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Dietary Restriction Behaviors and Binge Eating in Anorexia Nervosa, Bulimia Nervosa and Binge Eating Disorder: Trans-diagnostic Examination of the Restraint Model

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Abstract

Objective: To compare dietary restriction behaviors among adults with eating disorders involving binge eating, including anorexia nervosa-binge/purge subtype (AN-BE/P), bulimia nervosa (BN), and binge eating disorder (BED), and to examine whether dietary restriction behaviors impact binge eating frequency across diagnoses.

Method: Participants included 845 treatment seeking adults ($M = 30.42 \pm 10.76$ years) who met criteria for DSM-5 AN-BE/P (7.3%; $n = 62$), BN (59.7%; $n = 504$), and BED (33.0%; $n = 279$). All participants self-reported their past and current eating disorder symptoms on the Eating Disorder Questionnaire.

Results: Adults with AN-BE/P and BN reported significantly more dietary restriction behaviors (e.g. eating fewer meals per day, higher frequency of fasting, consuming small and low calorie meals) in comparison to adults with BED. Adults with AN-BE/P and BN who reported restricting

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Contributors

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Conflict of Interest

None of the other authors have any financial disclosures or conflicts of interest to report.

food intake via eating fewer meals per day had more frequent binge eating episodes. However, adults with BN who reported restricting food intake via eating small meals and low calorie meals had less frequent binge eating episodes.

Discussion: This study provides mixed support for the restraint model by suggesting that not all dietary restriction behaviors are associated with higher levels of binge eating. It may be that adults with BN who report a higher frequency of eating small and low calorie meals display more control over their eating in general, and therefore also have lower frequency of binge eating. Clinicians should assess for dietary restriction behaviors at the start of treatment prior to assuming that all forms of strict dieting and weight control behaviors similarly impact binge eating.

Keywords

Anorexia Nervosa; Bulimia Nervosa; Binge Eating Disorder; Restraint Model; Restriction Behaviors; Binge Eating

1. Introduction

Binge eating, defined as consuming large amounts of food in a discrete period of time while experiencing a sense of loss of control over eating (American Psychiatric Association, 2013), is a core diagnostic feature of bulimia nervosa (BN) and binge eating disorder (BED), and is frequently endorsed by individuals with anorexia nervosa (namely, those with the binge eating/purging subtype; AN-BE/P). The restraint model of binge eating theorizes that attempts at dietary restriction arising from shape and weight over concern promote binge eating, which in turn leads to a vicious cycle of increased efforts to restrict eating again (Lowe, 1993; Polivy & Herman, 1985). The existing literature provides scientific support for the restraint model by showing that attempted dietary restriction may be associated with increased rates of binge eating episodes among individuals with BN (Davis, Freeman, & Garner, 1988; Masheb, Grilo, & White, 2011) and BED (Harvey, Rosselli, Wilson, Debar, & Striegel-Moore, 2011; Stein et al., 2007). However, little is known about the specific behaviors of dietary restriction (e.g., fasting, skipping meals, reducing caloric content or portion sizes) that may contribute to the onset of binge eating across eating disorder diagnostic subgroups. Furthermore, the literature exploring the restraint model among individuals with AN-BE/P is relatively scarce.

Previous research suggests that dietary behaviors differ across the eating disorder diagnostic spectrum. While individuals with AN typically follow rigid dietary behaviors (e.g., fixed meal times, reduced portion sizes, low caloric food choices) (Burd et al., 2009; Harvey et al., 2011; Huse & Lucas, 1984; Wallin, Norring, & Holmgren, 1994), individuals with BN and BED tend to have more chaotic and inconsistent dietary behaviors and greater intra-individual variability than those with AN (Goldfein, Walsh, LaChaussee, Kissileff, & Devlin, 1993; Hetherington, Altemus, Nelson, Bernat, & Gold, 1994; Masheb et al., 2011). When they are not engaging in binge eating, individuals with AN-BE/P and BN have been found to attempt to restrict their caloric intake for the purpose of weight control (Wallin et al., 1994), whereas individuals with BED have been found to be less likely to reduce their food consumption outside of binge eating with a slight tendency towards overeating (Goldfein et al., 1993; Mitchell, 2005; Mitchell et al., 2007; Raymond et al., 2012; Stein et

al., 2007). However, the literature comparing dietary restriction behaviors among these three groups is relatively limited.

