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Negative childhood experiences and disordered eating in adolescents in a weight management program: The role of depressive symptoms

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Abstract

Objective: Stress negatively impacts adolescent weight status and eating behaviors. Previous research investigating this association has focused on traumatic events in childhood, but little is known about the impact of commonly experienced stressful life events and weight-related outcome. The aim of this cross-sectional study was to examine the association between negative life events and weight-related outcomes (i.e., weight status, disordered eating behaviors, insulin sensitivity) in a sample of treatment-seeking adolescents with overweight and obesity. A further aim of the study was to examine the potential mediating role of depression.

Method: Adolescents (N = 170; M age = 14.8; 62% female) presenting to an interdisciplinary weight management program completed measures related to negative life events, disordered eating patterns, and depressive symptoms prior to initiating treatment. Weight status and insulin sensitivity (using fasting glucose and fasting insulin) were objectively measured.

Results: Stressful experiences during childhood were significantly related to weight status, F = 2.78, p < .05, and disordered eating, F = 5.51, p < .001, in regression analyses. Stressful life events were not related to insulin sensitivity. Depressive symptoms mediated the association between stressful experiences and disordered eating (b = 0.001, [CI = 0.0002, 0.0011]). Depressive symptoms did not mediate this association for weight status or insulin sensitivity.

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Declaration of competing interest

Dr. Jelalian is a Consultant for WW. WW has not provided financial support for this study, nor did it have any influence on the methods in this study. All other authors declared no conflicts of interest.

Discussion: Findings from the present study suggest that relatively common stressful events may be associated with development of disordered eating patterns in adolescents with overweight or obesity presenting to treatment. Providers working in weight management settings should consider assessing a range of potentially stressful life events and their potential weight-related implications.

Keywords

Obesity; Adolescent; Stress

Approximately 40% of adolescents in the U.S. is overweight or obese (Skinner, Ravanbakht, Skelton, Perrin, & Armstrong, 2018). Obesity is associated with multiple negative physical and psychosocial outcomes from adolescence into adulthood (Fontaine, Redden, Wang, Westfall, & Allison, 2003; Kraak, Liverman, & Koplan, 2005). In addition to escalating weight gain secondary to typical physical and pubertal development (Spear, 2002), adolescence is characterized by increased autonomy with regard to eating behavior, raising risk for excess caloric intake and weight gain (Jasik & Lustic, 2008). Among the numerous genetic and environmental factors that influence obesity, negative life events are known to play a significant role in the development and maintenance of increased weight status in adolescents (Danese & Tan, 2014; Wilson & Sato, 2014).

The association between adolescent stress and increased weight status has been established in prior research (Wilson & Sato, 2014), with focus on the association between adverse childhood experiences (ACEs; e.g., physical, sexual, emotional abuse) and increased risk for obesity in adolescents and young adults (Fuemmeler, Dedert, McClernon, & Beckham, 2009; Wells, Evans, Beavis, & Ong, 2010). For example, childhood sexual abuse has been related to increased risk of overweight and obesity in young adult men, and childhood physical abuse has been related to increased disordered eating in young adult women (Fuemmeler et al., 2009). Most prior studies of the association between childhood adversity and obesity have focused on severe and/or traumatic events, such as abuse or neglect, but less is known about the association between more commonly experienced stressful life events (e.g., changing schools, parental divorce) (Yeaworth, McNamee, & Pozehl, 1992) and weight-related outcomes in adolescence.

Multiple potential mechanisms for the association between stressful events in childhood and weight-related outcomes have been proposed (e.g., Davis, Barnes, Gross, Ryder, & Shlafer, 2019; Midei, Matthews, & Bromberger, 2010) with one such mechanism being psychological distress or internalizing symptoms. Depression has been linked to increased weight status, disordered eating patterns, and metabolic concerns in adolescents and adults (Luppino et al., 2010; Reeves, Postolache, & Spitker, 2008). Symptoms of depression mediate the association between adverse experiences and increased weight status in adult women (O'Neill et al., 2018). However, the potential mediating effect of depressive symptoms on the association between stressful events and weight-related outcomes during the developmental period of adolescence is unknown.

