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A prospective study of overeating, binge eating, and depressive symptoms among adolescent and young-adult women

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Abstract

Purpose—To investigate the temporal relationship between depressive symptoms, overeating and binge eating among adolescent and young-adult females in the United States.

Methods—We investigated incident overeating, binge eating, and depressive symptoms among 4,798 females in the Growing Up Today Study (GUTS), a prospective cohort study of adolescents and young adults throughout the United States. Participants who reported at least monthly episodes during the past year of eating a very large amount of food in a short of amount of time, but not experiencing a loss of control, were classified as overeaters. Those who did report a loss of control while overeating were classified as binge eaters. Depressive symptoms were assessed with the McKnight Risk Factor Survey. Participants were followed from 1999 until 2003. Generalized estimating equations were used for lagged-analysis with time-varying covariates. Analyses were adjusted for age, age at menarche, body mass index (BMI), and follow-up time.

Results—Females reporting depressive symptoms at baseline were two times more likely than their peers to start overeating (odds ratio (OR)=1.9; 95% confidence interval (CI): 1.4, 2.5) and binge eating (OR=2.3; 95% CI: 1.7, 3.0) during the follow-up. Similarly, females engaging in overeating (OR=1.9, 95% CI: 1.1, 3.4) or binge eaters (OR=1.9, 95% CI: 1.2, 2.9) at baseline, were two times more likely than their peers to develop depressive symptoms during the follow-up.

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Implications and Contribution: This is the first study to demonstrate that adolescent females who binge eat are more likely to develop high levels of depressive symptoms and those with depressive symptoms are more likely to start binge eating. Thus, interventions are needed that target the prevention of both depressive symptoms and binge eating.

Conclusions—These results indicates that it is important to consider depressive symptoms in overeating and binge eating prevention and treatment initiatives targeting adolescent and young adult females.

Keywords

Binge Eating; Overeating; Depressive Symptoms; Overweight; Obesity; Adolescent; Young-Adult; Females

Introduction

Adolescence is a critical period for onset of eating disorders: approximately 90 percent of cases of anorexia nervosa and bulimia nervosa begin before the age of 20 years¹ while onset of binge eating typically occurs during late adolescence.² In addition to those meeting the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)³ criteria for anorexia nervosa, bulimia nervosa and binge eating disorder, many more adolescents and young adults engage in disordered eating patterns that may not be severe or frequent enough to meet DSM-IV diagnostic criteria but are themselves associated with increased risk of poor health outcomes.⁴ In Project EAT (Eating Among Teens), a population-based investigation involving over 4,700 adolescents from public schools in Minnesota, 56.9% of females and 32.7% of males reported engaging in unhealthy behaviors, including fasting and skipping meals in an attempt to control their weight.⁵ In this same cohort, 3.1% of girls and 0.9% of boys satisfied criteria for a binge eating disorder, and an additional 7.9% of girls and 2.4% of boys indicated sub-clinical levels of binge eating defined as objective overeating with loss of control, but low frequency or no distress due to overeating.⁶

High levels of depressive symptoms are at least as common as eating disorders among adolescent females. In the National Longitudinal Study of Adolescent Health (Add Health) 9% of adolescents reported moderate to severe depressive symptoms. An additional 16% were classified as at risk for developing depression.⁷ Although pre-adolescent rates of depression are higher among males than females,⁸ by age 13 rates of depression among females are higher than that in males. Beginning at age 15 and continuing into adulthood, rates in females are nearly twice that of their male peers.⁸ Thus both eating disorders and depression are much more common among females than males during adolescence and young adulthood. Cross-sectional studies have observed that depressive symptoms in adolescence are related to an increased likelihood of participation in adverse health behaviors, including smoking⁹ and suicidal ideation during adulthood.¹⁰ Moreover, cross-sectional studies have reported an association between binge eating and low self-esteem,¹¹ obesity,¹² and depressive symptoms.^{11,13} A few studies have investigated the latter association prospectively and concluded that there is a “reciprocal relationship” between increases in depressive and bulimic symptoms.¹⁴ However, they have not answered whether the association is due to symptomatic females becoming more symptomatic or whether depressive symptoms predict the development of bulimic symptoms and vice versa. The current investigation aims to further the understanding of this temporal relationship by assessing whether depressive symptoms predict the onset of overeating and binge eating and whether overeating and binge eating predict the onset of depressive symptoms in a large nationwide cohort of adolescent and young adult female participants in the ongoing Growing Up Today Study (GUTS).