A few studies have compared patterns of eating among individuals with BN and BED. For example, a study investigating meal and snack patterns among women with BN, BED, and controls, found that the BN group ate significantly fewer meals per day than the other two groups, and that the BED group ate significantly more snacks per day than the control group (Masheb et al., 2011). These data have added to the current knowledge about eating behaviors and the frequency of skipping meals among individuals with BN and BED, but there is a gap in the understanding of other dietary restriction behaviors that these individuals may endorse outside of binge eating episodes. Identifying specific dietary restriction behaviors (e.g. reducing caloric intake or portion sizes) that increase risk for binge eating behaviors across eating disorder diagnoses may guide future treatment efforts. In particular, a better understanding of dietary restriction behaviors that are associated with the onset of binge eating may be helpful in tailoring treatment efforts targeted at eating disorder treatment seekers who would like to cease their binge eating behaviors (Iacovino, Gredysa, Altman, & Wilfley, 2012). Furthermore, the trans-diagnostic cognitive-behavioral treatment model (Fairburn, 2008; Fairburn & Harrison, 2003) suggests that a decrease in dietary restriction is a critical component for a successful reduction of binge eating behaviors across eating disorder diagnoses. A better understanding of dietary restriction behaviors may inform therapists using this trans-diagnostic treatment model by helping to identify the specific dietary restriction behaviors that impact binge eating behaviors.

Research examining correlations between dietary restriction and binge eating has focused primarily on individuals with BN and BED (Stice, Davis, Miller, & Marti, 2008). These studies suggest that individuals who restrict caloric intake (Zunker et al., 2011) or consume meals and snacks with irregular frequency (Harvey et al., 2011; Masheb et al., 2011) tend to engage in more frequent binge eating episodes. However, it is still unclear how caloric restriction and irregular meal patterns interact to increase risk for binge eating. For example, data collected via Ecological Momentary Assessment (EMA) have shown that the odds of binge eating among individuals with BN increase on the day that caloric restriction occurs (Zunker et al., 2011). These data provide preliminary support for the restraint model, but the specific dietary behaviors that are used by those individuals to restrict their caloric intake (e.g. fasting/skipping meals/specific food selections) remain unclear. Additionally, a study examining meal patterns among individuals with BED found that an irregular meal pattern of less than three meals a day is associated with more binge-eating episodes (Harvey et al., 2011). However, it is unclear if those irregular meal patterns are associated with caloric restriction among patients with BED. In spite of the growing literature examining dietary behaviors and binge eating behaviors, there has been a lack of research examining variability in dietary restriction behaviors that may impact binge eating across diagnoses. Furthermore, the literature exploring the restraint model among individuals with AN-BE/P is limited (Elran-Barak et al., 2014). It is unknown whether these relations between dietary behaviors and binge eating hold true in AN-BE/P, and to what extent they differ among individuals with AN-BE/P, BN and BED.

The current study examines dietary restriction behaviors including fasting, skipping meals, and reducing caloric intake with an aim to answer two questions: (American Psychiatric Association, 2013) Do individuals with AN-BE/P, BN and BED differ in their dietary restriction behaviors? (Polivy & Herman, 1985) What are the associations between dietary restriction behaviors and binge eating frequency among individuals with AN-BE/P, BN and BED? Findings from this study may contribute to the understanding of the role that dietary restriction behaviors play in binge eating among individuals with eating disorders and may have implications for adaptations and new developments for treatment and prevention.

2. Method

2.1. Participants

Participants were 845 treatment-seeking adults who reported recent recurrent binge eating episodes (Table 1). Recent recurrent binge eating was defined as a minimum of one binge eating episode per week on average in the month prior to the assessment. Participants met DSM-5 (American Psychiatric Association, 2013) criteria for AN-BE/P (7.3%; $n = 62$), BN (59.7%; $n = 504$), or BED (33.0%; $n = 279$); were on average 30.4 years old ($s.d. = 10.79$) and were mostly female ($n = 785$; 92.9%) and Caucasian ($n = 726$; 85.9%).

