

Associations Between Eating Patterns and Clinical  
Correlates of Binge Eating

by

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## **Abstract**

**Objective:** This thesis examined the relationship between eating patterns and obesity, eating disorders involving binge eating, and clinical correlates of recurrent binge eating. **Method:** The first section of the thesis presents a review of the current research on the relationship between eating patterns and obesity, as well as eating patterns and disordered eating. The second section utilized data from 106 women with a minimum diagnosis of recurrent binge eating. Meal and snack frequencies were correlated with measures of weight, eating disorder features, and depression. **Results:** The literature reviewed in Section I showed inconsistent results in terms of the relationship between meal and snack frequencies and disordered eating and obesity. This research, however, did consistently demonstrate that individuals with disordered eating and individuals who are obese are more likely to skip breakfast and consume meals and snacks later in the day. Section II found that breakfast was the least, and dinner the most commonly consumed meal. Evening snacking was the most common snacking occasion. Meal patterns were not significantly associated with clinical correlates; however, evening snacking was associated with binge eating. **Conclusion:** More research is needed to understand the relationship between eating patterns and binge eating disorders. Future studies should consider the nutritional content, types, and amounts of food consumed when examining this relationship. Additionally, researchers should examine whether eating patterns mediate the effectiveness of cognitive behavioral therapy for binge eating disorders.

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## Introduction

Binge eating disorder (BED) is characterized by recurrent binge episodes in which the individual feels a loss of control while eating a large amount of food. In contrast to bulimia nervosa, those with BED do not exhibit compensatory behaviors designed to prevent weight gain (American Psychiatric Association, 2000). A survey of 2,980 men and women from the United States conducted between 2001 and 2003 showed that 3.5% of women and 2% of men reported having BED at some point in their lives (Hudson, Hiripi, Pope, & Kessler, 2007). This statistic is particularly striking when compared with the prevalence rates of other eating disorders: 0.9% of women and 0.3% of men reported having anorexia at some point in their lives, and 1.5% of women and 0.5% of men reported having bulimia nervosa (Hudson et al., 2007). Although BED is more prevalent than either bulimia or anorexia, the disorder is currently classified in the DSM-IV under the category “eating disorder-not otherwise specified” (ED-NOS), with suggested research criteria included in the appendix. Researchers have recently recommended that the newest version of the DSM-V, which will be published in May 2013, officially includes BED as a separate disorder (Wonderlich, Gordon, Mitchell, Crosby, & Engel, 2009). Consequently, continued research is needed to establish the unique pathological features of BED, as well as viable treatment options for those with the disorder.

Although a small literature has examined the characteristics of binge episodes, such as amounts or types of foods consumed (Allison & Timmerman, 2007; Cooke, Guss, Kissileff, Devlin, & Walsh, 1997; Engel et al., 2009), and times of day when

binge eating may be especially likely to occur (Allison & Timmerman, 2007), eating patterns outside of these episodes have not yet received much empirical attention. Investigation of meal and snack patterns is important because the literature has shown that individuals with disordered eating are weight preoccupied (Stein & Corte, 2007), and this preoccupation with weight status may translate to abnormal meal patterning. Additionally, individuals with disordered eating may engage in eating patterns that put them at risk for weight gain (Mussell et al., 1995; Yanovski, 2003). Cognitive-behavioral therapy emphasizes the regularization of eating patterns as a key component of treatment for both bulimia nervosa and BED (Wilson, Wilfley, Agras, & Bryson, 2010), however, little research has been done thus far on the efficacy of regularizing meal and snack consumption in the treatment of these eating disorders (Kern, Friedman, Reichmann, Costanzo, & Musante, 2002). A deeper understanding of the function of regulating eating patterns as a basis for treatment may lead to improved therapies, greater recovery rates, and fewer relapses for those with disordered eating, as well as greater sustained weight loss for overweight or obese individuals.

The goal of this thesis is to examine the role of eating patterns in BED. Toward this aim, the following sections examine the significance of meal and snack patterns within two different contexts. The first section reviews the current research on the relationship between meal and snack patterns and obesity and between meal and snack patterns and disordered eating. The second section reports the findings of an empirical study that examined the association between eating patterns and clinical correlates of recurrent binge eating.

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## **Section I. Eating Patterns: Associations with Obesity and Disordered Eating**

Eating patterns are defined as the number of intake occasions and the temporal distribution of these occasions across the day (Ma et al., 2003). They have become a topic of interest for researchers examining weight and eating disorders for several reasons. First, some research suggests an inverse relationship between meal frequency and weight, presumably in part because of the thermogenic effect of eating (i.e., the calorie loss associated with eating) (LeBlanc, Mercier, & Nadeau, 1993). The notion that greater frequency of eating is associated with lower weight is somewhat counter-intuitive. Thus, the first goal of this section is to provide a comprehensive review of the research examining the relationship between eating patterns and obesity.

Second, weight preoccupation is a hallmark feature of eating disorders (Saules et al., 2009; Stein & Corte, 2007), and this preoccupation with weight status contributes to abnormal meal patterning such as meal skipping to lose weight or to avoid weight gain (The McKnight Investigators, 2003). Although dietary restriction (i.e., limiting one's overall caloric intake or limiting intake of certain foods) has been studied extensively among eating disordered individuals, less is known about general meal and snack patterns in this population. The second goal of this section is to review studies that have assessed eating patterns and frequencies among individuals with either bulimia nervosa (BN) or binge eating disorder (BED).

