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A Prospective Study of Loss of Control Eating for Body Weight Gain in Children at High Risk for Adult Obesity

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Abstract

Objective—Limited data suggest that disordered-eating may predispose children to excessive weight gain. We investigated the relationship between baseline responses to the Eating Disorder Examination adapted for Children (ChEDE) and change in BMI (kg/m²) in children at high risk for adult obesity.

Method—Children (6–12 years) were administered the ChEDE to assess loss of control (LOC) eating, dietary restraint, and eating, shape, and weight concern. Height and weight were measured at baseline and annually.

Results—Between July, 1999, and August, 2007, 772 measurements were obtained from 143 children over 4.5 ± 1.9 years. LOC eating predicted an increased rate of BMI growth over time ($p = .02$). Compared with children without LOC, those reporting LOC gained an additional mean 2.4 kg of weight per year.

Conclusion—LOC is a salient predictor of weight gain during middle childhood. Interventions that decrease LOC eating should be evaluated for their ability to prevent excessive pediatric weight gain.

Keywords

middle childhood; loss of control eating; disordered eating; weight gain; high risk

Introduction

Binge eating is defined as ingesting a large amount of food while experiencing a sense of loss of control (LOC) over eating.¹ Prospective studies support the importance of binge eating for predicting excessive gain in children and adolescents' weight^{2,3} and body fat.⁴ During middle childhood, however, the presence of LOC eating while eating appears to be more salient than the reported quantity of food consumed.⁵ The age of onset of LOC eating appears to be during

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middle childhood, with retrospectively self-reported means ranging from 8 years in a child sample⁶ to ~12 years of age in adult samples.^{7–10} Although there is no available study to date that describes the stability of LOC eating during middle childhood,¹¹ LOC eating at a single time-point has been shown to be associated with increased eating-related psychopathology and with excess body weight.⁵ The latter relationship may be the result of the difficulty in determining what constitutes a “large amount of food” in growing children.⁵ Further, children often report that LOC eating is associated with a decreased awareness while eating, potentially compromising recall of the amount of food consumed.¹² To date, no study has prospectively examined the impact of LOC eating on body weight gain. Further, none has made use of a full structured interview to assess predictor variables; rather, questionnaires, or partial interviews, have been utilized.^{2–4} Finally, there are few data regarding the association between disordered-eating attitudes and subsequent weight gain.⁴ Because constructs of disordered-eating attitudes (e.g., “weight concern”) have been demonstrated to predict eating disorder development,¹³ the impact of disordered-eating on weight gain also merits investigation.

We prospectively assessed the relationship of children’s LOC eating episodes, dietary restraint, and other disordered-eating attitudes, as determined by the Eating Disorder Examination¹⁵ adapted for Children (ChEDE),¹⁶ with weight gain. We hypothesized that LOC eating, dietary restraint, and weight concern at baseline would contribute to weight gain over time.

Method

Participants

A convenience sample of nontreatment-seeking participants was studied between July, 1999, and August, 2007. Questionnaire data from 93 participants were previously reported.⁴ Inclusion criteria required that all children were considered at increased risk for overweight in adulthood by virtue of their own overweight (BMI for age and sex ≥ 95 th percentile¹⁷ or their parents’ overweight (BMI > 25 kg/m²). No study participant was undergoing weight loss treatment. All also understood that they would not receive treatment as part of the study, but would be financially compensated for their participation. Participants were healthy, other than some being overweight, and medication-free for at least 2 weeks prior to baseline evaluation. Recruitment and assent/consent procedures are described elsewhere.^{4,18}

Procedures

Height and weight were measured, as previously described, at baseline¹⁸ and then annually. The ChEDE,¹⁶ a semistructured clinical interview, was administered in its entirety at baseline only to assess disordered-eating behaviors and attitudes. The ChEDE identifies objective binge episodes (OBE, overeating with LOC), subjective binge episodes (SBE, LOC eating without objective overeating), and objective overeating (OO, overeating without LOC) over the 28 days before assessment. The ChEDE generates four subscales: Restraint, Eating Concern, Shape Concern, and Weight Concern. ChEDE training, administration, and psychometrics are described elsewhere.¹⁸

