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To Skip or Not to Skip? Varying definitions of breakfast skipping and associations with disordered eating, obesity, and depression

by

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Abstract

Objective: Much of the previous research on breakfast skipping and its associations with disordered eating, obesity, and depression has been limited by the use of different definitions "breakfast skipping." The present study examines breakfast skipping and its associations with these negative health correlates in the Add Health Wave III sample of adolescents and young adults using all the definitions of breakfast skipping employed by the literature within a seven-day timeframe. **Method:** The Wave III sample of Add Health is comprised of 15,197 participants; all those who responded to the breakfast consumption question were included in some portion of the data analysis. The three definitions of breakfast skipping employed in this study were missing breakfast at least once, at least four times, or at least six times during the past seven days. **Results:** Statistically significant gender differences were found in breakfast skipping frequency in two of three definitions; however, small effect sizes call into question the clinical significance of these differences. The two stricter definitions of breakfast skipping were also associated with purging in women and depression in men and women. Obesity was associated with breakfast skipping in all cases. **Conclusion:** These findings suggest that stricter definitions of breakfast skipping are more useful in identifying populations susceptible to these negative health behaviors. They also indicate the need to regularize meal patterns as a means of combating obesity.

Introduction

Objectives

This thesis examines the prevalence of breakfast skipping among adolescents and young adults as a function of differing operational definitions of breakfast skipping, as well as the relationship between varying definitions of breakfast skipping and disordered eating, obesity, and depression. First, I explore how applying different operational definitions of breakfast skipping change the incidence of breakfast skipping within the sample. Second, the study investigates the differences between breakfast skippers and consumers on a number of measures of disordered eating including binge eating and purging. Third, it also investigates breakfast skipping among obese versus non-obese individuals. Lastly, this thesis explores the relationship between breakfast consumption and depressed mood. All analyses are conducted separately by gender and key study variables are tested for gender differences.

Literature Review

The extant research on breakfast consumption shows a myriad of benefits associated with regular breakfast eating. A recent review examining the breakfast consumption literature found evidence suggesting breakfast eaters had lower body mass index (BMI), improved academic performance, and superior nutritional profiles compared to their breakfast skipping peers (Rampersaud, Pereira, Girard, Adams, & Metzl, 2005). Although not all breakfast research yields consistent results, especially concerning BMI (Rampersaud et al., 2005), general consensus exists that eating

breakfast is an integral part of a healthy diet and lifestyle, particularly in children and adolescents.

Breakfast skipping has significantly increased among young people over the past thirty years, and children and adolescents are more likely to skip breakfast than any other meal (e.g., Siega-Riz, Popkin, & Carson, 1998). Breakfast skipping is more prevalent in girls than boys (e.g., Keski-Rahkonen, Kaprio, Rissanen, Virkkunen, & Rose, 2003; Shaw, 1998; Videon & Manning, 2003) and its occurrence increases from childhood through adolescence, with older children and adolescents being more likely to skip breakfast (e.g, Pearson, Biddle, & Gorely, 2009; Shaw, 1998). Data from the National Longitudinal Study of Adolescent Health (Add Health) show a decrease in breakfast consumption between Wave II and Wave III of data collection (Niemeier, Raynor, Lloyd-Richardson, Rogers, & Wing, 2006), indicating that a decrease in breakfast consumption over time occurred in the participants of the present study, mirroring the trend found in other samples.

Breakfast skipping has been associated with higher BMI and overweight status in some but not all studies. The first longitudinal study to examine breakfast skipping and weight change in adolescents found cross-sectionally that children who skipped breakfast were more likely to be overweight (Berkey, Rockett, Gillman, Field, & Colditz, 2003). However, over the course of a year, overweight children who never ate breakfast experienced a decrease in BMI compared to overweight children who ate breakfast nearly every day. Interestingly, the opposite result occurred in normal weight children: children of normal weight who never ate breakfast gained weight compared to their peers who ate breakfast every day (Berkey et al., 2003).

Keski-Rahkonen and colleagues (2003) found cross-sectional associations between breakfast skipping and high BMI in adolescents, and Nicklas, Baranowski, Cullen, and Berenson (2001) found that adolescents with a consistent meal pattern of three meals a day were leaner. Adult samples have also revealed a relationship between regular breakfast consumption and decreased BMI, even among patients suffering from binge eating disorder (BED) (Masheb & Grilo, 2006; Wyatt et al., 2002).

Obesity is widespread in the United States today, and much like breakfast skipping, its occurrence has increased over the past few decades among all age groups. Nicklas et al.'s (2001) review paper examining energy intake in children from 1973 through 1994 suggests that changes in specific eating patterns, such as meal skipping, may explain the increase in adiposity among children. Using Add Health data, Gordon-Larsen, Adair, Nelson, and Popkin (2004) found an increased proportion of overweight and obese respondents from Wave II to Wave III. The significant increase in obese Add Health participants exemplifies the nationwide problem of obesity, and also provides a basis for examining obesity in association with breakfast skipping, which, as previously mentioned, has also increased over time.

Why do adolescents choose to eat or skip breakfast? Several reasons for breakfast skipping in adolescents have been suggested, and many environmental factors associated with breakfast consumption have been identified. Common reasons to skip breakfast given by adolescents are lack of time, lack of hunger, and dieting to lose weight (Shaw, 1998). An important factor in breakfast consumption in adolescents is parental presence and influence at mealtime: one study found that parental breakfast eating was the factor most significantly associated with adolescent

breakfast eating, and that children of breakfast skippers had higher BMIs, suggesting transmission of breakfast skipping and correlated behaviors from parent to child (Keski-Rahkonen et al., 2003). In a study using Add Health Wave I data, parental presence at the evening meal was correlated with a decreased risk of skipping breakfast, and adolescents whose parents made decisions for them as to what they ate were significantly less likely to skip breakfast. Autonomy was a significant risk factor for breakfast skipping: adolescents who made their own decisions about what to eat were 25% more likely to skip breakfast (Videon & Manning, 2003).

