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Depression, Anxiety and Severity of Obesity in Adolescents: Is Emotional Eating the Link?

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Abstract

The purposes of this study were to characterize the impact of depression and anxiety on the severity of obesity among youth seeking weight management treatment and to determine the extent to which emotional eating mediates the relationship between depression and/or anxiety and degree of obesity. This cross-sectional, retrospective chart review of 102 adolescent patients from a weight management clinic analyzed demographics, body mass index (BMI), depression (Patient Health Questionnaire-9) and anxiety (Generalized Anxiety Disorder Scale-7) screens, and the Child Eating Behavior Questionnaire, Emotional Over-Eating subscale. After adjusting for demographics and emotional eating, the odds of having severe obesity versus obesity were 3.5 times higher for patients with depression compared to those without [Odds Ratio (O.R.) 3.5 95% CI: (1.1, 11.3), $p=0.038$] and nearly 5 times higher for those with anxiety [O.R. 4.9 (1.2, 20.9), $p=0.030$]. Emotional eating, however, was not a mediator between depression/anxiety and degree of adiposity.

Keywords

depression; anxiety; emotional eating; severe obesity; adolescents

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Conflicts of Interest

Dr. Kelly serves as a consultant for Takeda Pharmaceuticals and Novo Nordisk Pharmaceuticals and is the signatory author for a pediatric obesity clinical trial sponsored by Novo Nordisk Pharmaceuticals; he does not accept personal or professional income for his services. Dr. Kelly also receives research support from Astra Zeneca Pharmaceuticals in the form of drug/placebo. Dr. Fox is a site principal investigator for a pediatric obesity clinical trial sponsored by Novo Nordisk Pharmaceuticals. None of the other authors have disclosures. Kyle Rudser was supported in part by funding from award UL1TR000114 of the NCATS.

Introduction

Mental illness and obesity are common conditions in adolescents. Nearly 8% of teens have a diagnosis of depression and 25% have anxiety at any given time.¹ One third of youth are overweight or obese and nearly 6% have severe obesity² (defined as an age- and sex-specific body mass index (BMI) 1.2 times the 95th percentile).³

Also, mental illness is a common co-morbidity of obesity.⁴⁻⁶ However, the studies examining the prevalence of depression, for example, in youth with obesity are inconsistent and there are far fewer studies addressing the prevalence of anxiety in this group.⁷ In the case of depression, results seem to vary according to treatment status. That is, most studies indicate that obesity treatment-seeking youth have a greater prevalence of depression compared to population-based samples of youth with obesity.⁸ Further, although youth with severe obesity, compared to milder forms of obesity, have more adverse physiological profiles, such as a higher prevalence of hypertension, insulin resistance, and fatty liver disease,³ it is uncertain if these differences extend to their psychological profiles. Depression and/or anxiety could serve as a driver in the development of more severe forms of obesity, or alternatively, more severe forms of obesity could lead to anxiety and/or depression.^{8,9}

Emotional eating is one of the many plausible mediators between depression and/or anxiety and obesity. The term “emotional eating” stems from the Psychosomatic Theory which considers overeating as a coping mechanism to regulate and reduce negative emotions.^{10,11} This reaction, however, is not evolutionarily advantageous or biologically appropriate given that a reduction in food intake, not an increase, in the face of stress is expected. In particular, the stress induced “flight or fight” response of the hypothalamic-pituitary-adrenal axis should decrease physiological hunger. Nonetheless, emotional eating has been associated with anxiety and depression in youth with obesity. In terms of anxiety, emotional eating may be a way of dealing with hyper-arousal. Regarding depression, emotional eating may be a way of producing more positive emotion.¹²⁻¹⁴

The objectives of this study were to 1) characterize the impact of depression and anxiety on the severity of obesity among youth seeking weight management treatment, and 2) examine if emotional eating mediates the relationship between depression and/or anxiety and degree of obesity. We hypothesized that depression and anxiety would be associated with more severe forms of obesity and that emotional eating would account for this relationship.