Examining links among stressful life events experienced, depressive symptoms, and obesity-related outcomes in a treatment-seeking sample of adolescents with overweight/obesity will

clarify the association between stressful life events and biological (i.e., insulin resistance, weight status) and behavioral aspects (i.e., eating behaviors) of obesity and provide preliminary data regarding whether this association may be mediated by depressive symptoms. The first aim of the present study was to examine the association between adverse events and weight-related outcomes in a sample of treatment-seeking adolescents with overweight and obesity. The second aim of the study was to examine the mediating effect of depressive symptoms on the association between stressful events in childhood and weight-related outcomes.

1. Method

1.1. Participants

Retrospective chart review identified 170 eligible adolescents (62% female; *M* age = 14.8 years) seen in a hospital-based adolescent weight management program between 2015 and 2019. Descriptive information about the sample is presented in Table 1. Clinic eligibility included being between the ages of 11–18 years, and BMI above the 85th percentile for age and sex. All adolescents that completed measures at baseline were eligible for the present study, however adolescents presenting with significant cognitive delay did not complete measures. Institutional Research Board approval was obtained prior to conducting this retrospective chart review.

1.2. Procedure

Adolescents' parents returned an informational packet containing background information prior to initial evaluation. Adolescents were requested to refrain from eating or drinking anything except for water starting at 10 pm prior to their morning time appointment, in order to obtain fasting bloodwork. Adolescents completed self-report questionnaires pertaining to negative life events, eating behaviors, and depressive symptoms on a tablet during their first appointment.

1.3. Measures

1.3.1. Demographic characteristics—Parents reported key demographic information including adolescents' age, race/ethnicity, and sex on a questionnaire submitted prior to the initial evaluation. Missing or incomplete demographic information was obtained from the electronic medical record.

1.3.2. Anthropometries—Adolescents' weight and height, wearing no shoes and light clothing, were measured using a calibrated digital scale and stadiometer by a trained medical assistant. Adolescent height and weight data were entered into the electronic medical record to calculate $\%BMI_{p95}$ (percent of the 95th percentile of BMI) using the CDC child and adolescent growth charts (Flegal et al., 2009). $\%BMI_{p95}$ has been identified as having strong relationships with other measures of adiposity in childhood for adolescents with severe obesity (Freedman et al., 2017).

1.3.3. Negative life events—The Adolescent Life Change Event Scale (ALCES) (Yeaworth, York, Hussey, Ingle, & Goodwin, 1980) is a 31-item self-report measure used to

determine the occurrence of specific stressful personal, social, and family events in an adolescen's life. For each event that an adolescent endorses, they are asked to indicate if it happened within the last year. Each event (e.g., "death of a parent" "sibling getting married") is weighted to reflect the severity of the event, accounting for the recency of the event (e.g., ever vs. past year). Individual event weights were summed to derive a composite score (Yeaworth et al., 1980). Both reliability and validity, including test-retest reliability (Basch & Kersch, 1986) as well as concurrent validity and content validity of the measure have been previously established (Yeaworth et al., 1992).

1.3.4 Disordered eating patterns—The Eating Disorder Examination Questionnaire (EDE-Q) (Fairburn & Beglin, 1994) is a well-validated self-report questionnaire (Luce & Crowther, 1999), assessing eating disorder attitudes and behaviors (e.g., "Over the past 4 weeks, how dissatisfied have you felt with your shape?"). Each item is rated on a Likert scale from 0 (no days/not at all) to 6 (every day/markedly). The EDE-Q contains four subscales (Restraint, Eating Concern, Shape Concern, and Weight Concern), as well as a global score reflecting the average of all four subscales (including 22 items from the overall measure). Cronbach's α in the present sample was 0.92 for the global score. The global score was used for subsequent analyses within the present study, with higher scores indicating greater symptomatology (Fairburn & Beglin, 1994).

1.3.5. Depressive symptoms—The Reynolds Adolescent Depression Scale-2 (RADS-2) (Reynolds, 2002) is a 30-item measure of depressive symptoms in adolescents. Items reflect four dimensions of depression: dysphoric mood, anhe-donia/negative affect, negative self-evaluation and somatic complaints (e.g., "I feel sad"). Items are rated on a 4-point Likert-type scale ranging from 1 (almost never) to 4 (most of the time). The RADS-2 has demonstrated good psychometric properties in previous research (Myers & Winters, 2002; Reynolds, 2002). Cronbach's α in the present sample was 0.94. Total RADS score was used as a continuous measure of depressive symptoms, with higher scores indicating greater depressive symptoms.