However, a later cross-sectional study examining genetic and environmental factors in breakfast eating patterns among 16-year-old Finnish twins found no significant effect of parental breakfast eating on child behavior. Instead, researchers found significant family environmental effects on child breakfast eating in both sexes. These results suggest that other types of parental effects may be present in determining child breakfast eating. Girls were found to be more influenced by the family environment than boys, with environmental influences possibly overriding genetically driven factors. In particular, disruption of family meal patterns may induce breakfast skipping in both sexes (Keski-Rahkonen, Viken, Kaprio, Rissanen, & Rose, 2004). Additionally, Franko, Thompson, Bauserman, Affenito, and Striegel-Moore (2008) found that “family cohesion” was associated with higher rates of breakfast consumption, further suggesting a complex interplay between family environment and breakfast consumption rather than a straightforward relationship between, for example, parental and thus child breakfast eating or skipping. Pearson and colleagues (2009) provided a thorough and systematic review of the family

correlates of breakfast consumption among children and adolescents. Broadly, the review found that parental eating habits were positively correlated with both healthy and unhealthy child eating habits.

In multiple studies, breakfast skipping has been associated with dieting, concerns about body weight, and body shape dissatisfaction (e.g., Barker, Robinson, Wilman, & Barker (2000); Shaw (1998); see Rampersaud et al. (2005) for review), suggesting that adolescents may skip breakfast to reduce daily caloric intake. Thus, adolescents who perceive their body weight as too high or are concerned with their weight may be more likely to skip breakfast. Fernandez-Aranda and colleagues (2007), using retrospective recall of childhood eating attitudes and behaviors, found that participants who reported eating breakfast during childhood and early adolescence were significantly less likely to have developed an eating disorder, specifically bulimia nervosa or eating disorder not otherwise specified (EDNOS). It should be noted that these findings were obtained using a newly developed instrument, were based on recall of early eating patterns, and have yet to be replicated using longitudinal data. Keski-Rahkonen et al. (2004) note that diet-related breakfast skipping may be at the "milder end of the continuum" (p. 504) spanning slightly disordered eating behaviors to clinically severe eating disorders.

Thus, breakfast skipping—particularly among adolescent girls who are either dieting or concerned with their weight—is a potential warning sign for the development of disordered eating behavior, which can lead to severe health consequences including eating disorders, weight gain/obesity, and depressive symptoms (Neumark-Sztainer, Eisenberg, Fulkerson, Story, & Larson, 2008). Past

studies have established correlations between disordered eating and overweight status and depression (Neumark-Sztainer & Hannan, 2000), and not regularly eating three meals a day has been positively correlated with the occurrence of an eating disorder in adolescents (Fernandez-Aranda et al., 2007). In one study, adolescents who reported objective overeating in the past year were more likely to be overweight or obese, to have dieted in the past year, to be currently trying to lose weight, and to report weight and shape as very important to their overall feelings about themselves (Ackard, Neumark-Sztainer, Story, & Perry, 2003). In the same study, youth meeting study criteria for BED scored significantly lower on measures of body satisfaction, and scored higher on measures of depressed mood, than subclinical or non-binge eating youth (Ackard et al., 2003). Several studies have indicated that breakfast skipping is associated with body dissatisfaction, disordered eating, and negative health outcomes such as eating disorders, obesity and depression; however, these studies have not evaluated all of these factors as simultaneous correlates of breakfast skipping within a given sample. Such an analysis will help to elucidate more comprehensively what role breakfast skipping plays in the relationship between disordered eating behavior and its health outcomes.

A major limitation of the literature on breakfast skipping and its correlates, causes, and consequences lies in the absence of a commonly agreed upon definition of breakfast skipping; this problem is illustrated in Table 1, which reviews publications from the past four decades that explicitly define breakfast skippers versus non-skippers. Table 1 shows six different definitions of breakfast skipping based within four varying timeframes of seven days/one week, three days, one day/24

hours, and "usual" breakfast eating habits. Within the seven-day category, three distinct definitions were used, ranging from skipping breakfast one time or more in the past seven days (e.g., Dubois, Girard, Potvin Kent, Farmer, & Tatone-Tokuda, 2009) to skipping breakfast at least six out of the past seven days (e.g., Timlin, Pereira, Story, & Neumark-Sztainer, 2008). As can be seen from these two different definitions, there is clearly great variability across studies in what constitutes breakfast skipping.

Table 1: *Definitions of breakfast skipping used in the literature*

Timeframe	Definitions	Studies Using Definitions
7 Days / 1 Week	Missed breakfast at least 1x/week	Steele et al., 1952 Sjoberg et al., 2003 Dubois et al., 2008
	Missed breakfast at least 4x/week	Pastore et al., 1996
	Missed breakfast at least 6x/week	Keski-Rahkonen et al., 2003 Keski-Rahkonen et al., 2004 Timlin et al., 2008 Cheng et al., 2008
3 days	Ate breakfast less than or equal to 1 day out of the 3 day reporting period	Morgan et al., 1986
1 Day / 24 Hours	Missed breakfast on day of survey, 24-h food recall, or food record	Hanes et al., 1984 Skinner et al., 1985 Nicklas et al., 1993 Wolfe & Campbell, 1993 Wolfe et al., 1994 Sampson et al., 1995 Siega-Riz et al., 1998 Nicklas et al., 2000 Dwyer et al., 2001 Serra-Majem et al., 2002 Molcho et al., 2007
"Usual Breakfast Habits"	Usually skip breakfast, or never or almost never eat breakfast	Resnicow, 1991 Shaw, 1998 O'Dea & Caputi, 2001 Boutelle et al., 2002 Kovarova et al., 2002 Berkey et al., 2003 Videon & Manning, 2003

Table 1: *continued*.