Methods

Study Design and Participants

Data for this retrospective, cross-sectional study were collected from adolescent patients (ages 12 to 18 years) who were seeking obesity treatment from an academic health center-based, multidisciplinary, pediatric weight management clinic between January 2012 and October 2013. The clinic team members include a pediatric bariatrician, endocrinologist, nurse practitioner, psychologist, nurse coordinators, dietitians, and physical therapists. Services provided include lifestyle modification therapy, pharmacotherapy, and bariatric

surgery. Per the standard clinic protocol, before the initial appointment, all patients complete a series of questionnaires which assess, among other items, depression, anxiety, and eating behaviors. BMI, calculated from patients' measured intake height and weight, was used to classify them as having either obesity (BMI 95th percentile - <1.2 times the 95th percentile) or severe obesity (BMI ≥ 1.2 times the 95th percentile or greater than 35 kg/m².) Race was self-reported in the following categories: white/Caucasian, African American, Asian, Native Hawaiian/Pacific Islander, American Indian, or Hispanic/Latino; race categories were collapsed into white and non-white for the analyses. Passive consents for use of medical records for research were obtained from the participants' parents/guardians. This study was approved by the academic health center's Institutional Review Board.

Measures

Depression was assessed with the Patient Health Questionnaire (PHQ-9), a 9-item, self-report survey on a 4-point Likert scale (0="not at all" to 3="nearly every day"). Anxiety was assessed with the Generalized Anxiety Disorder Scale (GAD-7), a 7-item self-report survey on a 4-point Likert scale (0="not at all" to 3="nearly every day"). A PHQ-9 score cut point of ≥ 11 was considered positive for detecting depression¹⁵ and a GAD-7 score cut point of ≥ 10 was considered positive for detecting anxiety.¹⁶ Both of these measures are validated in adolescents.¹⁵⁻¹⁷ Emotional eating was measured by patient self-report on the Child Eating Behavior Questionnaire (CEBQ), Emotional Over-Eating subscale.¹⁸ The CEBQ was originally designed as a parent report of child eating behavior, yet precedent has been made for using a modified version of the CEBQ as an adolescent self-report measure.¹⁹ As such, prefix statements were modified from "My child..." to "I..." The four items comprising the Emotional Over-Eating subscale are: "eat more when anxious," "eat more when annoyed," "eat more when worried," and "eat more when nothing else to do." Each item was rated on a 5-point Likert scale (1=never to 5=always). The mean of the four items was used as the emotional eating score.

Statistical Analysis

Descriptive characteristics were calculated by obesity group (severe obesity vs obesity), which included mean and standard deviation for continuous variables and frequency for categorical variables. As noted above, a PHQ-9 score cut point of ≥ 11 was considered positive for detecting depression¹⁵ and a GAD-7 score cut point of ≥ 10 was considered positive for detecting anxiety.¹⁶ Unadjusted comparisons between groups for categorical variables used the Chi-square test while comparisons of continuous variables used the t-test with unequal variances and Welch degrees of freedom for confidence intervals and p-values. Adjusted results for associations with obesity categories used logistic regression with robust variance estimates for confidence intervals and p-values. Associations with BMI treated continuously were based on linear regression with robust variance estimates for confidence intervals and p-values. All analyses were performed using R v3.1.1.²⁰

Results

There were a total of 102 adolescents, mean age 15.3±1.9 years, included in this study (Table 1). Thirty-four percent were boys, 33% were non-white, 17% were classified as

having obesity (mean BMI $30.3 \pm 1.9 \text{ kg/m}^2$), and 83% as having severe obesity (mean BMI $41.2 \pm 7.2 \text{ kg/m}^2$). In the overall sample, 34% endorsed symptoms consistent with depression and 32% endorsed symptoms of anxiety. Among patients with and without depression, 91% and 79% had severe obesity, respectively ($p=0.192$) in unadjusted analyses. Among patients with and without anxiety, 94% and 78% had severe obesity, respectively ($p=0.088$), also in unadjusted analyses.