1.3.6. Insulin sensitivity—Clinical assays were used to obtain measurement of fasting glucose and fasting insulin. These were used to calculate the Quantitative Insulin Sensitivity Check Index (QUICKI) (Katz et al., 2000). This is a previously validated measure of insulin sensitivity that has been used to measure insulin resistance in adolescents, with lower values indicating increased insulin resistance (Conwell, Brown, Trost, & Batch, 2004). A subset of 63 adolescents were used in analyses of QUICKI values as other patients did not have data available to calculate QUICKI.

1.4. Analyses

Three regression models were run to examine the associations between stressful experiences and the three outcomes, weight status, disordered eating patterns, and fasting glucose level. These analyses were conducted controlling for age, race/ethnicity (non-Hispanic White vs. other), and sex due to prior research indicating that each of these is associated with weight-related outcomes. Power analyses indicate that a sample size of 68 individuals is appropriate to detect a moderate effect.

Three bootstrapped mediation models were examined for the three primary outcome variables: $\%BMI_{p95}$, fasting glucose level, and disordered eating symptomatology. Mediation was employed despite concerns related to cross sectional data to further understanding of these associations to potentially be tested in a longitudinal framework. Concerns are partially mitigated by the temporal association between life events (which presumably occurred prior to assessment) and other variables measured the day of assessment. The PROCESS macro for SPSS (Hayes, 2017) was employed to conduct mediation analyses, using bootstrapping. The current method overcomes limitations of the widely used Baron and Kenny model due to computation of the indirect effect, and elimination of unnecessary steps. (Hayes, 2009; Zhao, Lynch, & Chen, 2010) Specifically, the need for direct association between IV and DV is eliminated, as only the indirect effect is required to be significant in statistical mediation (Hayes, 2009; Zhao et al., 2010) Confidence intervals not containing zero indicate a significant mediation effect.

2. Results

2.1. Baseline characteristics of the sample

Analysis of baseline data revealed no significant demographic differences between adolescents with a QUICKI score ($n = 63$) and those without ($n = 107$). In regard to stressful experiences, only 4 adolescents indicated not experiencing any of the stressful events and 27 adolescents reported experiencing at least 10 of the stressful events. On average, teens reported experiencing 6.34 (SD = 3.16) of the stressful events measured.

2.2. Regression analyses

Stressful experiences during childhood were significantly related to $\%BMI_{p95}$, controlling for age, sex, and race/ethnicity. Similarly, stressful experiences were significantly associated with the EDE-Q total score, $F(4, 165) = 5.51$, $p < .001$, beyond age, sex, and race/ethnicity. Stressful experiences were not significantly related to adolescents' insulin resistance. Please see Table 2 for full regression results.

2.3. Mediation analyses

Depressive symptoms mediated the association between stressful experiences and disordered eating symptomology (b = 0.001, [CI = 0.0002, 0.0011]), explaining 23.7% of the variance in eating disorder symptoms. Depressive symptoms did not mediate the association between adverse experiences and weight status or insulin resistance.

3. Discussion

The present study extends prior literature by examining the relation between experienced stressful events and weight-related outcomes in adolescents presenting to weight management. Further, this study looked at depression as one potential mediator of these associations. Findings indicate that stressful experiences during childhood are related to both adolescent weight status and overall eating disorder symptoms. Depressive symptoms mediated this association for disordered eating symptomology, but not for weight status or insulin resistance. Interestingly, adolescents in the present study endorsed higher rates of

eating pathology as compared to a normative sample of adolescents (Mond et al., 2014), but lower than adults with obesity (Aardom, Dingemans, & Slof Op't Landt, 2012). This is consistent with prior work indicating treatment-seeking adolescents endorse high rates of eating pathology (Glasofer et al., 2007). Future research should consider specific adolescent eating outcomes (e.g., emotional eating, binge eating) related to stressful experiences during childhood.