### **Method**

The articles reviewed in this section were found through the databases PubMed and PsycInfo. The first search terms were “meal patterns” and “meal

frequency”, and the searches were restricted to papers which examined human eating behavior and were written in English. These searches yielded a total of 423 results. Papers were selected for inclusion if the researcher examined meal and snack frequencies or the temporal distribution of intake occasions as a part of their study. Of the 423 results, only eight papers contained analyses specifically related to eating patterns. The remaining papers examined energy intake, macro or micronutrient content of meals, or portion size. Seven of the selected papers were related to obesity, and one was about disordered eating. The reference sections of these papers were also reviewed for potentially relevant articles not returned in the initial searches. This yielded three additional papers, all of which were related to obesity.

Using the same restrictions as described earlier, the original search terms were then combined with the term “obesity” in both databases. This returned 98 articles, which were again selected for inclusion if they explicitly examined meal and snack frequencies or number of intake occasions. Two papers were found in these searches, and one relevant article was found in a review of the reference sections. One additional paper was found by searching the Social Science Citation Index using the authors of the previously selected papers as search criteria. In total, we examined fourteen papers describing the relationship between obesity and meal and snack patterns, the methodologies of which are described in Table 1.

Articles focusing on the relationship between disordered eating and meal patterns were found by combining the original search terms “meal patterns” and “meal frequency” with the terms “bulimia nervosa”, “binge eating disorder”, and “eating disorder”, in six separate searches. These searches yielded a total of 56

results. Of these results, four articles specifically examined meal and snack frequencies or number of intake occasions. Five additional papers were found by evaluating the reference sections of these articles. In total, ten papers (presented in Table 2) examined the relationship between disordered eating and meal patterns.

#### Methodological Concerns

Across the areas of literature reviewed here, several methodological issues limit the reliability or validity of the study findings. These limitations include: lack of uniform definitions of key variables, over-reliance on self-report, the cross-sectional nature of the studies, and the generalizability of results.

This literature suffers from a lack of uniformity in the definitions of key variables. Many studies examining the relationship between obesity and eating patterns used different criteria in determining what constitutes an eating occasion. Specifically, studies varied greatly in their definitions of snacking episodes. Four studies considered beverage consumption to be a separate snacking occasion (Andersson & Rossner, 1996; Forslund, Torgerson, Sjostrom, & Lindroos, 2005; Hampl, Heaton & Taylor, 2003; Nicklas et al., 2004), whereas the rest either did not assess drinking occasions or did not consider them to be eating episodes (see Table 1).

The literature also tends to rely heavily on self-report measures of key variables. All studies of obesity and most studies of disordered eating assessed meal patterns through self-report. A majority of these assessed meal patterns through either dietary recall or parental dietary recall. This method involves the participant, or the parent of the participant, being asked to recall their intake over a certain number of

days prior to the interview. Such measures may be compromised by both intentional and unintentional error. Three studies assessed meal patterns using food records in which a participant recorded his or her food intake at the time of consumption (Drummond, Crombie, Cursiter, & Kirk, 1997; Franko et al., 2008; Ruidavets, Bongard, Bataille, Goury, & Ferrieres, 2002). This self-report style of assessment may be problematic because it has been shown that many individuals, particularly those who are obese, tend to under-report intake occasions (Andersson & Rossner, 1996; Berg et al., 2009; Forslund, Lindroos, Sjostrom, & Lissner, 2002; Forslund et al., 2005). Additionally, a minority of studies used self-reported estimates of height and weight to calculate BMI (Andersson & Rossner, 1996; Hampl et al., 2003; Howarth, Huang, Roberts, Lin, & McCrory, 2007). It is possible that some participants may have misrepresented either their height or, more likely, their weight.

With the exception of two studies (Franko et al., 2008; Nicklas et al., 2004), all literature examining the relationship between obesity and eating patterns are cross-sectional in nature. Thus, it is not possible to determine whether there is a casual relationship between the two variables. Additionally, studies of eating disorders ranged from 1 to 7 days in length, which may not have been a long enough time to ascertain average meal patterns.

The location of some of the studies may contribute to generalizability issues. Specifically, two studies examining the relationship between eating disorders and eating patterns were conducted in a Human Feeding Laboratory (Kaye et al., 1992; Weltzin, Hsu, Pollice, & Kae, 1991), which may not be a realistic observation setting and thus may limit the generalizability of the findings to real-world eating behaviors.

Finally, studies of disordered eating in particular have tended to include, or restrict analyses to, only female participants. Researchers have noted that men and women with disordered eating patterns differ significantly in terms of eating attitudes (Scagliusi et al., 2009), and that men are more likely than women to report overeating (Striegel-Moore et al., 2009). This suggests that the relationship between eating disorders and eating patterns seen in women may not generalize to men.

### Meal and Snack Patterns and Obesity

Table 1 describes the methodologies and samples used in studies of the relationship between obesity and eating patterns. These studies examined diverse populations, ranging in age from five years at the youngest (Toschke, Kuchenhoff, Koletzko, & von Kries, 2005) to ninety at the oldest (Howarth et al., 2007), and were conducted in a variety of countries including the United States, Australia, Greece, France, Sweden, Scotland, and Germany.