2.2. Procedures

Data were collected as part of the initial psychological evaluation at five eating disorder treatment centers (Department of Psychiatry and Behavioral Neuroscience, The University of Chicago, Chicago, IL; Department of Psychiatry, University of South Florida, Tampa, FL; Department of Psychiatry, University of Minnesota School of Medicine, Minneapolis, MN; The Center for Balanced Eating, Worthington, OH; and the Sanford Eating Disorders and Weight Management Center, Fargo, ND). Data were collected at the baseline assessment before participants initiated treatment. Approximately 90% of clinic cases consented to participate in the study. Each data collection center received institutional review board approval for the study.

2.3. Measures

Participants self-reported their current height and weight, and past and current eating disorder symptoms, on the Eating Disorder Questionnaire (EDQ Version 9.0) (Mitchell, 2005). The EDQ is a self-report measure used to collect current and historical information on patients being evaluated for eating disorders. It consists of detailed questions about current and past eating problems, weight history, co morbid psychopathology, prior treatment, family history, alcohol and substance abuse and dependence, and includes a detailed review of medical systems. Although the EDQ was not designed as a diagnostic instrument, DSM-5 criteria (e.g., binge eating ≥ 1 times per week; regular use of compensatory behaviors for BN and absence of use of compensatory behaviors for BED; fear of weight gain) were used to generate eating disorder diagnoses (Goldschmidt et al., 2011). EDQ-generated ED diagnoses show good agreement with those derived from a semi structured interview (Eddy et al., 2009; Keel, Crow, Davis, & Mitchell, 2002; Mitchell et al., 2007).

Six EDQ items (Mitchell, 2005) were included in the analyses of the current study: (American Psychiatric Association, 2013) “On the average, how many main meals do you eat each day?”; (Polivy & Herman, 1985) “During the entire LAST MONTH, what is the average frequency that you have engaged in the following behaviors: Binge eating, Fasting (skipping meals for the entire day), Skipping meals, Eating very small meals, Eating meals low in calories and/or fat grams” (Never/ Once a Month or Less/ Several Times a Month/ Once a Week/ Twice a Week/ Three to Six Times a Week/ Once a Day/ More Than Once a Day).

2.4. Statistical analysis

Participants were compared on age, sex, race, BMI, dietary behaviors and binge eating episodes using ANOVA and χ^2 analyses. Specific EDQ items included: current number of meals per day, frequency of fasting, frequency of skipping meals, frequency of very small meals, frequency of low calorie meals, and frequency of binge eating episodes in the past month. Pearson’s correlations were used to examine relations between dietary restriction behaviors and frequency of binge eating episodes in the last month.

3. Results

General results indicate that participants with different diagnoses of eating disorders differ in demographic characteristics and dietary behaviors. Means and standard deviations of the results are reported in Table 1. The ANOVAs were significant for age ($F(2,843) = 8.69, p < .001$), BMI ($F(2,843) = 247.76, p < .001$), and for the eating behaviors of fasting ($F(2,843) = 26.08, p < .001$), skipping meals ($F(2,843) = 38.99, p < .001$), meals per day ($F(2,843) = 41.09, p < .001$), very small meals ($F(2,843) = 38.87, p < .001$), low calorie meals ($F(2,843) = 31.20, p < .001$), and binge eating ($F(2,843) = 25.56, p < .001$). Post-hoc comparisons revealed that individuals with AN and BN reported significantly lower frequency of meals per day and significantly higher frequency of fasting, skipping meals, very small meals, and low calorie meals, in comparison to individuals with BED. Furthermore, individuals with BN reported significantly higher frequency of binge eating episodes relative to individuals with AN and BED.