	DeJong et al., 2009 Moore, Moore, & Murphy 2009

A consistent definition within the field is integral to meaningful discussion, mutual understanding and comparability across studies. Without using the same definition within a given timeframe, participants classified as "skippers" can represent virtual extremes of the breakfast consumption spectrum despite sharing the same label. It is possible that the lack of consensus on how to define breakfast skipping is obscuring analogous results while simultaneously rendering potentially informative data incomparable due to simple yet key methodological differences.

To that end, this study examines how applying the varying definitions of breakfast skipping changes the prevalence of "breakfast skippers" within the sample. It also examines group differences between skippers and non-skippers along several forms of disordered eating behavior, obesity, and depression. How common is breakfast skipping when using varying definitions? Does the previous finding that breakfast skipping is more common in women than men always hold true, or only when certain definitions are applied? Is breakfast skipping associated with symptoms of disordered eating behavior or having an eating disorder? Is it associated with obesity or depression? These are the questions that the present study seeks to answer.

Methods

Participants

Data for this study were drawn from Wave III of the National Longitudinal Study of Adolescent Health (Add Health), which was collected between August 2001 and April 2002. Wave III consisted of 15,197 Wave I respondents who could be located and consented to be re-interviewed. At Wave III, respondents were between 18 and 26 years old.

Add Health is a nationally representative, probability-based survey that examines a broad range of health-related attitudes and behaviors of American adolescents. Wave I was conducted between September 1994 and April 1995 and included 20,745 students in grades 7-12 at that time. A systematic random sample of high schools and "feeder schools" was selected proportional to enrollment size and was subsequently representatively stratified by geographic region, urbanicity, school type, and ethnicity. Overall, there were 132 schools from 80 communities in the core study.

Add Health is a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add

Health data files is available on the Add Health website (http://www.cpc.unc.edu/addhealth). No direct support was received from grant P01-HD31921 for this analysis.

Procedure

The Wave III in-home interview was designed to obtain relationship, marital, childbearing, and educational histories. Some questions remained unchanged from previous waves, while new sections were added to focus on topics more relevant to young adults. The average length of a complete interview was 134 minutes.

During the in-home survey, an interviewer read the questions aloud and recorded the respondent's answers using a laptop computer-assisted personal interview system. Portions of the interview containing sensitive information were administered with an audio computer-assisted self-interview (ACASI), allowing the participants to enter their responses directly into the computer.

Measures

Only items relevant to the present study are described. Age, race, and ethnic background were measured based on self-report. Because Add Health separates Hispanic ethnicity from other racial categories, race was measured separately but not exclusively of Hispanic status. Racial category was based on the question, "What is your race? You may give more than one answer." If a participant gave more than one answer, they were asked the follow-up question of "Which one category best describes your racial background?" Thus, participants identifying with multiple racial groups were categorized based on self-identified preference. Body Mass Index (BMI) was calculated using self-reported height and weight. Participant status as

obese or non-obese was determined using BMI; those with BMIs greater than or equal to 30 lb/in^2 were considered obese.

Breakfast eating was measured by the question, "On how many of the past seven days did you eat breakfast—that is, a meal within an hour of getting up?" with responses ranging from zero to seven days. In the present study, three definitions of breakfast skipping were created in keeping with those used in prior studies examining breakfast skipping behavior within a seven-day timeframe: Missing breakfast at least once, at least four times, or at least six times in the past seven days.

Add Health did not measure binge eating based on the DSM-IV definitions of either overeating or loss of control over the eating episode. The DSM-IV defines overeating as "eating, within a discrete period of time…an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances," and loss of control over the eating episode as "a sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating)" (American Psychiatric Association, 2000, p. 787). However, in Add Health, participants were asked the following two questions, the first assessing objective overeating and the second loss of control over the eating episode: "In the past seven days, have you eaten so much in a short period that you would have been embarrassed if others had seen you do it?" ("embarrassment"), and "In the past seven days, have you been afraid to start eating because you thought you wouldn't be able to stop or control your eating?" ("loss of control") (Bennett & Dodge, 2007). Using these two items we created a proxy

variable for binge eating, defining the behavior by requiring the presence of both "embarrassment" and "loss of control" in relation to the eating episode.

Three items measured purging compensatory behaviors, using binary response options. Specifically, participants were asked if they had engaged in vomiting, taken laxatives, or used diuretics in order to lose weight or stay the same weight in the past seven days. For the present study, because of the low prevalence of these behaviors (e.g., only 27 of over 15,000 participants vomited as measure of weight control) we created a binary variable of "any purging behavior" by assigning a score of 1 if participants answered "yes" to at least one of these three items and a score of 0 if they answered "no" to all three items. The Add Health interview also included a question asking participants whether they had "Ever been told by a doctor that you have an eating disorder, such as anorexia nervosa or bulimia," which we refer to as "Ever diagnosed with (an) ED."

The depression measure in Add Health is based on a shortened version of the Center for Epidemiological Studies-Depression Scale (CES-D) (Costello, Swendsen, Rose, & Dierker, 2008). The present study determined depressed mood using three items drawn from the Depressed Affect scale of the CES-D: how often in the past week participants a.) felt sad; b.) felt depressed; and c.) felt like they could not shake off the blues (Radloff, 1977). Responses to these three questions ranged from never or rarely (score = 0) to most of the time or all of the time (score = 3). The responses to each item were summed, creating a composite score ranging from 0-9 for each participant. Use of this three-item measure of depressed mood in Add Health has been previously validated (see Costello et al., 2008).

Statistical Analysis

All statistical analyses were conducted using SPSS 17.0. Descriptive statistics were calculated to describe the sample. Chi-square analyses were conducted to determine the associations between breakfast skipping and the disordered eating behavior variables of interest. Gender differences were examined using chi-square analyses for categorical variables and *t*-tests for continuous variables. Independent sample *t*-tests were used to test for the difference between mean days of breakfast consumption and the disordered eating behavior measures, as well as breakfast eater status and depression. Pearson correlations were used to examine the relationship between BMI and breakfast eating status, as well as depressed mood and number of days of breakfast consumption. Linear regressions were calculated to determine the variance in number of days of breakfast consumption explained by depressed mood.

