing awareness regarding portion size and portion distortion and teaching individuals self-regulation strategies to control portion size selection and intake, and behavioral strategies to decrease portions such as not purchasing jumbo-sized packages and only making one serving size for meals (Poelman, de Vet, Velema, de Boer, et al., 2014; Poelman, de Vet, Velema, Seidell, & Steenhuis, 2014; Rolls, Roe, James, & Sanchez, 2017; Steenhuis & Poelman, 2017). In addition, increasing exposure to smaller portions and developing positive associations about consuming smaller portions may be useful strategies. Another strategy may be to consume larger portions of low-energy-dense foods (e.g., vegetables and fruits) while reducing portions of higher-energy-dense foods (e.g., high fat foods).

Similar to previous studies (Vinai et al., 2016; Vinai et al., 2015), we found that compared to participants with obesity without BED, individuals of a similar weight with BED scored higher on disinhibition and hunger subscales of the Eating Inventory. Those without BED had a score of 12.1 for disinhibition compared to 8.7 points for those without BED. Individuals with BED had a score of 8.6 on hunger compared to 5.6 for those without BED. This supports current practices in CBT for BED and behavioral weight management, which often address establishing regular eating patterns, controlling impulses to eat, and reducing hunger (e.g., (Murphy, Straebler, Cooper, & Fairburn, 2010; Wadden et al., 2019).

In addition to BED status, subjective hunger and gender were associated with thresholds for a large amount of food. Individuals with greater feelings of hunger had a higher boundary for a normal amount of food, suggesting that addressing portion sizes and satiation during weight loss may be particularly relevant for individuals with heightened hunger. Similar to a previous study (Arikian et al., 2012), males had higher thresholds for a large amount of food than females, even after adjusting for BMI. This finding supports guidance from the Eating Disorder Examination (EDE), a structured interview for the diagnosis of eating disorders, that food amounts to quality for an objectively large amount of food may need to be adjusted for certain social groups based on factors such as gender (Cooper & Fairburn, 1987).

Strengths of this study include comparisons among participants with and without BED of a similar weight status and the interviewer-based diagnosis of BED. Interviewer-based assessments of BED are generally thought to be more accurate relative to self-report measures (Berg, Peterson, Frazier, & Crow, 2011a, 2011b; Fairburn & Beglin, 1994). However, inter-rater reliability of the interviewers was not assessed in this study. This study is also limited by the cross-sectional design, so causality cannot be determined among variables. All participants were seeking treatment for obesity and did not have type 2 diabetes, which may limit generalizability. The study also had a small total number of participants who were men and those who met criteria for BED (76% of the sample did not meet criteria for subclinical or clinical BED). We asked about the upper limits of normal

food consumption, and not a demarcation of binge eating or overeating episodes. As proposed previously (Arikian et al., 2012), normative eating and binge eating may not be dichotomous, and the upper threshold for normative eating may not be equivalent to the lower threshold for binge eating or overeating. Research is needed to assess the role of different contextual factors in demarcating an unusually large amount of food. The Cronbach's alpha for the dietary restraint scale of the Eating Inventory was questionable and results from this subscale should be interpreted cautiously. This study examined normative eating in participants with BED, though defining amounts of food that constitute a binge are relevant to individuals with other eating disorders such bulimia nervosa. Farther research is needed to examine similarities and differences in thresholds in perceptions of food between individuals with BED and bulimia nervosa, and how this compares to individuals without these disorders.

In conclusion, this study extends previous literature by demonstrating that participants with obesity and BED have an expanded view of what constitutes a normal amount of food relative to those with obesity without BED. Considerations of normative food boundaries should also include gender as well as hunger levels. These findings have clinical implications for the assessment and diagnosis of BED, as well as for weight management in these individuals. In particular, this line of research can begin to help clinicians distinguish objective binge eating episodes (i.e., consuming an unusually large amount of food and feeling a loss of control), from subjective binge eating episodes (i.e., feeling a loss of control over eating but the amount not be viewed as large). Future studies are also needed that test interventions that incorporate portion size interventions for patients with obesity and BED.