Correlations between dietary restriction behaviors and binge eating episodes within the last month are shown in Table 2. To ensure that correlations were not falsely inflated due to the diagnostic distinctiveness of the three groups, the correlations are presented separately for the AN-BE/P, BN, and BED groups as well as jointly for the entire sample. Among the AN-BE/P group, binge eating episodes were significantly and negatively correlated with meals per day. Participants with AN-BE/P who reported eating more meals per day reported lower frequency of binge eating episodes. Among the BN group, binge eating episodes were significantly and negatively correlated with meals per day, frequency of very small meals, and frequency of low calorie meals. Participants with BN who reported eating more meals per day reported a lower frequency of binge eating episodes. Additionally, participants with BN that reported eating fewer very small meals or low calorie meals reported a greater frequency of binge eating episodes. No significant correlations were found among the BED group between any of the dietary behaviors and frequency of binge eating episodes.

4. Discussion

The aim of the current study was to compare dietary restriction behaviors (i.e. fasting, skipping meals, and eating small meals or low calorie meals) among individuals with AN-BE/P, BN, and BED, and to examine whether these dietary restriction behaviors are associated with binge eating frequency within and across diagnoses. The results showed that individuals with AN-BE/P and BN differed in their non-binge eating behaviors in comparison to individuals with BED. Individuals with AN-BE/P and BN reported eating fewer meals per day and reported a higher frequency of fasting, skipping meals, and consuming small meals and low calorie meals relative to individuals with BED. Furthermore, several associations were found between self-reported dietary restriction behaviors and binge eating among the AN-BE/P and BN groups. Although our data are cross-sectional and cannot determine causation, this study provides preliminary support for the restraint model as well as the possibility that some dietary restriction behaviors, particularly eating few meals per day, may be associated with increased rates of binge eating among individuals with AN-BE/P and BN (Lowe, 1993; Masheb et al., 2011; Polivy & Herman, 1985).

Our data suggest that individuals with AN-BE/P and BN tend to attempt to restrict their food consumption when they are not binge eating and report higher rates of fasting, skipping meals, and consuming small meals and low calorie meals relative to individuals with BED. While restriction of energy intake is a core diagnostic feature for AN (American Psychiatric Association, 2013), these data show that individuals with BN also tend to decrease their energy intake outside of binge eating. These findings are consistent with previous studies looking at non-binge eating behaviors among individuals with BN (Alpers & Tuschen-Caffier, 2004; Gendall, Sullivan, Joyce, Carter, & Bulik, 1997; Hadigan, Walsh, Lachaussée, & Kissileff, 1992; Weltzin, Hsu, Pollice, & Kaye, 1991; Woell, Fichter, Pirke, & Wolfram, 1989). For example, studies that have used dietary recall methods to examine energy intake among patients with BN have suggested that these individuals typically ingest foods with a high caloric density only during binge eating episodes, and that binge eating overcompensates for low non-binge eating energy intake (Alpers & Tuschen-Caffier, 2004; Gendall et al., 1997; Hadigan et al., 1992; Weltzin et al., 1991; Woell et al., 1989). Furthermore, a study comparing energy intake among individuals with BN and controls found that non-binge energy intake is typically lower and total energy intake is typically higher in patients with BN relative to the population median (Gendall et al., 1997). These data may explain why individuals with BN report a similar frequency of attempts to control shape and weight relative to patients with AN; however, their attempts are more frequently followed by episodes of binge eating (perhaps due to differing neurobiological factors), and as a result, individuals with BN have higher BMIs than individuals with AN.

Our findings showed multiple significant correlations between the self-reported dietary restriction behaviors of fasting, skipping meals, eating small meals, and eating low calorie meals. For example, consuming small meals and low calorie meals was significantly associated with skipping meals among adults with BN and BED. This finding suggests that these individuals with BN and BED who are consuming small and low calorie meals also tend to skip meals, and therefore may be likely to get inadequate nutrition.

Examination of the correlations between the frequency of self-reported dietary restriction behaviors and binge eating episodes provides partial support to the restraint model. This examination suggests that eating more meals per day is associated with lower frequencies of binge eating among patients with AN-BE/P and BN, although it cannot be established from these cross-sectional data whether restriction promotes binge eating or vice versa. These associations are consistent with previous studies showing that BN patients who eat regularly (i.e. three meals per day) tend to have fewer binge eating episodes relative to BN patients that do not eat regularly (Harvey et al., 2011; Masheb et al., 2011).