Table 1. *Summary of cross-sectional studies of the relationship between BMI or obesity and meal and snack frequencies*

Study	Recruitment Method/Region	Sample	Meal pattern /drinking assessment	Height/ weight	Conclusions
Wahlqvist et al., 1999	RS phone directory and electoral rolls/ Melbourne, Australia/Spata, Greece	N = 293 men/women 49.5% female, 77.5 yrs (mean)	DR/c	Physical exam	-eating episodes negatively correlated with BMI -earlier breakfast times associated with lower BMI
Ruidavets et al., 2002	RS polling lists/ Toulouse, France	N = 330 men 45-64 yrs.	3 day FD/c	Physical exam	- eating episodes negatively correlated with BMI
Forslund et al., 2002	RS registry of obese subjects / Southwest region of Sweden	N=177 women 46.9% obese, 37-60 yrs.	DR/c	Physical exam	-obese ate more meals per day than controls -obese ate later in day more often than controls
Forslund et al., 2005	Volunteered to participate in study of obesity and diabetes / Sweden	N = 5562 men/women 42.6% female, 30-60 yrs.	DR/b	Physical exam	-non-obese/obese had similar meal frequency -obese snacked more -eating episodes positively correlated with BMI (especially snacks)

Table 1 *continued*

Study	Recruitment Method/Region	Sample	Meal pattern /drinking assessment	Height/ weight	Conclusions
Berg et al., 2009	RS / Västra Götaland Region, Sweden	N = 3594 men/women 52.8% female, 25-74 yrs.	DR/a	Physical exam	-obese ate later in day more often than controls -non-obese/obese had similar meal and snack frequencies
Drummond et al., 1997	Recruited volunteers from manufacturing companies/ Edinburgh and Glasgow, Scotland	N = 95 men/women 49.5% female, 20-55 yrs.	7 day FD/c	Physical exam	-men: negative correlation between eating frequency, body weight -women: no significant correlation between eating frequency and body weight or BMI
Ma et al., 2003	Recruitment by healthcare telemarketers / Worcester County, Massachusetts	N=499 men/women 49.7% female, 20-70 yrs.	24-h DR/ c	Physical exam	-eating episodes negatively correlated with BMI -ppl who ate 4+ times per day had a 45% lower risk of obesity -skipping breakfast associated with risk of obesity -ppl who skipped breakfast 75% of days had 4.5 times the risk of obesity
Andersson & Rosner, 1996	RS waiting list of weight loss clinic / Sweden	N = 147 men 58.5% obese, 20-60 yrs.	24-h DR/b	Self-report	-non-obese/obese had similar meal and snack frequencies
Howarth et al., 2007	RS US residents	N = 2685 men/women 43.7% female, 20-90 yrs.	24-h DR/a	Self-report	-eating episodes positively correlated with BMI -only snack frequency correlated with BMI -skipping meals not associated with BMI
Hampel et al., 2003	RS US residents	N = 3267 men/women 46.3% female, 18-65 yrs.	24-h DR/b	Self-report	-no relationship between snacking and BMI
Wurbach et al., 2009	RS and recruitment of children / Jena, Germany	N=2054 boys/girls 47.9% female, 7-14 yrs.	PR/a	Physical exam	-meal frequency negatively correlated with BMI
Toschke et al., 2005	School examination, parents completed a survey/Germany	N = 4370 boys/girls 47.4% female, 5-7 yrs.	PR/a	Physical exam	-meal frequency negatively correlated with childhood overweight and obesity

RS=random selection

DR=dietary recall

a=drinking episode not assessed

FD = food diary

b=drinking episode considered an eating episode

PR = parent recall

c=drinking episode not considered an eating episode

Is there a correlation between meal and snack frequency and obesity? Papers examining the relationship between meal and snack patterns and obesity often focus on the frequency of eating occasions as a correlate of obesity. Three studies found that the number of eating occasions (both meals and snacks) negatively correlated with BMI (Ma et al., 2003; Ruidavets et al., 2002; Wahlqvist, Kouris-blazos, & Wattanapenpaiboon, 1999). Interestingly, Drummond et al. (1997) determined that men showed a negative association between eating occasions and body weight, however, women did not show this correlation for either body weight or BMI. Three studies showed that meal frequency alone negatively correlated with BMI (Franko et al., 2008; Toschke et al., 2005; Wurbach, Zellner, & Kromeyer-Hauschild, 2009). In particular, Franko et al. (2008) conducted a ten-year longitudinal study of the meal patterns of 2379 black and white girls from across the United States. Starting at age nine, the girls were asked to participate in ten annual visits to a study site, during which 3-day food records and demographic information were collected. For both black and white girls, meal frequency, but not snack frequency, was found to be inversely related to BMI throughout adolescence.

Two studies found a positive correlation between meal and snack frequencies and BMI (Forslund et al., 2005; Howarth et al., 2007). However, in both cases, this relationship was stronger for snacking frequency than for meal frequency. Forslund et al. (2005) found that obese and non-obese individuals had similar meal patterns, however, they noted a positive relationship between eating occasions and BMI. The authors determined that snack occasions in particular accounted for the correlation. Similarly, Howarth et al. (2007) found that, when assessed individually, snack

frequency was positively associated with BMI, whereas meal frequency was only marginally associated with BMI, especially in younger individuals. Finally, two studies found no relationship between either meal frequencies and BMI (Nicklas et al., 2004) or snack frequencies and BMI (Hampl et al., 2003), and two studies found that obese individuals reported as many intake occasions as non-obese individuals (Andersson & Rossner, 1996; Berg et al., 2009).

A wide variety of techniques were used to study the relationship between eating frequency and obesity, however, studies that had similar findings had very few commonalities in terms of samples or methodologies used. Because there are no obvious similarities between studies with similar results, additional research is needed to clarify the relationship that exists between these two variables.