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References

American Psychiatric Association. (2013). Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (5 ed.): American Psychiatric Pub.

Arikian A, Peterson CB, Swanson SA, Berg KC, Chartier L, Durkin N, & Crow SJ (2012). Establishing thresholds for unusually large binge eating episodes. International Journal of Eating Disorders, 45(2), 222–226. [PubMed: 21520216]

Berg KC, Peterson CB, Frazier P, & Crow SJ (2011a). Convergence of scores on the interview and questionnaire versions of the Eating Disorder Examination: A meta-analytic review. In: American Psychological Association.

Berg KC, Peterson CB, Frazier P, & Crow SJ (2011b). Convergence of scores on the interview and questionnaire versions of the Eating Disorder Examination: A meta-analytic review. Psychological assessment, 23(3), 714. [PubMed: 21517194]

Cohen J (1988). Statistical power analysis for the behavioral sciences (2nd ed.): Routledge.

Cooper Z, & Fairburn C (1987). The Eating Disorder Examination: A semi-structured interview for the assessment of the specific psychopathology of eating disorders. International Journal of Eating Disorders, 6(1), 1–8.

Crowther JH, Lingswiler VM, & Stephens MAP (1984). The topography of binge eating. Addictive Behaviors, 9(3), 299–303. [PubMed: 6594034]

Fairburn CG, & Beglin SJ (1994). Assessment of eating disorders: Interview or self-report questionnaire? International Journal of Eating Disorders, 16(4), 363–370. [PubMed: 7866415]

Forney KJ, Holland LA, Joiner TE, & Keel PK (2015). Determining empirical thresholds for "definitely large" amounts of food for defining binge-eating episodes. Eating Disorders, 23(1), 15–30. [PubMed: 24983483]

Geliebter A, & Hashim SA (2001). Gastric capacity in normal, obese, and bulimic women. Physiology & Behavior, 74(4–5), 743–746. [PubMed: 11790438]

Goldfein JA, Walsh BT, Devlin MJ, Lachaussée JL, & Kissileff HR (1993). Eating behavior in binge eating disorder. International Journal of Eating Disorders, 14(4), 427–431. [PubMed: 8293024]

Goldschmidt AB (2017). Are loss of control while eating and overeating valid constructs? A critical review of the literature. Obesity Reviews, 18(4), 412–449. [PubMed: 28165655]

Grilo CM, Shiffman S, & Carter-Campbell JT (1994). Binge eating antecedents in normal-weight nonpurging females: Is there consistency? International Journal of Eating Disorders, 16(3), 239–249. [PubMed: 7833957]

Herman CP, & Mack D (1975). Restrained and unrestrained eating. Journal of Personality, 43(4), 647–660. [PubMed: 1206453]

Herman CP, & Polivy J (1984). A boundary model for the regulation of eating. Eating and Its Disorders, 141–156.

Hudson JI, Hiripi E, Pope HG Jr, & Kessler RC (2007). The prevalence and correlates of eating disorders in the National Comorbidity Survey Replication. Biological Psychiatry, 61(3), 348–358. [PubMed: 16815322]

Hudson JI, Lalonde JK, Coit CE, Tsuang MT, McElroy SL, Crow SJ, … Rosenthal NR (2010). Longitudinal study of the diagnosis of components of the metabolic syndrome in individuals with binge-eating disorder. The American Journal of Clinical Nutrition, 91(6), 1568–1573. [PubMed: 20427731]

Ivezaj V, Kalebjian R, Grilo CM, & Barnes RD (2014). Comparing weight gain in the year prior to treatment for overweight and obese patients with and without binge eating disorder in primary care. Journal of Psychosomatic Research, 77(2), 151–154. [PubMed: 25077857]