Interestingly, our findings showed that individuals with BN who reported restricting food intake via eating small meals or low calorie meals had less frequent binge eating episodes. These individuals also reported skipping more meals, which suggests that their overall food consumption (outside of binge eating) is relatively small. These findings contradict the restraint model by implying that there are restriction behaviors among the BN group (i.e. eating small meals or low calorie meals) that do not increase binge eating but rather are associated with lower rates of binge eating. It may be that individuals with BN who report a higher frequency of eating small meals or low calorie meals display more control over their eating in general, and therefore also have lower frequency of binge eating. The tendency to have more control over eating and to restrict food intake by eating small and low calorie meals is often associated with AN, however this study suggests that this tendency may also be prevalent among a subset of individuals with BN (of note, these may be individuals with a history of AN, but this was not assessed in the current study). An alternative explanation, which is not counter to the restraint model, is that individuals with BN who eat small or low calorie meals are grazing throughout the day (which may reflect an overall tendency towards disinhibited eating) and therefore present with *less* restrictive eating behaviors. This lack of restrictive behaviors can clarify why individuals with BN who eat more small meals or low calorie meals, also report less frequent binge eating episodes.

To our knowledge, this is the first study to investigate specific behaviors of self-reported dietary restriction among individuals with AN-BE/P, BN, and BED. A strength of the study is that individuals included in the sample had diagnoses spanning the eating disorder diagnostic spectrum (i.e., AN-BE/P, BN, and BED). This diagnostic heterogeneity in a large sample facilitated comparisons within and across diagnoses. In addition, the fact that the data were collected from five separate treatment sites in different geographic locations may also enhance the generalizability of these findings. Several limitations should be noted. First, the use of cross-sectional data for this particular study (in contrast to EMA and longitudinal designs) did not inform the temporal order of dietary restriction behaviors and binge eating behaviors. Second, our study focused on the behavioral rather than cognitive aspects of dietary restriction (e.g., the intention to diet or the desire to restrict). Therefore we did not test the possibility that in certain cases (e.g., in BED) these cognitive aspects of dietary restraint played a role by impacting frequency of binge eating behaviors among our study groups. Additionally, our study did not assess for other factors unrelated to restriction (e.g., negative affect) that may lead to binge eating. Furthermore, height, weight, dietary behaviors and binge eating episodes were assessed by self-report questionnaire which does not address the possibility of participants providing inaccurate data by over- or under-reporting, although some studies suggest that individuals with eating disorder symptoms may provide accurate

self-reported height, weight (Gorber, Tremblay, Moher, & Gorber, 2007) and food intake data (Schebendach, Porter, Wolper, Timothy Walsh, & Mayer, 2012; Shah, Passi, Bryson, & Agras, 2005; van der SterWallin, Norring, Lennernas, & Holmgren, 1995).

These findings may inform future treatment development in several ways. The trans-diagnostic model of treatment for eating disorders that is based on cognitive behavior therapy (Fairburn, 2008) suggests that dietary restriction needs to be addressed in order to achieve successful outcomes (i.e. reduction in binge eating behaviors). Our findings suggest that clinicians should assess specific dietary restriction behaviors at the start of treatment prior to assuming that all forms of strict dieting and weight control behaviors impact binge eating. This assessment could help clinicians to identify strengths and areas of opportunity and to build the most effective treatment plan. For patients who are eating meals infrequently, instituting a regular meal pattern may be an effective initial intervention (Fairburn, 2008). For patients who tend to control their dietary intake by eating small meals or low calorie meals, it may be that other dietary restriction behaviors are related to increases in binge eating. In any case, additional factors including negative affect, perceived stress, and low self-esteem should always be considered as potential contributors to binge eating.

In order to better understand the role of dietary restriction behaviors in the development and maintenance of binge eating across diagnoses, future work should look at additional variables such as personality and environmental factors that may be associated with increases in binge eating. In addition, future research should focus on longitudinal designs in order to better understand the temporal order of dietary restriction behaviors and binge eating, as well as how these behaviors may change with time and with treatment.

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Table 1
Demographic variables, dietary behaviors and eating-related symptoms among individuals with AN-BE/P, BN and BED.