Does timing of the eating episodes matter? In a study of the relationship between meal patterns and obesity in 177 obese and non-obese women from Sweden, Forslund et al. (2002) determined that obese participants ate more meals per day than non-obese participants, and that the obese group tended to eat more than the comparison group in the afternoon, evening, and night. Although Berg et al. (2009) found that obese and non-obese participants displayed a similar number of intake occasions, they also found that the obese group was more likely to skip breakfast and lunch and eat more in the evening and at night. Berg et al. (2009) and Forslund et al. (2002) may have had different results in the comparison of intake occasions because Berg et al. (2009) studied men in addition to women, whereas Forslund et al. (2002) only used female participants. Additionally, the obese group in Berg et al.'s (2009)

study comprised only 14.9% of their total participants, whereas the obese group in Forslund et al.'s (2002) study was much larger (46.9% of the total).

### Meal and Snack Patterns and Disordered Eating

Studies examining the relationship between eating patterns and disordered eating focused their analyses on individuals with either bulimia nervosa or binge eating disorder (Table 2). With one exception (Elmore & deCastro, 1991), all participants in the studies examining bulimia nervosa were beginning either inpatient or outpatient treatment at the study sites. Most studies of bulimia nervosa, excluding Mitchell, Hatsukami, Eckert, and Pyle (1985), included only female participants who had a mean illness duration ranging from 3.7 to 7 years. The studies examining binge eating disorder recruited individuals through media ads, and a majority of the analyses included both male and female participants.

Table 2. *Summary of studies of the relationship between bulimia nervosa and binge eating disorder and meal and snack frequencies*

Study	Disorder/ Diagnostic Criteria (DSM)	Recruitment Method	Sample	Mean illness length	Meal pattern assessment/ length of study	Conclusions
Davis et al., 1988	BN / III-R	Beginning inpatient treatment	26 women w/BN 26 controls	5.7 years	Self-report / 6 days	-groups did not differ in frequency of snacks -BN ate less meals per day than controls
Hetherington et al., 1994	BN / III	Beginning inpatient treatment	10 women w/BN 10 matched controls	6.6 years	Staff observation, computer records / 7 days BN,4 days control	-total number of meals was similar for both groups, but variance for bulimic subjects was higher
Kaye et al., 1992	BN / III-R	Beginning treatment at in/ outpatient centers	21 women w/BN 11 matched controls	3.7 years	Human Feeding Lab / 3 days	-total number of meals was similar for both groups

Table 2 *Continued*

Study	Disorder/ Diagnostic Criteria (DSM)	Recruitment Method	Sample	Mean illness length	Meal pattern assessment/ length of study	Conclusions
Weltzin et al., 1991	BN / III-R	Beginning outpatient treatment	54 women w/BN 11 controls	6.6 years	Human Feeding Lab / 1 day	-both groups ate a similar number of meals per day -control group ate meals at regular times, bulimic group did not show this regular pattern
Mitchell et al., 1985	BN / III	Beginning outpatient treatment	275 patients	7 years	Eating history questionnaire	-21.3% ate 2+ normal meals per day -18.7% ate one normal meal per day -38.9% ate a normal meal once/several times per week -21% ate normal meals < 1x/wk or not at all
Elmore & de Castro, 1991	BN / III-R	Recruited from newspaper ads and psych students	19 women w/BN 26 recovered BN 21 normal eaters	Not reported	Self-report / 7 days	-no statistical differences
Allison et al., 2005	BED / IV	Media recruitment for people with BED, NES, neither	177 w/BED 45overweight/ obese controls	Not reported	EDE	-BED ate more evening meals than controls -BED ate more frequently during the day than controls
Masheb & Grilo, 2004	BED / IV	Ads for binge eating treatment studies	173 obese w/BED	Not reported	EDE	-those who ate 3 meals per day binged less -ppts who ate more meals had lower BMI -breakfast was eaten less frequently than lunch or dinner
Raymond et al., 2003	BED / IV	Media recruitment for women 50 lbs. overweight	12 women w/ BED 8 obese controls	Not reported	24-h dietary recall	-during binge days, BED ate later in the afternoon and evening -binge and non-binge days combined: BED still ate significantly later
Engel et al., 2009	BED / IV	Controls recruited through flyers, BED referred from treatment facility	9 obese BED 13 obese NBED 16 non-obese control	Not reported	Ecological momentary assessment / 7 days	-BED did not significantly differ from obese NBED or non- obese controls in eating occasions

Is there a correlation between meal frequency and bulimia nervosa? A

majority of the studies examined showed that the number of meals consumed was similar for individuals with and without bulimia nervosa (Elmore & deCastro, 1991; Hetherington, Altemus, Nelson, Bernat, & Gold, 1994; Kaye et al., 1992; Weltzin et al., 1991). However, one study, conducted by Davis, Freeman, and Garner (1988), found that while the two groups did not differ in the amount of snacks consumed, those with bulimia nervosa consumed fewer meals than those without.

Most studies found that the number of meals consumed by bulimic individuals was similar to the number of meals consumed by control participants. However, in two of these studies (Elmore & deCastro, 1991; Weltzin et al., 1991), bulimic individuals were found to consume more calories during meals than control individuals. Weltzin et al. (1991) reported that 63% of the time, the bulimic and control group consumed a similar number of calories; however, the other 37% of the time, bulimic individuals ate larger than average meals. Additionally, Elmore and deCastro (1991) found that both recovered and non-recovered individuals ate meals that were larger than those of the comparison group.