Methods

Sample

The Growing Up Today Study (GUTS) is an ongoing prospective cohort study of 9,039 female and 7,843 male offspring of women in the Nurses' Health Study II.¹⁵ GUTS cohort members were aged 9 to 14 years when the cohort was established in 1996. Consent to invite the children to participate was obtained from their mother. Return of a completed baseline questionnaire was considered to be assent by the child. GUTS participants have been mailed questionnaires every 12 to 24 months since 1996. The questionnaires are revised before each subsequent cycle to support the instrument's alignment with the developmental stage of cohort participants and to optimize the information collected in each cycle. Content areas typically covered in the questionnaire include weight and height, health risk behaviors across a range of domains, and psychosocial experiences. Additional details on the cohort's establishment and characteristics have been previously reported.¹⁶

The current investigation utilizes data from female respondents to the 1999 (N=7,121), 2001 (N=6,273), and 2003 (N=6,578) GUTS surveys: data prior to 1999 was not utilized in this investigation as depressive symptoms were not assessed in surveys before this time. Female adolescents were the focus of this investigation given the increased risk of binge eating¹⁷ and depressive symptoms⁸ among females in this age group. Eligible female participants ranged in age from 12 to 18 years in 1999 and 16 to 23 in 2003. After excluding participants missing primary exposure, outcome or covariate data for 1999 or 2001 and for 2001 or 2003, 4,798 females remained for this analysis. The Human Subjects committees at the Harvard School of Public Health and Brigham and Women's Hospital approved the study.

Measures

Overeating and Binge Eating—Overeating and binge eating were assessed using a validated two-part question.¹⁸ The first question asked, “Sometimes people will go on an ‘eating binge’ where they eat an amount of food that most people, like their friends, would consider to be very large, in a short period of time. During the past year, how often did you go on an eating binge?” Participants who indicated overeating at least occasionally were asked six additional questions regarding their experiences while on an eating binge, one of which was the following: “Did you feel out of control, like you couldn't stop eating even if you wanted to stop?” Respondents were classified as overeating if they indicated overeating at least once per month without loss of control while overeating. We have previously found that the specificity (0.79) and negative predictive value (0.98) of self-reported binge eating are high among females in our cohort.¹⁸ Although the proposed DSM-5 criteria for binge eating set a cut-off of once per week, we selected a cut-off of at least once per month as we have previously found that the association between total depressive symptoms and binge eating was similar when binge eating was defined as occurring monthly or weekly.¹⁹ However, in secondary analyses we use the cut-off of at least weekly overeating or binge eating. Incident overeating was defined as overeating that was initiated between 1999 and 2001 or 2001 and 2003 among individuals who were not overeaters at baseline (1999 and 2001 for the respective time intervals). Binge eaters were overeaters who reported experiencing a loss of control while overeating. Incident binge eating was defined as binge eating initiated between the 1999 and 2001 or 2001 and 2003 questionnaires among individuals who did not binge eating at least monthly at baseline.

Depressive Symptoms—Depressive symptoms were assessed with the question: “In the past year how often did you feel ‘down in the dumps’ or ‘depressed’?” from the McKnight Risk Factor Survey (MRFS) IV.²⁰ A response of “always” or “usually” on the question's 5-point Likert response scale was reflective of depressive symptoms. Incident depressive

symptoms was defined as reporting “always” or “usually” feeling “down in the dumps” or “depressed” at follow-up (in 2001 or 2003) among females who reported “sometimes”, “rarely” or “never” at baseline (in 1999 or 2001, respectively).

Covariates—Respondent age at the time of questionnaire return was estimated based on date of survey return and recorded date of birth. Age at menarche was assessed based on data derived from participant responses to the 1999, 2001, or 2003 questionnaires. Participants who reported an age of menarche at or before 11 years of age were classified as having an early age at menarche.