Adjusted analyses were performed with a dichotomous obesity classification, i.e. severe obesity versus obesity, and with BMI as a continuous variable. After adjusting for sex, race, age, and emotional eating, the odds of having severe obesity versus obesity was three and a half times higher for patients with depression [Odds Ratio 3.5 95% CI: (1.1, 11.3), $p=0.038$] and nearly five times higher for patients with anxiety [4.9 (1.2, 20.9), $p=0.030$]. Emotional eating, however, was not significantly associated after adjusting for the other covariates ($p=0.201$ and 0.205 respectively) (Table 2a and 2b). Also, the odds ratios of depression and anxiety were attenuated when emotional eating was not adjusted for. In the adjusted analysis of associations with BMI treated as a continuous variable, depression was not significantly associated with BMI [difference of 1.74, (-1.25, 4.73), $p=0.255$]. However, anxiety was significantly associated with greater BMI [3.49, (0.41, 6.57), $p=0.026$] (Table 3a and 3b). Additionally, the association of depression and anxiety were slightly higher when emotional eating was not adjusted for (1.94 and 3.57 respectively).

Discussion

In the current study, obesity treatment-seeking youth with depression and anxiety were significantly more likely to have a BMI in the severe obesity category than in the obesity category. However, counter to our hypothesis, emotional eating was not a mediator between depression/anxiety and degree of adiposity.

Previous studies of treatment-seeking youth with obesity found no correlation between depression and BMI when BMI was used as a continuous variable.^{21–24} Our results were consistent with these reports when BMI was also used as a continuous variable, but may not be what one would expect. Specifically, it stands to reason that depression and obesity are related via mechanisms such as hypothalamic-pituitary adrenal axis dysregulation, body dissatisfaction, musculoskeletal pain, poor sleep, and disordered eating.^{9,25} It was only when our sample was dichotomized into those with severe obesity versus obesity that depression was found to be associated with significantly higher odds of being classified as having severe obesity. This suggests that those in the severe obesity category compared to those in the obese category may have a phenotype that is distinct in elements beyond that of weight/adiposity. It is also noteworthy that anxiety was very highly associated with increased adiposity whether BMI was used as a categorical or continuous variable.

Several prior studies using community samples of children identified a positive linear relationship between obesogenic eating behaviors, including emotional eating, and BMI using the CEBQ.^{26–29} However, to our knowledge, none have looked at emotional eating in a purely *clinical* sample of obesity treatment-seeking youth. In contrast to community samples, this study found that among patients who endorse emotional eating, the odds of

severe obesity were not significantly higher than obesity. One possible explanation for this finding may be that patients who seek clinical obesity treatment as a group are more alike on emotional eating, regardless of BMI. This suggests that emotional eating may be a driver for seeking clinical obesity treatment.

Strengths of this study include the use of a clinical, treatment-seeking sample, which may be relevant to health care practitioners who are in the trenches working with adolescents with comorbid obesity and mental illness. Further, although there are studies which support a relationship between anxiety/depression and emotional eating,^{12,13} emotional eating and obesity,^{11, 14} and anxiety/depression and obesity,^{30, 31} this is the first study to our knowledge to analyze all three variables simultaneously. A limitation is the use of the CEBQ as a self-report measure in adolescents. This instrument has not yet been validated as a self-report tool. However, it is relatively easy to administer in a clinical practice and there is precedent in using it as an adolescent self-report with minor rephrasing as done in the current study.¹⁹ Further, the small sample size of the obese group may have limited the power of this study to detect differences between groups, and the cross sectional nature of this study limits our ability to address causality. Indeed the relationship between mental illness and obesity is likely bidirectional. Finally, studies of emotional eating in adults have demonstrated that many individuals find it difficult to identify emotional eating behaviors in themselves.³²

In conclusion, depression and anxiety are associated with more severe obesity among treatment-seeking youth. Although emotional eating did not mediate the relationship between depression/anxiety and obesity severity in the current study, longitudinal studies will be valuable in identifying other mechanisms that explain the relationships between mental illness and obesity in this population, which in turn could serve as targets for intervention.