Statistical Analysis

We employed a mixed model with fixed effects for the independent variables of interest, and child-specific random intercepts and slopes over time. BMI, as opposed to BMI *z*-score,¹⁷ was used as the outcome variable. BMI *z*-score, although useful for classifying children at a single point in time, is problematic for describing changes over time because within-participant variability in BMI *z*-score is related to baseline BMI *z*-score.^{19,20} Mixed-model analysis is appropriate for longitudinal studies with unbalanced follow-up times and can accommodate different lengths of follow-up as long as the length of follow-up does not depend on unobserved measurements.²¹ Based upon longitudinal studies,^{22,23} we included age at baseline, age-

squared, sex, race, socioeconomic status, pubertal stage, and time in the study as covariates. To address the extent to which BMI (and BMI change) varies between overweight and nonoverweight children with one or more overweight parents, we included parents' overweight status in the model. To consider the relative contributions of the eating-related variables in predicting growth in BMI, we included significant covariates and the variables of interest: LOC eating (OBEs and SBEs in the past month, categorical), and ChEDE Restraint and Eating, Shape, and Weight Concern subscales (continuous). Interactions between each variable and time in the study were assessed to identify covariates associated with rate of BMI change. Nonsignificant covariates and interactions were removed from the model. The child-specific random intercepts account for variability in baseline BMI, and the random slopes account for variability in rates of BMI change that are not explained by the independent variables of interest. The error structure included serial correlation with a power structure allowing the correlation to depend on the time interval between repeated observations on the same child. Model parameters were estimated by restricted maximum likelihood using SAS 9.0 (SAS Institute, Cary, NC). Confidence intervals were computed using approximate *t* statistics.

Results

Data were collected at baseline from 188 children. Forty-five were excluded from the present analyses because they did not return for follow-up. These children did not differ from the 143 studied (Table 1) with regard to BMI, BMI *z*-score, socioeconomic status,²⁴ sex or race, but were somewhat younger at baseline (9.7 ± 1.5 vs. 10.3 ± 1.5 years, $p = .05$). Nineteen children (13.3%) reported LOC eating in the month prior to assessment (9 with SBEs and 10 with OBEs). Twenty-nine (20.3%) reported OOs; the remainder reported neither overeating nor LOC eating. LOC eating and all ChEDE subscales were significantly correlated with one another and with BMI (r from .20 to .75; p from <.05 to .001).

Follow-up intervals ranged from 0.04 to 7.8 years (4.5 ± 1.9 years) with 772 measurements obtained. Number of visits ranged from 2 to 24 (median 4), with 75% of the children completing three or more visits and 25% completing seven or more visits. Children gained, on average, 6.3 kg (1.2 kg/m^2) per year. Accounting for within-participant correlations between yearly BMI, BMI throughout the study was significantly higher in children who were older at baseline (slope: 2.0; 95% confidence interval [CI]: 1.2–2.9), had higher ChEDE Restraint scores at baseline (slope: 1.7; CI: 0.27–3.1), and had higher Weight Concern scores at baseline (slope: 3.2; CI: 2.2–4.2). The rate of change of BMI over time was not associated with age at baseline, ChEDE Restraint, or Weight Concern. However, children with LOC eating experienced a significantly greater rate of BMI growth compared with children without LOC eating (LOC eating $\times$ years of follow-up interaction: +0.61; CI: 0.09–1.1; Table 2). Neither ChEDE Eating nor Shape Concern significantly contributed to the model. Children reporting LOC eating gained an unadjusted average of 1.7 BMI units per year compared with 1.1 BMI units for children without LOC eating.

