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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 and 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, a prospective cohort study of adolescents and young adults throughout the United States. Participants who reported at least monthly episodes of eating a very large amount of food in a short amount of time in the past year, but not experiencing a loss of control, were classified as overeaters. Those who reported a loss of control while overeating were classified as binge eaters. Depressive symptoms were assessed with the McKnight Risk Factor Survey. Participants were followed between 1999 and 2003. Generalized estimating equations were used for lagged analysis with time-varying covariates. Analyses were adjusted for age, age at menarche, body mass index, 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 eating (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.

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

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Adolescence is a critical period for onset of eating disorders—approximately 90% of cases of anorexia nervosa and bulimia nervosa begin before the age of 20 years [1], although 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 adoles-

cents 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 more than 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 subclinical levels of binge eating defined as objec-

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tive overeating with loss of control, but low frequency or no distress because of 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, 9% of adolescents reported moderate to severe depressive symptoms. An additional 16% were classified as at risk for developing depression [7]. Although preadolescent rates of depression are higher among males than among 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 of depression in females are nearly twice that of their male peers [8]. Thus, eating disorders and depression are both much more common among females than among 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 smoking [9] and suicidal ideation, during adulthood [10]. Moreover, cross-sectional studies have reported an association between binge eating, 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 because of 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 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 9–14 years when the cohort was established in 1996. Consent to invite the children to participate was obtained from their mothers. Return of a completed baseline questionnaire was considered assent by the child. GUTS participants have been mailed questionnaires every 12–24 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 uses data from female respondents to the GUTS surveys conducted in 1999 (N = 7,121), 2001 (N = 6,273), and 2003 (N = 6,578): data before 1999 were not used in this investigation, as depressive symptoms were not assessed in surveys before this time. Given the increased risk of binge eating [17] and depressive symptoms [8] among females in this age-group, female adolescents were the focus of this investigation. Eligible female participants ranged in age from 12 to 18 years in 1999 and from 16 to 23 years in 2003. After excluding partici-

pants missing primary exposure, or covariate data in 1999 or 2001 and missing outcome data in 2001 or 2003, a total of 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 (.79) and negative predictive value (.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 cutoff of once per week, we selected a cutoff 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 cutoff 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 engage in binge eating at least monthly at baseline.

Depressive symptoms. Depressive symptoms were assessed with the following question: “In the past year how often did you feel ‘down in the dumps’ or ‘depressed?’” from the McKnight Risk Factor Survey 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 were 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, respectively (in 1999 or 2001).

Covariates. Respondent's 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 participants' responses to the 1999, 2001, or 2003 questionnaires. Participants who reported an age of menarche at or before 11 years were classified as having an early age at menarche.

Body mass index (BMI, kg/m²) 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's age- and gender-specific BMI cutoffs [21]. For participants ≥ 18 years of age, overweight was defined as a BMI

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 ^a	74 (1.5%)	245 (5.1%)	177 (3.7%)
Binge eating ^b	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	1,660 (37.7)	1,917 (40.0)	1,852 (43.2)
Rarely	1,715 (38.9)	1,761 (36.6)	1,618 (37.8)
Never	611 (13.9)	560 (11.6)	402 (9.4)

^a At least one overeating episode a month, but they did not feel out of control during the episodes.

^b At least one overeating episode a month during which they felt out of control, like they could not stop eating even if they wanted to.

ranging from 25 to 29.9 kg/m², and obesity was defined as a BMI \geq 30 kg/m², as specified in the World Health Organization BMI guidelines [22]. The validity of BMI based on self-reported height and weight has been found to be highly correlated ($r = .92$) 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 and overeating and binge eating were explored using χ^2 tests, t tests, and univariate regression analyses. Prospective analyses of the relationships between depressive symptoms and overeating and binge eating were conducted by using generalized estimating equations 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 age of the females was 14.9 (standard deviation: 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: the prevalence of overeating increased from 1.5% to 3.7% and that of binge eating increased from 2.4% to 5.7%. During the same 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 they were more than twice as likely to start binge eating (OR = 2.3; 95% CI = 1.7, 3.0) during the next 2 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 cutoff of at least weekly for overeating and binge eating, the results were virtually identical to those using the monthly cutoff. 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 = 1.9; 95% CI = 1.1, 3.4) among individuals who were overeaters compared with non-overeaters. Similarly, females who reported binge eating were approximately two times more likely (OR = 1.9; 95% CI = 1.2, 2.9) than nonbinge 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

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) ^a	
	Incident overeating	Incident binge eating
Depressive symptoms		
No or low ^b	1.00 (referent)	1.00 (referent)
High ^c	1.9 (1.4, 2.5)	2.3 (1.7, 3.0)

OR = odds ratio; CI = confidence interval.

^a Estimated from generalized estimating equations (GEE) models adjusting for age, early age at menarche, follow-up time, and weight status.

^b Individuals reporting “sometimes,” “rarely,” or “never” feeling “down in the dumps” or “depressed.”

^c 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) ^a
Overeating status at baseline	
Nonovereating	1.0 (referent)
Overeating	1.9 (1.1, 3.4)
Binge eating status at baseline	
Nonbinge eating	1.0 (referent)
Binge eating	1.9 (1.2, 2.9)

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

of overeating and binge eating during 2 years of follow-up, and overeating and binge eating predict the development of high-depressive symptoms during 2 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 contribute 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 result in an increase in depressive symptoms [26–29]. Although 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 although 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, whereas 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” subtype 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 nontreatment 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 with 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 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 10–14 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, that is, 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. During 8 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 a 1-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 binge eating increased the risk of developing depressive symptoms and vice versa among females without depressive symptoms. 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 because of a cross-sectional association at baseline that persists.

The current investigation is the first longitudinal analysis of the relationships between incident binge eating and 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. Although lack of information on respondent use of medications, including antidepressants, 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 possi-

ble that our self-report measure resulted in some misclassification.

In conclusion, we observed that during a 4-year period, the prevalence of overeating and binge eating more than doubled in a nationwide cohort of adolescents 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 and 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 and 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 screened for associated comorbidities.

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