Acknowledgments

CF and AG conceived study design and collected data. KR completed data analysis. AF collected data and reviewed manuscript. CF, AG, KR, and AK interpreted data and wrote manuscript.

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Table 1
Patient characteristics; values presented are mean (SD) or N (%) where indicated.

Covariate	Overall (N=102)	PHQ<11 (N=67)	PHQ 11 (N=35)	GAD<10 (N=69)	GAD 10 (N=33)
Age (years)	15.3 (1.87)	15.1 (1.95)	15.6 (1.66)	15.0 (1.87)	15.8 (1.75)
Non-white	34 (33.3%)	21 (31.3%)	13 (37.1%)	21 (30.4%)	13 (39.4%)
Male	35 (34.3%)	26 (38.8%)	9 (25.7%)	28 (40.6%)	7 (21.2%)
BMI (kg/m ²)	39.4 (7.81)	38.3 (7.48)	41.5 (8.08)	37.6 (6.8)	43.0 (8.59)
Severe obesity	85 (83.3%)	53 (79.1%)	32 (91.4%)	54 (78.3%)	31 (93.9%)
PHQ	8.56 (6.33)	4.72 (3.1)	15.9 (3.96)	5.77 (4.53)	14.4 (5.54)
GAD	6.66 (5.93)	3.85 (4.32)	12.0 (4.79)	3.07 (2.78)	14.2 (2.98)
PHQ 11	35 (34.3%)	0 (0.0%)	35 (100%)	10 (14.5%)	25 (75.8%)
GAD 10	33 (32.4%)	8 (11.9%)	25 (71.4%)	0 (0.0%)	33 (100.0%)
Emotional eating score	2.59 (1.05)	2.3 (1.0)	3.13 (0.95)	2.38 (0.99)	3.02 (1.06)

Table 2a

Association between depression and odds of severe obesity (vs obesity), adjusted for sex, race, age, and emotional eating score.

Covariate	Odds Ratio (95% CI)	p-value
PHQ 11	3.48 (1.07, 11.30)	0.038
Emotional eating	0.68 (0.38, 1.23)	0.201
Male vs Female	0.96 (0.28, 3.26)	0.950
White vs non-white	1.53 (0.42, 5.54)	0.516
Age (per year)	1.25 (0.94, 1.68)	0.125

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Table 2b

Association between anxiety and odds of severe obesity (vs obesity) adjusted for sex, race, age, and emotional eating score.

Covariate	Odds Ratio (95% CI)	p-value
GAD 10	4.93 (1.17, 20.85)	0.030
Emotional eating	0.69 (0.39, 1.23)	0.205
Male vs Female	1.13 (0.34, 3.75)	0.846
White vs non-white	1.57 (0.42, 5.84)	0.504
Age (per year)	1.26 (0.92, 1.72)	0.145

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Table 3a

Association of depression with BMI, adjusted for sex, race, age, and emotional eating score.

Covariate	BMI Difference (95% CI)	P-value
PHQ 11	1.74 (-1.25, 4.73)	0.255
Emotional eating	0.26 (-1.06, 1.58)	0.698
Male vs Female	-1.96 (-4.56, 0.64)	0.139
White vs non-white	2.43 (-0.49, 5.36)	0.103
Age (per year)	1.62 (0.92, 2.33)	<0.001

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Table 3b

Association of anxiety with BMI, adjusted for sex, race, age, and emotional eating score.

Covariate	BMI Difference (95% CI)	P-value
GAD 10	3.49 (0.41, 6.57)	0.026
Emotional eating	0.13 (-1.06, 1.33)	0.828
Male vs Female	-1.72 (-4.11, 0.67)	0.159
White vs non-white	2.22 (-0.77, 5.21)	0.145
Age (per year)	1.53 (0.85, 2.21)	<0.001

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