Body mass index (BMI, kg/m^2) was computed from self-reported weight and height. Participants < 18 years of age were classified as overweight or obese according to International Obesity Task Force (IOTF) age- and gender-specific BMI cutoffs.²¹ For participants ≥ 18 years of age, overweight was defined as a BMI ranging from 25 to 29.9 kg/m^2 and obesity was defined as a BMI $\geq 30 \text{ kg/m}^2$, as specified in the World Health Organization (WHO) BMI guidelines.²² The validity of BMI based on self-report height and weight has been found to be highly correlated ($r=0.92$) with measured BMI values among adolescents in grades 7 through 12 and only 3.8% of the youths were misclassified as obese using self-reported BMI.²³

Statistical Analysis

To assess the temporal relation between depressive symptoms and overeating and binge eating two sets of statistical models were run. In initial analyses, overeating and binge eating at baseline, defined as 1999 for the 1999 through 2001 time interval and as 2001 for the 2001 through 2003 time interval, were included as separate predictors in a model predicting incident depressive symptoms at follow-up, defined as 2001 or 2003 for the aforementioned time intervals. In other statistical models, depressive symptoms at baseline were treated as the primary exposure predicting incident overeating or incident binge eating, respectively, at follow-up.

The unadjusted associations between depressive symptoms, overeating and binge eating were explored using chi-square tests, t-tests and univariate regression analyses. Prospective analyses of the relationships between depressive symptoms and overeating and binge eating were conducted with using generalized estimating equations (GEE) with a logit link for lagged-analyses with time-varying covariates. Follow-up time was included in all models to adjust for individual variation in time between consecutive survey completion. All models also adjusted for age, early age at menarche, and weight status (underweight or healthy weight vs. overweight vs. obese).

Results

The demographics of the study population in 1999, 2001, and 2003 are presented in Table 1. In 1999 the mean (standard deviation (SD)) age of the females was 14.9 (1.6) years. Between 1999 and 2003 the prevalence of overeating and binge eating more than doubled in this nationwide cohort of adolescent and young adult females: while the prevalence of overeating increased from 1.5% to 3.7% that of binge eating increased from 2.4% to 5.7%. During the same time period, the prevalence of overweight increased from 14.5% to 15.5% and obesity increased from 3.0% to 5.2%. Between 1999 and 2001 the prevalence of high depressive symptoms increased from 9.5% to 11.9% but subsequently decreased back to 9.6% in 2003 (Table 1).

Depressive symptoms at baseline were strongly predictive of incident overeating at follow-up. After adjustment for age, early age at menarche, follow-up time and BMI, females reporting “always” or “usually” feeling “down in the dumps” or “depressed” at baseline were almost twice as likely as females without depressive symptoms at baseline to initiate overeating (odds ratio(OR)=1.9; 95% confidence interval (CI): 1.4, 2.5) and were more than twice as likely to start binge eating (OR=2.3; 95% CI: 1.7, 3.0) during the next two years (Table 2). When we further adjusted the models for dieting, the association between depressive symptoms and incident overeating did not materially change (OR=2.1, 95% CI 1.4–3.1). However, the association with incident binge eating was attenuated (OR=1.6, 95% CI 1.0–2.5).

In secondary analyses where we used a cut-off of at least weekly for overeating and binge eating, the results were virtually identical to those using the monthly cut-off. This was true for both overeating (OR incident weekly overeating=1.8 (95% CI 1.4–2.5) vs. OR incident monthly overeating=1.8 (95% CI 1.4–2.5)) and binge eating (OR incident weekly binge eating=2.4 (95% CI 1.9–3.2) vs. OR incident monthly binge eating=2.3 (95% CI 1.7–3.0))

Females who engaged in overeating or binge eating were more likely to develop high levels of depressive symptoms. After adjustment for age, early age at menarche, BMI, and follow-up time, the risk developing high depressive symptoms during follow-up was almost twice as high (OR=1.995% CI: 1.1, 3.4) among individuals who were overeaters compared to non-overeaters. Similarly, females who reported binge eating were approximately two times more likely (OR=1.9, 95% CI: 1.2, 2.9) than non-binge eaters to develop high levels of depressive symptoms (Table 3).

Discussion

The results of our study support the existence of two distinct prospective pathways between depressive symptoms and overeating and binge eating: depressive symptoms predict the onset of overeating and binge eating during two years of follow-up, and overeating and binge eating predict the development of high depressive symptoms during two years of follow-up. Moreover, the relative strength of both prospective relationships appears similar.