Weltzin et al. (1991) conducted a study of the eating habits of 54 women with bulimia nervosa and 11 matched controls. Both groups of women were admitted to a Human Feeding Laboratory, where their food intake was monitored for 24 hours. Interestingly, the study showed that although the bulimic and non-bulimic groups consumed a comparable number of meals, the bulimic women did not eat breakfast, lunch, and dinner at regular times. Hence, while individuals with bulimia nervosa may eat a similar number of meals as individuals without the disorder, it is possible

that they consume their meals according to a less regular schedule across the day. However, the small number of studies investigating the question of schedule regularity (rather than simply counting the number of meals consumed per day), makes it impossible to draw a firm conclusion about this question. As will be described next, a small literature has examined timing of meals among individuals with BED.

Is there a correlation between meal frequency and binge eating disorder? Most studies reviewed here found that the timing of eating occasions is skewed toward later in the afternoon and evening in individuals with binge eating disorder (Allison, Grilo, Masheb, & Stunkard, 2005; Masheb & Grilo, 2004; Raymond, Neumeyer, Warren, Lee, & Peterson, 2003). Allison et al. (2005) conducted a comparative study of 245 individuals with either binge eating disorder or night eating syndrome, and a group of 45 overweight or obese controls. They found that individuals with binge eating disorder ate more evening meals than the comparison group, and that the comparison group often stopped eating after their evening meal, whereas the BED group often consumed evening snacks. Similarly, Masheb and Grilo (2004) found that individuals with BED consumed breakfast less frequently than lunch or dinner. Finally, Raymond et al. (2003) found that individuals with BED ate later in the afternoon and evening on binge eating days, and when they combined data for binge eating and non-binge eating days, they still found that these individuals ate significantly later than the comparison group.

Although the research has indicated that individuals with BED shift their consumption schedules to later in the afternoon and evening, studies comparing meal

frequencies have found mixed results. Allison et al. (2005) found that individuals with BED ate more frequently during the day than the comparison group; however, Engel et al. (2009) found that those with BED did not differ from either the non-BED or non-obese controls on number of eating occasions. Interestingly, although Masheb and Grilo (2004) did not compare BED and non-BED individuals on number of eating occasions, they did find that individuals with BED who ate three meals per day binged less than those who did not eat three meals per day.

### Discussion

The studies examined here showed inconsistent results in terms of the relationship between eating frequency and obesity, as well as eating frequency and disordered eating. A majority of the studies examining obesity found a negative correlation between eating frequency and BMI. It is interesting to note that three of these studies found that only meal frequency, and not snack frequency, was negatively correlated with obesity (Franko et al., 2008; Toschke et al., 2005; Wurbach et al., 2009). In contrast, the two studies that found a positive correlation between eating patterns and obesity noted that the relationship was stronger for snacking frequency than it was for meal frequency (Forslund et al., 2005; Howarth et al., 2007). These results suggest that snacking frequency may play a role in weight gain. However, as demonstrated by the discrepant results, more research is necessary to clarify the relationship between meal and snack frequency and obesity.

The literature reviewed in this section suggests that both individuals who are obese and individuals who exhibit disordered eating are more likely to skip breakfast and shift their consumption schedule to later in the day. Continued research is

necessary to understand the interplay between the timing of intake occasions and clinical correlates of disordered eating such as weight, eating disorder pathology, and depression.

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## Section II. Eating Patterns in Patients with Spectrum Binge Eating Disorder

A core element of cognitive-behavioral treatment of bulimia nervosa is the proscription that patients adopt a pattern of regular eating involving three planned meals and two to three planned snacks spread out over the course of the day (Fairburn, Marcus, & Wilson, 1993) in order to reduce the risk of bingeing in response to a perceived or real nutritional deficit (Shah, Passi, Bryson, & Agras, 2005). Initially developed to treat the highly chaotic eating patterns commonly observed in individuals with bulimia nervosa, who report fasting or highly restrictive eating outside of bingeing episodes, the recommendation for regular meals and snacks also has been adopted for individuals with BED (Fairburn, Marcus, & Wilson, 1993).

Only two studies, with overlapping samples, have examined the relationship between general eating patterns and clinical features among persons with BED (Allison, Grilo, Masheb, & Stunkard, 2005; Masheb & Grilo, 2006). Masheb and Grilo (2006) found that more frequent consumption of meals and snacks was associated with lower weight in a sample of male ( $n = 46$ ) and female ( $n = 127$ ) obese patients with BED. However, breakfast frequency was more strongly associated with lower weight than lunch frequency, and the frequency of eating dinner was not correlated significantly with weight. Of note, breakfast was the least frequently eaten meal in this sample. Although the frequency of individual meals was not associated with binge frequency, patients who reported regularly eating three meals a day had fewer binge eating episodes than patients who did not regularly eat three meals a day. Daily evening snacking was positively associated with binge frequency, yet

surprisingly, it also was associated with lower Body Mass Index (BMI). The generalizability of these findings may be limited to patients in treatment for weight loss at specialty clinics and additional research with patients presenting at different clinical settings, or for reasons other than weight loss, is needed (Masheb & Grilo, 2006).

The present study utilized data collected as part of the baseline assessment for the Binge Eating Self-help Treatment study (BEST) (Debar et al., 2009; Striegel-Moore et al., 2009) and expands upon prior research by recruiting participants from the membership of a large Health Maintenance Organization (HMO) rather than a specialized clinic and by using broader study entry criteria. Specifically, participants were eligible if they reported a minimum average frequency of one binge eating episode per week for the past three months (recurrent binge eating; RBE) and they were not required to be obese. Hence, our sample included individuals whose clinical presentation in terms of binge frequency or degree of overweight was less severe than that represented in Masheb and Grilo (2006).