Effect sizes were calculated for all statistically significant results at the $p \leq .05$ level; Cohen's *d* was calculated for significant *t*-test results and Number Needed to Treat (NNT) analyses were calculated for significant chi-square results; NNT was employed because it takes into account the base rates of each condition of interest (Kraemer & Kupfer, 2006; Striegel-Moore et al., 2009). NNT was originally developed to help assess the efficacy of one treatment compared to another; however, in the current study NNT seeks to answer the question, "How many women do you have to see to find one more 'failure' (e.g., one more women who [purges]) than if you had sampled men?" (Striegel-Moore et al., 2009, p. 473). For example, in the case of the analyses of obesity among breakfast skippers, an NNT of 15 would indicate that for every 15 participants who skip breakfast, 14 are just as likely to be

obese as not, and only one is more likely to be obese than not obese. An NNT greater than 9 is considered a weak effect, between 4 and 9 a moderate effect, and less than 4 a strong effect. Statistical analyses examining the correlates of breakfast skipping were done separately by gender due to the well-established gender differences in the prevalence and correlates of disordered eating behaviors (Anderson & Bulik, 2004; Striegel-Moore, et al., 2009).

Results

Demographics

The overall sample was comprised of 47% men and 53% women, with a mean age of 22 years. Approximately 16% of the sample self-identified as Hispanic, and the majority of respondents identified their primary race as White (65%). However, other racial/ethnic groups were oversampled to comprise more of the Add Health sample population than their prevalence in the United States (U.S.) (see Table 2).

Table 2: *Add Health Wave III Sample Demographic Characteristics*

Characteristic	Total Sample	Men	Women
N	15,197	47.2% (7,167)	52.8% (8,030)
Age: mean (SD)	21.96 (1.78)	22.06 (1.78)	21.86 (1.77)
Hispanic (n)	16.3% (2,477)	17.1% (1,226)	15.6% (1,251)
Race (n)			
White	64.8% (9,845)	65.4% (4,687)	64.2% (5,158)
Black/African-American	22.6% (3,429)	20.8% (1,494)	24.1% (1,935)
Asian/Pacific Islander	7.8% (1,184)	8.5% (612)	7.1% (572)
Native American	3.2% (489)	3.5% (253)	2.9% (236)

Descriptive Sample Characteristics and Gender Differences for Relevant Study Variables

Respondents ate breakfast a mean of three out of the past seven days. Roughly 75% of the sample was classified as breakfast skippers using the definition of missing breakfast at least one time in the past week, 60% when missing at least four times in the past week, and 40% when missing at least six times in the past week. Overall very few participants exhibited disordered eating behaviors, with feelings of embarrassment associated with binge eating being the most common (6%) and purging being the least commonly reported (0.7%). Just over 2% of the sample had been told by a doctor that they had an eating disorder. Slightly more than 20% of the sample was obese; the sample mean was BMI = 27 lb/in^2 (see Table 3 for all relevant sample characteristics).

Table 3: *Sample characteristics for relevant variables*

Characteristic	Total Sample	Men	Women	Test Statistic; Effect Size
How many of past seven days ate breakfast (n)				
0	29.2% (4,432)	29.1% (2,085)	29.2% (2,347)	
1	9.3% (1,419)	9.6% (689)	9.1% (730)	
2	11.4% (1,727)	11.8% (844)	11.0% (883)	
3	9.0% (1,364)	9.8% (699)	8.3% (665)	
4	7.0% (1,086)	7.6% (542)	6.6% (526)	
5	7.4% (1,119)	7.4% (528)	7.4% (591)	
6	3.2% (494)	3.5% (248)	3.1% (246)	
7	23.5% (3,571)	21.3% (1,530)	25.4% (2,041)	
Mean days ate breakfast (SD)	3.10 (3.05)	3.02 (3.12)	3.16 (2.98)	$t(15195) = -2.83$, $p = .005$; $d = .046$
Missed at least 1x/past week (n)	76.5% (11,632)	78.6% (5,635)	74.6% (5,988)	$\chi^2(1) = 34.83$, $p < .001$; NNT = 24
Missed at least 4x/past week (n)	58.8% (8,942)	60.2% (4,317)	57.6% (4,625)	$\chi^2(1) = 10.88$, $p = .001$; NNT = 37

Table 3: *continued.*

Missed at least 6x/past week (n)	38.5% (5,851)	38.7% (2,774)	38.3% (3,077)	$\chi^2(1) = .24$, $p = .625$
Binge Eating (n)	1.0% (156)	0.6% (44)	1.4% (112)	$\chi^2(1) = 22.74$, $p < .001$; NNT = 128
Embarrassment (n)	6.3% (957)	5.3% (382)	7.2% (575)	$\chi^2(1) = 21.59$, $p < .001$; NNT = 55
Loss of Control (n)	2.4% (360)	1.5% (105)	3.2% (255)	$\chi^2(1) = 47.98$, $p < .001$; NNT = 59
Any Purging[1] (n)	0.7% (112)	0.2% (16)	1.2% (96)	$\chi^2(1) = 21.00$, $p < .001$; NNT = 73
Vomiting	0.2% (27)	0.1% (4)	0.3% (23)	
Diuretics	0.4% (55)	0.1% (9)	0.6% (46)	
Laxatives	0.3% (45)	0.1% (6)	0.5% (39)	
Ever diagnosed with ED (n)	2.1% (318)	0.4% (27)	3.6% (291)	$\chi^2(1) = 195.07$, $p < .001$; NNT = 31
Mean BMI (SD)	26.70 (9.44)	26.82 (9.51)	26.59 (9.38)	$t(14402) = 1.47$, $p = .142$
Obese (n)	21.3% (3,232)	20.2% (1,446)	22.2% (1,786)	$\chi^2(1) = 12.23$, $p < .001$; NNT = 42
Mean depressed mood score (SD)	1.20 (1.71)	1.00 (1.54)	1.37 (1.84)	$t(15157) = -13.34$, $p < .001$; $d = .224$