Variable	AN (n = 62)	BN (n = 504)	BED (n = 279)	Test statistics
Demographic				
Age	30.08(12.5) ^{ab}	29.27(10.07) ^a	32.58(11.23) ^b	F(2,843) = 8.69, <i>p</i> < 0.001
Female, % (n)	96.8(60) ^a	94.2(475) ^a	89.6(250) ^b	$\chi^2 = 2.08$, <i>p</i> < 0.05
Caucasian, % (n)	87.1(54)	85.1(429)	87.1(243)	$\chi^2 = 0.66$, <i>p</i> < 0.05
BMI	16.28(0.94) ^a	23.94(6.97) ^b	36.66(11.80) ^c	F(2,843) = 247.76, <i>p</i> < 0.001
Eating Related Symptoms				
Fasting [/]	2.78(2.26) ^a	2.62(2.15) ^a	1.60(1.39) ^b	F(2,843) = 26.08, <i>p</i> < 0.001
Skipping Meals [/]	5.71(2.41) ^a	4.87(2.53) ^b	3.39(2.44) ^c	F(2,843) = 38.99, <i>p</i> < 0.001
Meals per Day	1.50(0.99) ^a	1.77(0.97) ^a	2.33(0.78) ^b	F(2,843) = 41.09, <i>p</i> < 0.001
Very Small Meals [/]	5.46(2.61) ^a	4.75(2.45) ^a	3.28(2.39) ^b	F(2,843) = 38.87, <i>p</i> < 0.001
Low Calorie Meals [/]	5.41(2.71) ^a	5.17(2.49) ^a	3.75(2.39) ^b	F(2,843) = 31.20, <i>p</i> < 0.001
Binge Eating [/]	6.02(1.33) ^a	6.68(1.25) ^b	6.09(1.08) ^a	F(2,843) = 25.56, <i>p</i> < 0.001

[/] Refers to the past month only. Range = 1 to 8 (1 = never; 2 = once a month or less; 3 = several times a month; 4 = once a week; 5 = twice a week; 6 = three to six times a week; 7 = once a day; 8 = more than once a day). Note: Differing letters indicate significant differences.

Table 2
Correlations between Dietary Restriction Behaviors and Binge Eating in the Last Month among AN-BE/P, BN and BED.

	1		2		3		4		5		6																		
	AN- BE/ P (n = 62)	BN (n = 504)	AN- BE/P (n = 62)	AN- BE/P (n = 62)	AN- BE/P (n = 62)	BN (n = 504)	BN (n = 504)	AN- BE/P (n = 62)	AN- BE/P (n = 62)	BN (n = 504)	BN (n = 504)	AN- BE/P (n = 62)	Total Sample (n = 845)	Total Sample (n = 845)	BED (n = 279)	BED (n = 279)	BN (n = 504)	BN (n = 504)	AN- BE/P (n = 62)	Total Sample (n = 845)	Total Sample (n = 845)	BED (n = 279)	BED (n = 279)	BN (n = 504)	BN (n = 504)	AN- BE/P (n = 62)	Total Sample (n = 845)	Total Sample (n = 845)	
1. Fasting	-	-	-	.420***	.486***	.393***	.490***	-.503***	-.371***	-.314***	-.009	.247***	.377***	.304***	-.051	.116*	.287***	.196***	.107	-.007	-.002	.049							
2. Skipping Meals	-	-	-	-	-	-	-	-.611***	-.456***	-.397***	.227	.413***	.384***	.446***	.081	.238***	.268***	.296***	.234	-.037	-.022	.031							
3. Meals Per Day	-	-	-	-	-	-	-	-	-	-	.059	-.109*	-.179**	-.194***	.201	.034	.032	-.036	-.295*	-.135**	-.041	-.163***							
4. Very Small Meals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.610***	.650***	.648***	.673***	-.101	-.187***	-.082	-.091**							
5. Low Calorie Meals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-.101	-.187***	-.092	-.093**							
6. Binge Eating Episodes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* $p < 0.05$,
** $p < 0.01$,
*** $p < 0.001$, Range = 1 to 8 (1 = never; 2 = once a month or less; 3 = several times a month; 4 = once a week; 5 = twice a week; 6 = three to six times a week; 7 = once a day; 8 = more than once a day).