Our secondary data analyses addressed three aims: (1) to describe the frequency and regularity of meals and snacks in our sample of recurrent binge eaters; (2) to examine the associations between eating patterns and clinical correlates, including BMI, dimensional measures of eating pathology, and depression; and (3) to compare clinical features of participants who reported regular eating with those who did not. Because a growing literature suggests that eating breakfast, in particular, may be helpful in managing weight or preventing weight gain (Berg et al., 2009; Niemier, Raynor, Lloyd-Richardson, Rogers, & Wing, 2006; Schlundt, Hill, Sbrocco, Pope-

Cordle, & Sharpe, 1992), we also compared participants who ate breakfast regularly with those who did not on the clinical measures. The present report is restricted to women because only four men (3.6%) participated in the treatment trial, precluding analyses based on sex.

## Method

### *Sample*

The sample consisted of 106 women (94.3% white, 96.2% non-Hispanic), most of whom completed at least some college (83.0%) and were married or partnered (69.8%), with a mean age of 33.9 years ( $SD = 7.4$ ) and a mean BMI of 33.3  $\text{lbs/in}^2$  ( $SD = 7.2$ ). Thirty participants (28.3%) were overweight ( $25 \leq \text{BMI} < 30$ ) and 67 (63.2%) were obese ( $\text{BMI} \geq 30$ ). Forty-eight women met full syndrome diagnostic criteria for BED and the remainder reported RBE. Compensatory behaviors were reported by 15.1% of participants, although none reported such behaviors at diagnostic thresholds.

### *Instruments and Procedure*

Only instruments and procedures relevant to the present report are described below. Recruitment (Debar et al., 2009) and case finding (Striegel-Moore et al., 2009) for BEST have been detailed in previous reports. In brief, health plan members between the ages of 18 and 50, randomly selected from the HMO database, were mailed an invitation to the clinical trial. Brochures and posters advertising the trial were also placed in HMO clinics. A two-stage case finding procedure was used in which participants completed an initial self-report screening questionnaire (the Patient Health Questionnaire) (Spitzer, Kroenke, & Williams, 1999) followed by a

confirmatory diagnostic interview and additional self-report measures. All study procedures were approved by the participating institutions' human subjects review boards.

*Eating Disorder Pathology.* An abbreviated version of the Eating Disorder Examination (EDE) (Fairburn & Cooper, 1993) was administered by telephone to confirm study eligibility and eating disorder diagnosis (DSM-IV) (American Psychiatric Association, 2000) and to assess meal and snack frequency during the past month. We recorded the number of objective bulimic episodes (OBEs), defined as an episode in which an individual objectively overeats while feeling a loss of control, as well as the number of days with at least one OBE. Because findings for these variables were similar, we report only the number of days with OBEs. Participants were asked on how many of the past 28 days they had consumed breakfast, lunch, and dinner, as well as had mid-morning-, mid-afternoon-, evening-, or nocturnal snacks. Nocturnal eating was defined as an episode of eating after the participant had been to sleep. We also rated meal or snack frequencies using EDE scoring procedures (0 = not eaten; 6 = meal or snack eaten every day).

The Eating Disorder Examination Questionnaire (EDE-Q) (Fairburn & Beglin, 2008) was used to assess dietary restraint, eating concern, shape concern, and weight concern. In addition, two items with demonstrated validity as indicators of body checking (e.g., frequent weighing or pinching the body to measure fat) and body avoidance (e.g., wearing baggy clothing or avoiding weighing oneself) (Reas, White, & Grilo, 2006) were included. Participants rated, on a scale from 1 (never) to 6

(always), how often in the past 28 days they had engaged in body checking or avoidance behaviors.

*Depression.* Depressive symptoms were assessed by self-report using the Beck Depression Inventory (BDI) (Beck, Steer, & Garbin, 1988).

#### *Data Analyses*

Pearson product moment correlations were used to correlate meal and snack frequencies with weight and measures of eating behaviors, body image concerns, BMI, and self-reported depression. Independent samples t-tests were used to test group differences between those who ate breakfast daily versus those who did not, and between those who ate three meals per day versus those who did not, on the clinical indicators of interest. A conservative value of  $p < .01$  was adopted in light of the large number of statistical tests and Cohen's  $d$  (Cohen, 1988) was calculated to estimate effect size.

### Results

#### Meal and Snack Consumption among Women with Recurrent Binge Eating

Table 1 shows the frequency of meal and snack consumption in the past 28 days. On average, lunch (mean = 24 days) and dinner (mean = 26 days) were consumed on all but one day per week. Breakfast was also consumed on a majority of days (mean = 19 days), though less often than lunch or dinner. Snacking during the evening was more common than snacking in the afternoon which, in turn, was more common than snacking mid-morning.