Respondents differed significantly on most sample characteristic measures. Women consumed breakfast significantly more frequently than men ($p = .005$); however, a Cohen's *d* of .05 indicates an extremely small effect size. Significant gender differences were found in the prevalence of breakfast skipping by the varying definitions of skipping. Significantly more men than women skipped breakfast when the behavior was defined as missing breakfast at least one time in past week ($p < .001$) and at least four times in the past week ($p = .001$). NNT effect sizes were small

[1] Note: Gender differences on individual measures not tested because of small cell size in men.

(NNT = 24; NNT = 37), indicating that these sex differences are mostly negligible and likely due to the large sample size. For the most stringent definition of breakfast skipping, skipping at least six times in the past week, there was no difference in prevalence of breakfast skipping between men and women ($p = .625$).

Men and women differed significantly on all measures of disordered eating at the $p < .001$ level, with women being more likely to exhibit the disordered eating characteristics in all cases. Women were significantly more likely than men to have been diagnosed with an eating disorder ($p < .001$) and were also significantly more likely to be obese ($p < .001$). For all disordered eating indicators, as well as obesity, NNT effect sizes were very small, suggesting few true differences between men and women on these measures. Women had significantly elevated mean depressed mood scores compared to men ($p < .001$); however, a Cohen's *d* of .22 shows only a small effect size in the difference between genders. No significant gender differences were found for BMI.

Correlates of Breakfast Skipping in Men

For male participants, regardless of the disordered eating behavior, no difference was found between those with or without symptoms on the mean number of days they ate breakfast (see Table 4).

Table 4: *Mean number of days with breakfast as a function of disordered eating for male participants*

Disordered Eating Symptom	Mean days of breakfast consumption		Test Statistic
	Symptom Present	Symptom Absent	
Binge Eating (n; SD)	3.23 (44; 2.56)	3.01 (7,119; 2.91)	$t(7161) = -.496$; $p = .620$
Embarrassment (n; SD)	3.06 (382; 2.70)	3.01 (6,779; 2.92)	$t(7159) = -.342$; $p = .732$
Loss of Control (n; SD)	2.92 (105; 2.59)	3.01 (7,054; 2.92)	$t(7157) = .301$; $p = .763$
Purging (n; SD)	3.31 (16; 2.68)	2.96 (2,545; 3.27)	$t(2559) = -.437$; $p = .662$

There were no differences in breakfast skipping frequency between men who exhibited disordered eating and men who did not, regardless of the definition of breakfast skipping (see Table 5).

Table 5: *Percent of male participants skipping breakfast as a function of disordered eating behavior symptoms and skipping definition*

Disordered Eating Symptom	Definition of Breakfast Skipping	Symptom Present	Symptom Absent	Test Statistic
Binge Eating (n)	Missed ≥ 1x/past week	79.5% (35)	78.7% (5,599)	$\chi^2(1) = .02$, $p = .886$
	Missed ≥ 4x/past week	59.1% (26)	60.3% (4,290)	$\chi^2(1) = .03$, $p = .874$
	Missed ≥ 6x/past week	27.3% (12)	38.8% (2,762)	$\chi^2(1) = 2.45$, $p = .118$
Embarrassment (n)	Missed ≥ 1x/past week	78.5% (300)	78.7% (5,331)	$\chi^2(1) = .003$, $p = .957$
	Missed ≥ 4x/past week	59.9% (229)	60.3% (4,085)	$\chi^2(1) = .012$, $p = .904$
	Missed ≥ 6x/past week	37.2% (142)	38.8% (2,631)	$\chi^2(1) = .41$, $p = .522$
Loss of Control (n)	Missed ≥ 1x/past week	81.9% (86)	78.6% (5,547)	$\chi^2(1) = .66$, $p = .418$
	Missed ≥ 4x/past week	62.9% (66)	60.2% (4,249)	$\chi^2(1) = .30$, $p = .586$
	Missed ≥ 6x/past week	36.2% (38)	38.8% (2,735)	$\chi^2(1) = .29$, $p = .590$
Purging (n)	Missed ≥ 1x/past week	75.0% (12)	79.6% (2,024)	$\chi^2(1) = .203$, $p = .650$
	Missed ≥ 4x/past week	62.5% (10)	62.2% (1,583)	$\chi^2(1) = .001$, $p = .980$
	Missed ≥ 6x/past week	31.3% (5)	39.3% (1,000)	$\chi^2(1) = .43$, $p = .511$
Ever diagnosed with ED (n)	Missed ≥ 1x/past week	85.2% (23)	78.7% (5,610)	$\chi^2(1) = .68$, $p = .409$
	Missed ≥ 4x/past week	63.0% (17)	60.2% (4,298)	$\chi^2(1) = .08$, $p = .773$
	Missed ≥ 6x/past week	29.6% (8)	38.8% (2,765)	$\chi^2(1) = .95$, $p = .331$

Table 6 shows the prevalence of breakfast skipping in obese versus non-obese men by the varying definitions of breakfast skipping. Obese participants were significantly more likely to skip breakfast when every definition of breakfast skipping was employed ($p < .001$ in all cases). NNT calculations showed relatively small effect sizes of obesity status within breakfast skippers.