This study extends work focused on the association between ACEs and weight status. In previous studies examining adverse experiences, a large proportion of adolescents did not experience serious adverse events, and less than half experienced multiple adverse events (Dube, Felitti, Dong, Giles, & Anda, 2003). Our findings suggest that more common stressful events may similarly be associated with development of disordered eating patterns in adolescents with overweight or obesity. The current study also extends previous work focused on eating in response to stressful experiences (Van Jaarsveld, Fidler, Steptoe, Boniface, & Wardle, 2009), by examining experienced stressful situations, rather than perceived stress.

Contrary to hypotheses, depression did not significantly mediate the association between stressful life events and adolescent weight status. One potential reason for this lack of association may be because the weight-related criteria for depression involves *either* significant gain or weight loss (American Psychiatric Association, 2013). However, this may also be due to the restricted weight status within the present sample. Findings from this study did not support the hypothesis that depression mediated the association between life events and insulin resistance. Future research may seek to clarify the latency between stressful experiences and manifestation of insulin sensitivity to better understand this potential association.

Limitations of the study include the cross-sectional design, with all measures collected at the first appointment of a weight management program. The directionality of the associations within the current study was posited in the context of prior literature, however due to the cross-sectional nature of the data, we are unable to confirm this directionality. It is possible that stress directly contributes to eating pathology, which in turn impacts depression. Additionally, the sample size for analyses of insulin resistance was limited and therefore it is difficult to know if the lack of associations is due to insufficient power, or no underlying associations. Finally, all adolescents included in the present study were presenting to a weight management program, which may be different than the general population of adolescents with overweight or obesity (Fox et al., 2018). It is unclear how these processes may be similar for non-treatment seeking adolescents with overweight and obesity.

The present study highlights potential clinical implications for providers working in adolescent weight management. Although the number of stressful events that an adolescent experiences cannot be changed, providers working in adolescent weight management programs should consider assessing a range of potentially stressful life events and being attuned to their possible weight-related implications. Ideally, assessment of stressful events can promote addressing and potentially preventing subsequent depressive symptoms which

may lead to a reduction in disordered eating behaviors before they become wellestablished behaviors that are resistant to change.

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Table 1

Descriptive characteristics of relevant variables (N = 170 unless otherwise noted).

Characteristic	N (or *Mean*)	% (or *SD*)
Biological sex		
Female	106	62.4%
Male	64	37.6%
Ethnicity		
Hispanic or Latino	68	40.0%
Not Hispanic or Latino	102	60.0%
Race		
White/Caucasian	82	48.2%
Black/African American	18	10.6%
Asian	2	1.2%
>American Indian/Alaskan Native	1	0.6%
Multiracial/Other[a]	67	39.4%
Age	*M* = 14.81	*SD* = 1.82
Weight status (%BMI_{p95})	*M* = 142.24	*SD* = 32.89
Overweight (85th–95th percentile)	7	4.1%
Class I Obesity (≥95th percentile)	42	24.7%
Class II Obesity (> 120% of the 95th percentile)	44	25.9%
Class III Obesity (> 140% of the 95th percentile)	77	45.3%
QUICKI (Insulin Sensitivity; *N* = 63)	*M* = 0.31	*SD* = 0.02
Disordered Eating Patterns (EDE-Q Total)	*M* = 2.28	*SD* = 1.23
Stressful Life Events (ALCES)	*M* = 391.80	*SD* = 201.21
Depressive Symptoms (RADS)	*M* = 58.66	*SD* = 15.98

SD = standard deviation; *M* = sample mean.

[a]Racial Category of “Multiracial/Other” includes individuals self-identifying as multiracial or a category not within the Census Bureau racial categories (e.g., “Portuguese”).

Table 2

Hierarchical multiple regression analyses predicting weight-related outcomes from adverse experiences during childhood.

Predictor	Outcome					
	Weight status (%BMI_{p95})		Disordered eating (EDE-Q)		Insulin sensitivity (QUICKI)	
	Δ*R* (Fontaine et al., 2003)	β	Δ*R* (Fontaine et al., 2003)	β	Δ*R* (Fontaine et al., 2003)	β
Step 1	0.01		0.04		0.01	
Age		0.06		−0.05		−0.02
Sex		0.08		−0.19		0.03
Race/Ethnicity		0.03		−0.05		−0.10
Step 2	0.05**		0.08***		0.00	
ALCES		0.24**		0.30***		−0.05
Total R^2	0.06		0.10		0.01	
n		170		170	63	

** $p < .01$.

*** $p < .001$.