The findings that depressive symptoms at baseline were strongly predictive of incident overeating at follow-up contributes to the literature suggesting that binge eating may be initiated as a means of coping with negative affect.²⁴ One study of approximately 500 adolescent females found that ruminative thinking, or the tendency to focus on the causes, symptoms and consequences of distress versus engaging in active problem solving as a coping mechanism, was associated with increases in depressive symptoms and the onset of bulimic symptoms, including binge eating.²⁵

Alternatively, the indication that binge eating is predictive of onset of depressive symptoms may be explained in part by the guilt and/or shame experienced following binge eating sessions which can feed an increase in depressive symptoms.^{26–29} While the experience of guilt or shame following a binge eating session is not, by definition, required for an act of overeating to qualify as binge eating, the experience of guilt after overeating is a criterion that can be used in making the diagnosis of binge eating disorder.³⁰ In addition, research on the effects of a ruminating coping style indicate that while rumination may predict increases in depressive and bulimic symptoms, including binge eating, depressive symptoms and bulimic symptoms can further feed rumination.²⁵ This cyclical pathway may account, at least in-part, for the predictive influence of binge eating on depressive symptoms.

Historically, the etiology of binge eating was explained using a dieting model^{31,32} and a negative affect model.^{31–33} The dieting model contends that caloric restriction associated

with dieting increases the risk of binge eating, while the affect regulation theory posits that individuals with increased negative affect are more likely to binge eat in an effort to achieve the comfort and distraction that (binge) eating is believed to provide.^{31–33} More recently, a dual-pathway model, which conceptualizes the initiation and maintenance of binge eating as a result of dietary restraint, affect regulation, and sociocultural factors has been proposed.³³ The dual-pathway model distinguishes a “dietary-depressive” sub-type of binge eaters consisting of individuals whose binge eating is typified by dietary restraint and negative affect from that of a “dietary” subtype of binge eaters in whom binge eating is characterized by dietary restraint alone.³⁴

In a cross-sectional study of 543 non-treatment seeking girls, Chen et al. found that 10 year old girls in the “dietary-depressive” subtype were more than 13 times more likely to report binge eating compared to those females reporting little dietary restraint and few depressive symptoms.³¹ In a subsequent prospective analysis within this same study, females who were in the “dietary-depressive” subtype at age 10 were four times more likely to be classified as at-risk of binge eating at 12 and 14 years of age after adjustment for socioeconomic factors, body size dissatisfaction, and BMI at age 10.³¹ These results suggest that both dietary restraint and depressive symptoms (negative affect) predict incident binge-eating among girls aged 10 to 14 years and thereby provide further support for the validity of the dual-pathway model of binge eating.^{31,33,35,36}

To date, the prospective relationship between binge eating and depressive symptoms has been investigated only in a couple of relatively small community samples of adolescent females. In a prospective study of 231 adolescent females, bulimic symptoms, as well as pressure to be thin, thin-ideal internalization, body dissatisfaction and dieting predicted increases in depressive symptoms.^{37,38} A subsequent investigation by Presnell et al. explored the possibility of a “reciprocal” relationship between depressive and bulimic symptoms, i.e. the ability of depressive symptoms to predict increases in bulimic symptoms and the ability of bulimic symptoms to predict increases in depressive symptoms, among a community sample of 496 adolescent females. Over eight years of follow-up, depressive symptoms predicted higher levels of bulimic symptoms and bulimic symptoms predicted increased levels of depressive symptoms over each of seven study time points after allowing for a one-year lag in bulimic and depressive symptoms.¹⁴ The study did not report on onset of depressive symptoms or binge eating. Therefore it was unclear whether among females without depressive symptoms, binge eating increased the risk of developing depressive symptoms and vice versa. The results of our investigation provide strong support for the existence of a bidirectional relationship between depressive and bulimic symptoms among adolescent females and clearly demonstrate that the association is not due to a cross-sectional association at baseline that persists.

The current investigation is the first longitudinal analysis of the relationships between incident binge eating, overeating and depressive symptoms within a large, nationwide cohort of adolescents. In addition to the large size and geographic diversity of the study population, strengths of this investigation include adjustment for confounders in the relationships of interest and use of validated repeated measures of disordered eating.¹⁸ Limitations of this study include the inability to generalize study findings to adolescent and young adult males in the United States. Similarly, as the GUTS cohort is a largely white cohort of offspring of women in the Nurses' Health Study II, among whom there are few individuals of low socioeconomic status it is unclear if the results generalize to ethnic minority or low socioeconomic status females. While lack of information on respondent use of medications, including anti-depressants, which may confound the relationship between depressive-symptoms and overeating or binge eating may be viewed as a limitation, consideration of the nature of the associations between depressive symptoms and overeating and binge eating,

suggests that such residual confounding could have attenuated our results. Finally, although our measure of binge eating has been validated and our rates of bulimia nervosa, based on the self-report measure, are consistent with those using structured interviews, it is possible that our self-report measure resulted in some misclassification.