Table 6: *Percent of male participants skipping breakfast as a function of skipping definition and weight classification*

Breakfast Skipping Definition	Participant Weight Classification		Test Statistic; NNT
	Obese	Non-Obese	
Missed at least 1x/past week (n)	83.3% (1,204)	77.6% (4,183)	$\chi^2(1) = 21.98$, $p < .001$; NNT = 18
Missed at least 4x/past week (n)	67.7% (979)	58.5% (3,150)	$\chi^2(1) = 40.70$, $p < .001$; NNT = 11
Missed at least 6x/past week (n)	45.9% (663)	37.1% (1,997)	$\chi^2(1) = 37.03$, $p < .001$; NNT = 12

Table 7 shows the relationship between depressed mood and disordered eating for male participants, with depressed mood scores being significantly higher among those with binge eating or purging (binge eating, $p < .001$; purging, $p = .039$). Depression and number of days male participants ate breakfast were negatively correlated at the $p < .001$ level; however, the correlation coefficient of $r = -.053$ signifies a very weak correlation where depression explained only .3% of the variance in the number of days men ate breakfast. The definitions of skipping breakfast at least four times and at least six times in the past week were significantly associated with an increased depressed mood score ($p < .001$; $p = .001$). However, these relationships produced small Cohen's *d* effect sizes of .14 and .08, respectively. The

association between depressed mood and skipper status was not significant when breakfast skipping was defined as skipping at least once in the past week.

Table 7: *Male depressed mood scores as a function of disordered eating behavior symptoms and definition of breakfast skipping*

Eating Behavior	Mean Depressed Mood Score (n; SD)		Test Statistic; Cohen's *d*
	Behavior Present	Behavior Absent	
Binge Eating	2.36 (44; 1.84)	.99 (7,101; 1.54)	$F(1, 7134) = 34.56$, $p < .001$
Purging	1.81 (16; 1.72)	1.00 (2,537; 1.56)	$F(1, 2251) = 4.29$, $p = .039$
Missed ≥ 1x/past week	1.02 (5,625; 1.56)	.91 (1,522; 1.48)	$t(7145) = -2.52$, $p = .120$
Missed ≥ 4x/past week	1.08 (4,308; 1.63)	.88 (2,839; 1.40)	$t(7145) = -5.40$, $p < .001$; $d = .138$
Missed ≥ 6x/past week	1.08 (2,765; 1.65)	.96 (4,382; 1.47)	$t(7145) = -3.21$, $p = .001$; $d = .076$

Correlates of Breakfast Skipping in Women

For female participants, the only significant difference in mean number of days of breakfast consumption was found between those who engaged in purging behaviors and those who did not, with women who purged having a significantly lower mean number of breakfast days ($p = .013$; see Table 8). However, a Cohen's *d* of .07 indicates a very small effect size of the difference between these two groups.

Table 8: *Mean number of days with breakfast as a function of disordered eating for female participants*

Disordered Eating Symptom	Mean days of breakfast consumption		Test Statistic; Cohen's *d*
	Symptom Present	Symptom Absent	
Binge Eating (n; SD)	3.05 (112; 2.83)	3.15 (7,912; 2.79)	$t(8022) = .376$, $p = .707$
Embarrassment (n; SD)	3.14 (575; 2.77)	3.15 (7,444; 2.79)	$t(8017) = .132$, $p = .895$
Loss of Control (n; SD)	2.93 (255; 2.75)	3.16 (7,762; 2.78)	$t(8015) = 1.29$, $p = .229$
Purging (n; SD)	2.47 (96; 2.73)	3.18 (4,714; 2.78)	$t(4808) = 2.48$, $p = .013$; $d = .072$

Significant differences in breakfast skipping frequency were found between those who purged and those who did not when two of the three definitions of breakfast skipping were employed (see Table 9). When breakfast skipping was defined as missing breakfast at least four times or at least six times in the past week, women who purged were significantly more likely to skip breakfast than those who did not (p = .013; p = .001). NNT effect sizes were moderate (NNT = 8; NNT = 7), indicating a possible clinically meaningful relationship between these two definitions of breakfast skipping and purging behaviors in women. The diagnosis of an eating disorder was significantly associated with a decreased percentage of breakfast skipping when breakfast skipping was defined as skipping at least one time in the past week (p = .013). In this case, the NNT showed a small effect size.

Table 9: *Percent of female participants skipping breakfast as a function of disordered eating behavior symptoms and skipping definition*

Disordered Eating Symptom	Definition of Breakfast Skipping	Symptom Present	Symptom Absent	Test Statistic; NNT
Binge Eating (n)	Missed ≥ 1x/past week	73.2% (82)	74.6% (5,904)	$\chi^2(1) = .12$, $p = .734$
	Missed ≥ 4x/past week	60.7% (68)	57.6% (4,555)	$\chi^2(1) = .45$, $p = .504$
	Missed ≥ 6x/past week	37.5% (42)	38.3% (3,033)	$\chi^2(1) = .03$, $p = .857$
Embarrassment (n)	Missed ≥ 1x/past week	74.6% (429)	74.6% (5,554)	$\chi^2(1) = .000$, $p = .999$
	Missed ≥ 4x/past week	57.6% (331)	57.6% (4,289)	$\chi^2(1) = .001$, $p = .981$
	Missed ≥ 6x/past week	38.3% (220)	38.3% (2,852)	$\chi^2(1) = .001$, $p = .980$
Loss of Control (n)	Missed ≥ 1x/past week	76.5% (195)	74.5% (5,785)	$\chi^2(1) = .49$, $p = .484$
	Missed ≥ 4x/past week	61.6% (157)	57.5% (4,464)	$\chi^2(1) = 1.66$, $p = .197$
	Missed ≥ 6x/past week	40.4% (103)	38.3% (2,970)	$\chi^2(1) = .47$, $p = .491$
Purging (n)	Missed ≥ 1x/past week	79.2% (76)	74.8% (3,527)	$\chi^2(1) = .95$, $p = .331$
	Missed ≥ 4x/past week	69.8% (67)	57.1% (2,690)	$\chi^2(1) = 6.20$, $p = .013$; NNT = 8
	Missed ≥ 6x/past week	53.1% (51)	37.3% (1,756)	$\chi^2(1) = 10.11$, $p = .001$; NNT = 7
Ever diagnosed with ED (n)	Missed ≥ 1x/past week	68.4% (199)	74.9% (5,784)	$\chi^2(1) = 6.20$, $p = .013$; NNT = 15
	Missed ≥ 4x/past week	55.7% (162)	57.7% (4,459)	$\chi^2(1) = .476$, $p = .490$
	Missed ≥ 6x/past week	40.9% (119)	38.2% (2,955)	$\chi^2(1) = .834$, $p = .361$

Table 10 shows the prevalence of breakfast skipping in obese versus non-obese female participants by the varying definitions of breakfast skipping. Obese women were significantly more likely to skip breakfast under every definition of breakfast skipping ($p < .001$ in all cases). The effect sizes for these relationships were small, with NNTs ranging from 12 to 20.