Kessler RC, Berglund PA, Chiu WT, Deitz AC, Hudson JI, Shahly V, … Benjet C (2013). The prevalence and correlates of binge eating disorder in the World Health Organization World Mental Health Surveys. Biological Psychiatry, 73(9), 904–914. [PubMed: 23290497]

Murphy R, Straebler S, Cooper Z, & Fairburn CG (2010). Cognitive behavioral therapy for eating disorders. Psychiatric Clinics, 33(3), 611–627. [PubMed: 20599136]

Mustelin L, Kaprio J, & Keski-Rahkonen A (2018). Beyond the tip of the iceberg: Adolescent weight development of women and men with features of binge eating disorder. Eating Behaviors, 30, 83–87. [PubMed: 29933124]

Poelman MP, de Vet E, Velema E, de Boer MR, Seidell JC, & Steenhuis IH (2014). PortionControl@HOME: results of a randomized controlled trial evaluating the effect of a multi-component portion size intervention on portion control behavior and body mass index. Annals of Behavioral Medicine, 49(1), 18–28.

Poelman MP, de Vet E, Velema E, Seidell JC, & Steenhuis IH (2014). Behavioural strategies to control the amount of food selected and consumed. Appetite, 72, 156–165. [PubMed: 24076019]

Polivy J, & Herman CP (1985). Dieting and binging: A causal analysis. American Psychologist, 40(2), 193. [PubMed: 3857016]

Rieger E, Wilfley DE, Stein RI, Marino V, & Crow SJ (2005). A comparison of quality of life in obese individuals with and without binge eating disorder. International Journal of Eating Disorders, 37(3), 234–240. [PubMed: 15822089]

Rolls BJ, Roe LS, James BL, & Sanchez CE (2017). Does the incorporation of portion-control strategies in a behavioral program improve weight loss in a 1-year randomized controlled trial? International Journal of Obesity, 41(3), 434. [PubMed: 27899807]

Song M-K, Lin F-C, Ward SE, & Fine JP (2013). Composite variables: when and how. Nursing Research, 62(1), 45. [PubMed: 23114795]

Steenhuis I, & Poelman M (2017). Portion size: latest developments and interventions. Current Obesity Reports, 6(1), 10–17. [PubMed: 28265869]

Stunkard AJ, & Messick S (1985). The Three-Factor Eating Questionnaire to measure dietary restraint, disinhibition and hunger. Journal of Psychosomatic Research, 29(1), 71–83. [PubMed: 3981480]

Sysko R, Devlin MJ, Walsh BT, Zimmerli E, & Kissileff HR (2007). Satiety and test meal intake among women with binge eating disorder. International Journal of Eating Disorders, 40(6), 554–561. [PubMed: 17534911]

Udo T, & Grilo CM (2018). Prevalence and correlates of DSM-5–defined eating disorders in a nationally representative sample of US adults. Biological Psychiatry, 84(1), 345–354. [PubMed: 29859631]

Vinai P, Da Ros A, Cardetti S, Casey H, Studt S, Gentile N, … Bruno C (2016). The DSM-5 effect: psychological characteristics of new patients affected by Binge Eating Disorder following the criteria of the DSM-5 in a sample of severe obese patients. *Eating and Weight Disorders-Studies on Anorexia*, Bulimia and Obesity, 21(1), 107–113.

Vinai P, Da Ros A, Speciale M, Gentile N, Tagliabue A, Vinai P, … Cardetti S (2015). Psychopathological characteristics of patients seeking for bariatric surgery, either affected or not by binge eating disorder following the criteria of the DSM IV TR and of the DSM 5. Eating Behaviors, 16, 1–4. [PubMed: 25464057]

Wadden TA, & Foster GD (2006). Weight and Lifestyle Inventory (WALI). Obesity, 14(S3), 99S–118S. [PubMed: 16648601]