In conclusion, we observed that over a four year period the prevalence of overeating and binge eating more than doubled in a nationwide cohort of adolescent and young-adult females. Given the comorbidities and consequences, including obesity, associated with overeating and binge eating and suicide attempts associated with depressive symptoms, it is vital that we further our understanding of the relationship between depressive symptoms, overeating and binge eating among adolescents and young adults. This information is needed to develop effective prevention strategies. The results of the current investigation further illustrate the existence of two distinct prospective pathways responsible for the association between depressive symptoms and overeating as well as binge eating among females in this population. The findings suggest that binge eating prevention initiatives should consider the role of depressive symptoms in binge eating initiation and incorporate suggestions for dealing with negative emotions to enhance prevention program effectiveness. Similarly, interventions aimed at reducing depressive symptoms in this population should consider strategies to prevent binge eating. The fact that the same treatments, cognitive behavior therapy and interpersonal psychotherapy, are used to treat depression and binge eating disorder,^{39,40} suggest that combined prevention interventions might effectively prevent both outcomes. School-based interventions would be ideal for primary prevention, whereas screening in clinical settings would identify cases for early secondary prevention. In addition, in clinical settings, adolescent and young-adult females who present with signs of depressive symptoms, overeating or binge eating should be screening for associated comorbidities.

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Abbreviations

GUTS	Growing Up Today Study
BMI	Body mass index
GEE	Generalized Estimating Equations
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, 4 th edition
MDD	Major Depressive Disorder
MRFS	McKnight Risk Factor Survey
IOTF	International Obesity Task Force
WHO	World Health Organization

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Table 1

Characteristics of 4,798 girls in the Growing Up Today Study (GUTS); 1999–2003

	1999	2001	2003
Age (years) [Mean (SD)]	14.9 (1.6)	16.9 (1.7)	19.2 (1.6)
BMI (kg/m ²) [Mean (SD)]	20.9 (3.3)	22.1 (3.5)	22.7 (3.8)
Weight Status [n(%)]			
Overweight	651 (14.5%)	647 (13.9%)	670 (15.5%)
Obese	135 (3.0%)	198 (4.3%)	226 (5.2%)
Overeating [n (%)]			
Without loss of control [*]	74 (1.5%)	245 (5.1%)	177 (3.7%)
Binge eating [†]	113 (2.4%)	260 (5.4%)	272 (5.7%)
Frequency of Being “Down in the Dumps” or “Depressed” in the past year [n (%)]			
Always	62 (1.4)	104 (2.2)	52 (1.2)
Usually	358 (8.1)	467 (9.7)	359 (8.4)
Sometimes	1660 (37.7)	1917 (40.0)	1852 (43.2)
Rarely	1715 (38.9)	1761 (36.6)	1618 (37.8)
Never	611 (13.9)	560 (11.6)	402 (9.4)

^{*} At least one overeating episode a month, but not feel out of control during the episodes

[†] At least one overeating episode a month, during which they felt out of control, like they couldn't stop eating even if they wanted to.

Table 2

Risk of incident overeating or binge eating at follow-up by depressive symptoms in the past year at baseline among 4,768 girls in GUTS; 1999–2003

	Multivariate Adjusted OR (95% CI) [*]	
	Incident Overeating	Incident Binge Eating
Depressive Symptoms		
No or low [†]	1.00 (referent)	1.00 (referent)
High [‡]	1.9 (1.4, 2.5)	2.3 (1.7, 3.0)

^{*} Estimated from GEE models adjusting for age, early age at menarche, follow-up time, and weight status.

[†] Individuals reporting “sometimes” “rarely” or “never” feeling “down in the dumps” or “depressed”

[‡] Individuals reporting “always” or “usually” feeling “down in the dumps” or “depressed”

Table 3

Risk of incident depressive symptoms at follow-up by overeating and binge eating status at baseline among 4,591 girls in GUTS; 1999–2003

Multivariate Adjusted OR (95% CI)*	
Overeating Status at Baseline	
Non-Overeating	1.0 (referent)
Overeating	1.9 (1.1, 3.4)
Binge Eating Status at Baseline	
Non-Binge eating	1.0 (referent)
Binge eating	1.9 (1.2, 2.9)

* Estimated from GEE models adjusting for age, early age at menarche, follow-up time, and weight status.