Table 10: *Percent of female participants skipping breakfast as a function of skipping definition and weight classification*

Breakfast Skipping Definition	Participant Weight Classification		Test Statistic; NNT
	Obese	Non-Obese	
Missed at least 1x/past week (n)	78.2% (1,397)	73.2% (4,235)	$\chi^2(1) = 17.91$, $p < .001$; NNT = 20
Missed at least 4x/past week (n)	63.8% (1,139)	55.4% (3,202)	$\chi^2(1) = 39.50$, $p < .001$; NNT = 12
Missed at least 6x/past week (n)	44.1% (787)	36.4% (2,104)	$\chi^2(1) = 34.18$, $p < .001$; NNT = 14

Our analyses described in Table 11 demonstrate the relationship between depressed mood and disordered eating for women in the Add Health sample, with depressed mood scores being significantly higher in those reporting binge eating or purging ($p < .001$). Depressed mood scores and number of days of breakfast consumption were negatively correlated at the $p < .001$ level; however, a correlation coefficient of only $r = -.072$ demonstrates an extremely weak relationship between these two factors, and depressed mood explained only .5% of the variance in number of days of breakfast consumption. Breakfast skipping by all definitions was significantly associated with an increased depressed mood score ($p < .001$); however, Cohen's *d*s of no more than .15 indicate small effect sizes for these associations.

Table 11: *Female depressed mood scores as a function of disordered eating behavior symptoms and definition of breakfast skipping*

Eating Behavior	Mean Depressed Mood Score (n; SD)		Test Statistic; Cohen's *d*
	Symptom Present	Symptom Absent	
Binge Eating	2.92 (112; 2.25)	1.35 (7,898; 1.82)	$F(1, 8008) = 81.41$, $p < .001$
Purging	2.48 (96; 2.58)	1.36 (4,708; 1.82)	$F(1, 4802) = 34.82$, $p < .001$
Missed ≥ 1x/past week	1.43 (5,977; 1.88)	1.21 (2,035; 1.69)	$t(8010) = -4.71$, $p < .001$; $d = .105$
Missed ≥ 4x/past week	1.49 (4,615; 1.93)	1.21 (3,397; 1.68)	$t(8010) = -6.68$, $p < .001$; $d = .149$
Missed ≥ 6x/past week	1.50 (3,071; 1.97)	1.29 (4,941; 1.74)	$t(8010) = -4.96$, $p < .001$; $d = .111$

Discussion

The most noticeable change when the criteria for breakfast skipping are altered is in the prevalence of the behavior itself. When breakfast skipping was defined most leniently as missing at least one time in the past week, over 75% of the total sample skipped breakfast, and excluding obesity, this definition was not significantly associated with any negative health behaviors in either men or women. Categorizing more than 75% of adolescents/young adults as breakfast skippers seems exaggerated in terms of both common sense and previous estimates from large studies that projected breakfast skipping at a prevalence of no more than 35% for either boys or girls (Keski-Rahkonen et al., 2004). Defining a breakfast skipper as someone who misses breakfast one or more times within a week seems to be too all-encompassing, and provides little information regarding maladaptive health behaviors. In contrast, breakfast skipper status using the other two definitions was associated with depressed

mood in both genders, as well as purging in women. These findings indicate that the two more conservative definitions of breakfast skipping are more useful and informative regarding these negative health behaviors commonly associated with breakfast skipping.

Certain results of the present study were contradictory to prior research concerning gender differences in breakfast skipping behavior. Women in the Add Health Wave III sample consumed breakfast on significantly more days than men, and men skipped breakfast more frequently than women under two of the three definitions of breakfast skipping. However, these results were effectively rendered null by the extremely small effect sizes that were found. Instead, our significant results were most likely due in part to the large sample size of Add Health rather than clinically meaningful gender differences in breakfast consumption and breakfast skipping frequency.

Multiple past studies have found that girls or women skip breakfast more frequently than boys or men (e.g., Keski-Rahkonen, et al., 2003; Shaw, 1998; Videon & Manning, 2003), but our results regarding breakfast skipping gender differences were either non-significant or contradictory to previous research. Comparability to some studies was limited because they did not define breakfast skipping within the seven-day timeframe used in Add Health, and therefore the present paper. However, other studies found that women skipped more frequently than men using a seven-day measurement period and employing the strictest definition of breakfast skipping, that is, skipping breakfast at least six times in the past week (e.g., Keski-Rahkonen, et al., 2003). Conversely, gender no difference was found in the Add Health sample.

Because the Add Health sample is extraordinarily large and is specifically designed to represent all areas and populations of the United States, our sample likely gives an accurate portrayal of breakfast skipping patterns in older adolescents and young adults in the U.S. Potentially, Add Health offers a more representative picture of overall breakfast consumption than previous studies conducted with smaller, less representative samples. Our results therefore refute the commonly held notion that women skip breakfast more frequently than men, at least when defining breakfast skipping using the seven-day timeframe.