Wadden TA, Walsh O, Berkowitz RI, Chao AM, Alamudding N, Gruber K, … Tronieri JS (2019). Intensive behavioral therapy for obesity combined with liraglutide 3.0 mg: A randomized controlled trial. Obesity, 27(1), 75–86. [PubMed: 30421856]

Walsh BT, & Boudreau G (2003). Laboratory studies of binge eating disorder. International Journal of Eating Disorders, 34(S1), S30–S38. [PubMed: 12900984]

Wolfe BE, Baker CW, Smith AT, & Kelly-Weeder S (2009). Validity and utility of the current definition of binge eating. International Journal of Eating Disorders, 42(8), 674–686. [PubMed: 19610126]

Yanovski SZ, Leet M, Yanovski JA, Flood M. n., Gold PW, Kissileff HR, & Walsh BT (1992). Food selection and intake of obese women with binge-eating disorder. The American Journal of Clinical Nutrition, 56(6), 975–980. [PubMed: 1442665]

Yanovski SZ, Marcus MD, Wadden TA, & Walsh BT (2015). The Questionnaire on Eating and Weight Patterns-5: An updated screening instrument for binge eating disorder. International Journal of Eating Disorders, 48(3), 259–261. [PubMed: 25545458]

Table 1.

Participants' baseline characteristics.

Characteristic	No BED	Subclinical BED	BED	p-value	η^2 or Cramer's V
N (%)	114 (76.0)	18 (12.0)	18 (12.0)		
Sex (female)	92 (80.7)	14 (77.8)	13 (72.2)	.70	0.07
Race					
Black or African American	57 (50.0)	5 (27.8)	5 (27.8)	.09	0.16
White	56 (49.1)	13 (72.2)	12 (66.7)		
Multiracial or other	1 (0.9)	0 (0)	1 (5.6)		
Ethnicity (Hispanic)	8 (7.0)	2 (11.1)	0 (0)	.39	0.11
Age (years)	48.8±11.4†	40.9±12.8‡	46.9±12.2†‡	.03	0.05
Screening Weight (kg)	107.2±18.0	110.9±17.1	108.2±13.5	.70	0.01
BMI (kg/m^2)	38.2±5.0	38.6±4.6	37.6±4.8	.83	0.003
Dietary Restraint	9.8±3.4	10.7±3.2	10.6±4.2	.48	0.01
Disinhibition	8.7±3.0†	11.0±2.9‡	12.1±2.2‡	<.001	0.15
Hunger	5.6±3.3†	7.7±3.1‡	8.6±3.7‡	<.001	0.10

Note. N(%) or mean±standard deviation. BMI=body mass index. BED=binge-eating disorder. Values marked with different symbols differ significantly from each other for that item as determined by Tukey's post-hoc comparisons (two-tailed $p<0.05$).

Table 2.

Ratings of the largest amount of food that would not be an unusually large amount of food for an adult to eat in a 2-hour period.