Table 1. *Frequency of meals and snacks consumed in the past 28 days*

	Breakfast	Mid-morning snack	Lunch	Mid-afternoon snack	Dinner	Evening snack	Nocturnal eating
Frequency	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
0 (Absence)	4 (3.8)	7 (6.6)	0	3 (2.8)	0	2 (1.9)	78 (73.6)
1 (1-5 days)	6 (5.7)	22 (20.8)	2 (1.9)	14 (13.2)	0	4 (3.8)	16 (15.1)
2 (6-12 days)	17 (16.0)	15 (14.2)	7 (6.6)	17 (16.0)	2 (1.9)	17 (16.0)	5 (4.7)
3 (13-15 days)	6 (5.7)	18 (17.0)	4 (3.8)	13 (12.3)	2 (1.9)	10 (9.4)	2 (1.9)
4 (16-22 days)	22 (20.8)	30 (28.3)	11 (10.4)	26 (24.5)	13 (12.3)	28 (26.4)	4 (3.8)
5 (23-27 days)	26 (24.5)	11 (10.4)	46(43.4)	27 (25.5)	37 (34.9)	30 (28.3)	1 (0.9)
6 (28 days)	25 (23.6)	3 (2.8)	36 (34.0)	6 (5.7)	52 (49.1)	15 (14.2)	0
Mean Days	19.20	13.29	23.81	16.55	25.70	19.25	2.07

Employing Masheb and Grilo's (2006) definition of regular eating, i.e., eating a meal every day during the past 28 days, breakfast was again the least, and dinner the most, commonly consumed meal. Daily eating was reported by less than one-quarter of the sample for breakfast, by a third of the sample for lunch, and by just under one-half for dinner. Daily snacking was reported by only a minority of participants. Daily evening snacking was the most common (14.2%) and daily mid-afternoon snacking (5.6%) or mid-morning snacking (2.4%) were reported by only a handful of participants. At least one episode of nocturnal eating (a presumably undesirable behavior) was reported by about 25% of the sample; no participant reported daily episodes of nocturnal eating.

Clinical correlates of meal and snack consumption As shown in Table 2, neither breakfast, lunch, nor dinner frequency was associated significantly with BMI,

binge eating, dimensional measures of eating disorder pathology, or self-reported depression. No significant associations were noted between total meal frequency and any of the clinical correlates (data not shown). Correlations between snacking frequency and clinical correlates were also non-significant with the exception of evening snacking, which was associated with binge eating.

Table 2. *Correlation coefficients for meal and snack frequencies with binge eating, eating disorder pathology, BMI, and self-reported depression (N=106)*

Eating Related Measures	Breakfast	Mid-morning snack	Lunch	Mid-afternoon snack	Dinner	Evening snack	Nocturnal eating
Body Mass Index	-.02	.00	.08	-.08	.19	.03	.16
Number of Days with OBEs	-.06	.18	-.09	.23	.09	.29*	-.04
EDE-Q Restraint	-.17	.07	.03	-.05	-.11	-.08	-.12
EDE-Q Eating Concern	-.03	.24	.16	.17	.09	.08	-.12
EDE-Q Shape Concern	-.03	.06	.14	.09	.12	-.01	-.17
EDE-Q Weight Concern	-.13	.09	.10	.08	.04	-.05	-.11
Body Checking	.08	.12	.13	.21	.07	.00	-.22
Body Avoidance	-.08	.01	-.10	-.15	-.05	-.05	.08
Beck Depression Inventory	-.17	.05	.06	.10	-.11	-.09	-.05

OBEs = Objective bulimic episodes; EDE-Q = Eating Disorder Examination Questionnaire  
\* $p < .01$ ; A conservative significance level of  $p < .01$  was adopted to reduce type I error.

### Prevalence and Clinical Correlates of Regular Eating

Only 9.4% our sample reported eating three meals a day on each of the preceding 28 days. Regular meal eaters ( $n = 10$ ) did not differ from non-regular meal eaters ( $n = 96$ ) on any of the dependent variables, although effect size estimates

indicated differences of moderate magnitude for body checking ( $d = 0.59$ ) (data not shown).

Daily breakfast eating was reported by 23.6% of participants. No reliable ( $p < .01$ ) differences were observed between those who ate breakfast regularly and those who did not, although the effect size was moderate for body checking with daily breakfast eaters reporting more frequent body checking (Table 3).

Table 3: *Comparison of participants eating breakfast daily versus those eating breakfast less than every day*

Eating Related Measures	Overall sample (n = 106)		Eat breakfast daily (n = 25)		Don't eat breakfast daily (n = 81)		Test Statistic	Cohen's d
	Mean	SD	Mean	SD	Mean	SD		
Body Mass Index	33.28	7.17	31.80	6.18	33.73	7.42	t(104)=1.18,p=.24	-.27
Number of Days with OBEs	11.65	6.84	9.80	5.47	12.22	7.14	t(104)=1.56, p=.12	-.36
EDE-Q Restraint	2.68	1.45	2.50	1.31	2.74	1.50	t(103) < 1, ns	-.16
EDE-Q Eating Concern	3.75	1.21	3.87	1.15	3.72	1.23	t(103)= -0.56,p=.58	.13
EDE-Q Shape Concern	4.86	0.89	4.92	0.90	4.84	0.89	t(103)= -0.35,p=.73	.08
EDE-Q Weight Concern	4.28	0.99	4.18	1.04	4.32	0.98	t(103) < 1, ns	-.13
Body Checking	3.96	1.41	4.52	1.12	3.79	1.46	t(103)=-2.31,p= .02	.53
Body Avoidance Beck	3.95	1.35	3.76	1.23	4.01	1.39	t(103) < 1, ns	-.19
Depression Inventory	19.83	8.27	17.36	6.14	20.60	8.72	t(103)=1.73, p = .09	-.40

Note: A conservative significance level of  $p < .01$  was adopted to reduce type I error.