No associations were found between the frequency of breakfast skipping under any definition and disordered eating behaviors in men, indicating that breakfast skipping is not a useful marker of disturbances in eating patterns in young men. Future studies should explore whether among men with full syndrome eating disorders breakfast skipping occurs at a higher frequency than among men who do not experience an eating disorder.

As expected, in all cases women were significantly more likely than men to present with disordered eating behaviors or the diagnosis of an eating disorder by a doctor. Effect size estimates suggest that these gender differences are small, albeit statistically significant. An association between breakfast skipping and disordered eating was confirmed in women, as women who purged were significantly more likely to be defined as breakfast skippers than women who did not report purging, when breakfast skipping was defined as missing breakfast at least four times or at least six times in the past week. This finding indicates that categorizing young women as breakfast skippers using the stricter definitions can be useful in

determining which individuals are more likely to be engaging in disordered eating practices, especially extreme weight control behaviors such as self-induced vomiting, taking laxatives, or use of diuretics.

Obesity was associated with breakfast skipping for both men and women in the Add Health sample; those who were obese were significantly more likely to meet breakfast skipper classification standards under all skipping definitions. Our research confirms previous findings of breakfast skipping as a cross-sectional correlate of obesity and/or increased BMI (e.g., Berkey, et al., 2003). Because the prevalence of overweight status does not decrease from childhood through adolescence and adulthood, there is great need for early and ongoing obesity prevention efforts (Neumark-Sztainer, Wall, Eisenberg, Story, & Hannan, 2006). The significant correlation between breakfast skipping and obesity from our study serves to highlight the importance of a regularized meal pattern component to obesity intervention and prevention programs.

Additional relationships arose between the two more conservative definitions of breakfast skipping and depression in men, with those meeting skipping criteria showing increased CES-D depressed mood scores. In women, status as a breakfast skipper was significantly correlated with higher depressed mood scores under all definitions of breakfast skipping. Though in all cases the effect sizes were small, these relationships between breakfast skipping and depressed mood warrant further investigation. It is possible that making use of all the CES-D items in Add Health, rather than using an abbreviated measure, would reveal a more sizable relationship between classfication as a breakfast skipper and increased depressed mood.

Study Limitations and Directions for Future Research

Our results need to be interpreted in light of several limitations inherent in the Add Health survey. Though the survey was designed to assess health outcomes in adolescents and young adults, its main purpose was not to assess the correlates of eating disorders and disordered eating behavior. The prevalence of disordered eating behavior in participants was extremely low in part because the survey asked only about behaviors occurring within the past week rather than over a more extended period of time. The DSM-IV diagnostic criteria for bulimia nervosa indicate that the binge eating episode and subsequent inappropriate compensatory behaviors must occur *on average* twice a week for three months. Therefore, respondents could be suffering from a clinical eating disorder yet still not meet the purging classifications based on the Add Health questionnaire. Additionally, the questions asked by Add Health and used in the current study to assess the presence of binge eating are not completely in accordance with the DSM-IV. More consistent phrasing of these items to assess the presence of objective overeating and a sense of lack of control over the eating episode would lead to a more accurate assessment and perhaps increased prevalence of binge eating responders.

An additional limitation was the measure used to determine the medical diagnosis of an eating disorder. Participants were asked if they had ever been "told by a doctor" that they had an eating disorder "such as anorexia nervosa or bulimia." Firstly, the wording of this question is problematic in that it does not ask about clinical diagnoses; secondly, it primes participants to only consider anorexia and

bulimia when thinking about whether they have ever been “told” they had an eating disorder. The question inherently decreases the likelihood that participants will report a diagnosis of binge eating disorder. Further, physical symptoms commonly associated with eating disorders such as low weight or amenorrhea are not present in many patients with BED, as most patients with BED are overweight or obese (American Psychiatric Association, 2000). This lack of stereotypical physical eating disorder symptoms possibly makes it less likely a doctor would notice the presence of an eating disorder in these individuals. Thus, it is likely that there were participants who would have met DSM-IV diagnostic criteria for BED but were not diagnosed by doctors, or, if their symptoms were discussed, did not realize they had a clinical eating disorder that should have been reported in the Add Health interview.

The scope of the present findings is limited by the cross-sectional nature of the analyses; however, given the overall longitudinal design of Add Health, future studies could conduct longitudinal analyses to study changes over time. An analysis across all four waves of Add Health data collection could provide essential information pertaining to the progression of breakfast skipping behavior across time and whether skipping leads to or co-occurs with the development of disordered eating behaviors, obesity/increased BMI, and depression. Such an analysis would also offer a chance for researchers to evaluate the at-risk periods for the development of these behaviors, as the data span early-mid adolescence through young adulthood. Analyses between Waves I and II, Waves III and IV, and Waves I and IV could prove to be particularly useful in examining these behaviors and trends during the transition periods of early/mid to late adolescence, late adolescence/young adulthood to

mid/late twenties, and early/mid adolescence to mid/late twenties.

In the present study, breakfast skipping was assessed within the seven-day timeframe. Future studies could look at changes in associations between negative health outcomes and breakfast skipping using other timeframes employed by past research on breakfast skipping. Additionally, it would be interesting to compare self-report versus researcher classifications of breakfast skippers within the seven-day timeframe: does self-report of "usual breakfast habits" line up with what researchers consider breakfast skipping? Are participants' ideas of what constitutes regular breakfast skipping in line with a specific definition frequently employed by the literature?

Overall Conclusions

Overall, the present study indicates the need for more research on breakfast skipping and its negative health correlates. Our results highlight the efficacy of the two stricter breakfast skipping definitions in identifying the possible presence of disordered eating behaviors and depression. Especially given the staggering increases in obesity in the U.S. over the past few decades, the finding of breakfast skipping occurring more frequently in obese participants demonstrates the necessity of working to decrease breakfast skipping as a method of combating obesity. Future studies should examine what preventable factors lead to breakfast skipping in children and adolescents, as this information will prove invaluable in designing and implementing obesity prevention programs.

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