Variable	No BED (n=114)	Subclinical BED (n=18)	Clinical BED (n=18)	Hedges' *g*		
				No BED vs Subclinical BED	No BED vs Clinical BED	Subclinical BED vs Clinical BED
Burger	1.3±0.6†	1.6±0.7†‡	1.9±0.9‡	0.49	0.93	0.37
Popcorn, oz	3.1±1.0†	3.5±1.5†‡	4.2±1.6‡	0.37	1.00	0.45
Bagel	1.6±0.7†	1.8±0.4†‡	2.1±0.8‡	0.30	0.70	0.47
Cake (sheet cake, 9" x 13"), slices	1.4±0.6†	1.5±0.6†‡	1.9±0.8‡	0.17	0.79	0.57
Ice cream, cups	1.2±0.6†	1.8±1.6†‡	1.7±0.9‡	0.75	0.78	0.08
Chocolate (regular chocolate bar)	1.3±0.6†	1.6±0.8†‡	1.8±0.9‡	0.48	0.77	0.23
Cereal, cups	1.4±0.8†	1.6±1.1†‡	1.9±1.7‡	0.24	0.52	0.21
Pizza, slices	2.7±1.1†	2.8±1.4†‡	3.9±2.1‡	0.09	0.94	0.62
Macaroni and cheese, cups	1.7±0.9†	1.8±0.8†‡	2.3±1.1‡	0.11	0.65	0.52
Pastries	1.5±0.7†	2.1±1.1‡	1.9±0.8‡	0.79	0.56	0.21
Chips, ounces	4.8±3.6†	7.2±3.7‡	6.8±4.1‡	0.66	0.55	0.10
Vegetables (carrot sticks, celery stalks, asparagus or zucchini spears)	5.6±2.4†	7.4±3.1‡	6.8±2.1‡	0.72	0.51	0.23
Mashed potatoes, cups	1.2±0.6†	1.1±0.5†	1.6±0.7‡	0.17	0.65	0.82
Calories, kcal	1048.6±471.6	1247.1±404.8	1417.6±831.6	0.43	0.69	0.26
Meal (entrée, vegetable, starch, and dessert)	1.2±0.3	1.3±0.7	1.4±0.7	0.27	0.53	0.14
Cookies (store bought)	4.9±2.8	5.9±3.0	6.1±2.6	0.35	0.43	0.07
Pancakes/waffles/toast/bread	2.9±1.6	2.9±1.6	3.1±1.7	0.00	0.12	0.12
Eggs	2.4±0.8	2.4±1.0	2.5±0.9	0.00	0.12	0.11
Pasta, cups	2.0±1.2	2.1±1.0	2.3±1.1	0.09	0.25	0.19
Fruit (apple/orange/banana), pieces	1.8±1.0	2.5±1.4	1.9±0.9	0.66	0.10	0.51
Salad, plates	1.1±0.6	1.2±0.5	0.9±0.4	0.17	0.35	0.66
Chinese (1 meal=1 quart box of chow mein with 4 egg rolls and 4 fortune cookies)	1.1±0.3	1.0±0.4	1.3±0.7	0.32	0.53	0.53

Note. Mean±standard deviation. BED=binge-eating disorder. Values marked with different symbols differ significantly from each other for that item as determined by independent samples t-tests (two-tailed p<.05).

Table 3.

Hierarchical regression models predicting a standardized composite score of large amount of food and calories from demographic factors, binge-eating disorder diagnosis, and eating behaviors.

	Composite z-score			Calories		
	Step 1	**Step 2**	**Step 3**	**Step 1**	**Step 2**	**Step 3**
Age	−0.004±0.004	−0.02±0.004	0.001±0.003	0.36±3.75	1.84±3.75	2.97±3.81
Gender-female	−0.33±0.11 *	−0.32±0.11 *	−0.29±0.10 *	10.56±114.07	22.98±111.78	49.78±114.55
Race-black	−0.07±0.09	−0.01±0.09	0.06±0.08	−155.75±93.88	−118.62±93.10	−89.79±95.97
BMI	0.003±0.01	0.004±0.01	0.01±0.01	22.47±9.10 *	23.06±8.88 *	23.85±9.05 *
BED		0.45±0.13 **	0.35±0.13 *		364.07±135.15 *	357.11±147.07 *
Subclinical BED		0.26±0.13 *	0.21±0.13		178.62±137.29	190.43±143.72
Dietary restraint			−0.02±0.01			−18.61±13.20
Disinhibition			0.01±0.02			3.87±16.50
Hunger			0.04±0.01 *			6.21±14.75
F	3.27 *	4.93 **	5.84 **	2.11	2.81 *	2.17 *
Adjusted R^2	0.06	0.14	0.23	0.03	0.07	0.07
ΔR^2	0.08 *	0.09 *	0.10 **	0.06	0.05 *	0.02

Note.

* p<.05;

** p<.001.

BMI=body mass index. BED=binge-eating disorder.