## Discussion

Our principal findings were as follows. First, a majority of women in our sample reported eating breakfast, lunch and dinner and many also reported evening or mid-afternoon snacking on more days than not during the past 28 days. Dinner was

the most, and breakfast the least, commonly consumed meal, snacking was most often reported during the evening time, and nocturnal eating was infrequent. In addition, when employing the strict definition of regular eating used by Masheb and Grilo (2006), requiring daily consumption of breakfast, lunch, and dinner, fewer than one-half of participants in either study were deemed to be regular eaters, though participants in our study were especially unlikely to meet this stringent criterion. Finally, few significant associations were found between eating patterns and clinical correlates of interest.

The general meal and snack patterns we observed were consistent with those reported by Masheb and Grilo (2006): dinner was the most, and breakfast the least, commonly consumed meal, and evening snack was the most commonly reported snack. This eating pattern may be a stable feature of binge eating disorders. However, specific meal and snack frequencies were much lower in our study. Although our sample appeared to eat meals and snacks with some consistency, few participants evidenced a meal pattern that would meet the narrow definition of regularity used by Masheb and Grilo (2006). Indeed, less than 10% of our participants ate all three meals daily during the past four weeks. Yet, when the definition of regularity is adjusted to include individuals who consumed meals or snacks on more than half of the days, 96.3% of our sample and 95.3% of Masheb and Grilo's (2006) sample consumed dinner regularly.

Breakfast skipping is considered to be normative among adolescents (Shaw, 1998; Albertson et al., 2007; Rampersaud, Pereira, Girand, Adams, & Metz, 2005), however, health experts have noted that breakfast plays an important role in mood,

cognitive functioning, and weight management (Rampersaud et al. 2005; Song, Chun, Obayashi, Cho, & Chung, 2005; Wiedenorm-Muller, Hille, Klenk, & Weiland, 2008; Wyatt et al., 2002). Although a number of studies have found an inverse relationship between breakfast eating and BMI (Albertson et al., 2007; Barton et al., 2005; Cho, Dietrich, Brown, Clark, & Block, 2003; Ma et al., 2003; Masheb & Grilo, 2006), we did not. The cross-sectional nature of our data may have precluded the detection of a predictable long-term relationship between breakfast consumption and BMI. In addition, most of our participants (91.5%) were either overweight or obese, thus restricting the variance in BMI to detect a significant relationship.

Binge eating was not correlated with any specific meal, or pattern of meals, but was associated with evening snacking. Evening may present a vulnerable time for binge eating because snacks consumed at this time may develop into binge episodes (Masheb & Grilo, 2006). This would suggest that clinicians should work with clients to develop strategies to structure these eating occurrences in ways that minimize the risk that they lead to binge eating.

Neither meal nor snack frequency correlated with any other measures of weight, eating pathology, or depression. Masheb and Grilo (2006) also found few significant correlations between meals and snacks and eating pathology. Our participants, however, were not symptom-free. The women in our sample scored higher than average on measures of eating disorder features (Luce, Crowther, & Pole, 2008). The fact that these elevated scores did not correlate with eating patterns suggests that eating patterns alone do not contribute to eating disorder pathology.

Several limitations need to be noted. The sample size for some comparisons was very small; for example, only ten participants ate three meals per day every day. Our study did not assess all aspects of eating patterns which may be relevant to binge eating, such as the nutritional content (Raymond, Neumeyer, Warren, Lee, & Peterson, 2003) or types of food consumed during meals and snacks (Allison & Timmerman, 2007). Also, our sample was restricted to women, a majority of whom were white, insured, and highly educated. Nonetheless, our study expanded upon previous work (Masheb & Grilo, 2006) on the prevalence and clinical correlates of meal frequency and regularity by recruiting participants from the membership of a large HMO and including participants with a broader range of binge eating frequency. Research with more diverse participants is still needed to ensure broader generalizability. Additionally, future research should examine the role that eating patterns may play in recovery from binge eating disorders (Shah et al. 2005). Finally, because the nutritional content, types, and amounts of foods consumed during binges differs from non-binge eating episodes (Allison & Timmerman, 2007; Raymond et al., 2003), these variables may impact eating patterns and should be considered in examining the relationship (concurrently and, more importantly, prospectively) between eating patterns and disordered eating.

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## Conclusion

The aim of this thesis was to examine the clinical significance of eating patterns in binge eating disorder (BED). The first section reviewed the current research on the relationship between eating patterns and obesity, as well as eating patterns and disordered eating. The literature showed inconsistent results in terms of the relationships between eating frequency and disordered eating or obesity, with some studies reporting a positive correlation between eating patterns and BMI or eating pathology, and other studies reporting a negative correlation between eating patterns and the same variables. In contrast, the research consistently demonstrated that both individuals with disordered eating and individuals who are obese are more likely to skip breakfast and consume meals and snacks later in the day.

The second section reported the findings of an empirical study examining the association between eating patterns and clinical correlates of recurrent binge eating. Consistent with the literature reviewed in the first section, the women in this study showed a propensity to eat more in the afternoon and evening. Though breakfast was the least commonly consumed meal, a majority of participants reported eating meals and snacks, including breakfast, with regularity. The study did not find an association between specific meals or meal patterns and BED, however, participants did score higher than average on measures of eating disorder features.

The findings of the literature review and the empirical study highlight a variety of possible future research directions. First, the nutritional content, types, and amounts of food consumed during non-binge occasions may impact obesity and eating disorder symptomatology. Therefore, these variables should be considered

when examining the relationship between eating patterns and disordered eating.

Second, although cognitive behavioral therapy (CBT) is often used to treat BED, little is known about the mechanisms that make it effective. Future studies should examine whether eating patterns mediate the effects of CBT on the disorder.