The data were reanalyzed to determine whether OBEs, as opposed to SBEs, accounted for the finding that LOC eating predicted BMI growth. The unadjusted rate of BMI change over time was 1.7 for SBEs and 1.9 for OBEs ($p = .74$), compared with 1.1 for no eating episodes and OOs ($p = .84$). In this model, LOC eating and no-LOC eating children again differed with respect to change in BMI over time ($p = .01$).

Conclusion

In children (6–12 years) at high risk for adult obesity, LOC eating predicted a greater increase in BMI over time. None of the ChEDE subscales significantly predicted excess BMI growth.

The finding that childhood LOC eating, regardless of the reported amount of food consumed, is predictive of an increased rate of weight gain is novel and may have important implications. What constitutes a “large amount of food” is subjective and varies by age, making a definitive determination difficult in growing children. Further, many children report a sense of “numbing” when experiencing LOC eating,¹² possibly compromising recall of the amount eaten. We propose that identification of classic OBEs may not be necessary to diagnose children at risk of inappropriate weight gain. Healthcare providers may be able to direct interventions to youth reporting an inability to stop eating, regardless of the reported amount of food consumed, and thereby potentially decrease their risk for later obesity.

Contrary to prior reports,^{2–4,26} dietary restraint was not predictive of excessive weight gain. This result may reflect the use of interview methodology, and may help to clarify the seemingly contradictory prior findings that self-reported dieting predicts excess body weight and fat gain.^{2–4,26} The ChEDE Restraint subscale measures both behavioral and cognitive restriction. Some children may have been actually restricting their intake (behavioral restraint) while others were thinking about restricting or trying and failing (cognitive restraint), leading to variable outcomes. The finding that restraint was associated with higher BMI throughout the follow-up period supports the hypothesis that reported dieting may be a marker, rather than a cause, of overweight in youth.⁴

Strengths of this investigation include the use of a structured interview and measured heights and weights. Limitations include the relatively small sample, especially with regard to the subsample of children reporting LOC eating ($n = 19$), and the fact that children were not recruited in a population-based fashion. However, families were recruited for studies measuring plasma hormones, understood that they would not receive treatment, and did not have prior knowledge of the ChEDE contents. Thus, we believe this sample to be reasonably representative of the general population of children at high risk for adult obesity.

In conclusion, for children at high risk for adult obesity, those reporting LOC eating gain BMI more rapidly over time. Future investigation is necessary to determine if interventions aimed at reducing LOC eating during middle childhood are efficacious in the prevention of inappropriate weight gain.

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TABLE 1

Baseline characteristics ($N = 143$)

	Age: 6–8 years	Age: 9–10 years	Age: 11–12 years
N	29	64	50
Age (years)	8.3 ± 0.6	10.1 ± 0.6	11.9 ± 0.5
Sex	13.3% female	24.4% female	19.6% female
Race	9.1% African American 9.7% Caucasian 1.4% other	12.6% African American 30.1% Caucasian 2.1% other	11.2% African American 21.0% Caucasian 2.8% other
Socioeconomic status, ²⁴ median	3.0	3.0	3.0
BMI (kg/m^2)	20.6 ± 5.9	23.1 ± 7.6	24.8 ± 6.9
BMI z-score ^a	1.0 ± 1.3	1.2 ± 1.1	1.2 ± 1.0
Weight status			
<95th, nonoverweight	8.4% nonoverweight	16.8% nonoverweight	14.7% nonoverweight
≥ 95 th, overweight	11.9% overweight	28.0% overweight	20.3% overweight
Eating episode	1.4% OBE 1.4% SBE 1.4% OO 16.0% none	3.5% OBE 3.5% SBE 11.2% OO 26.6% none	2.1% OBE 1.4% SBE 7.7% OO 23.8% none
LOC eating in past month	2.9% LOC eating	7.1% LOC eating	3.6% LOC eating
ChEDE subscales ^b			
Restraint	0.39 ± 0.8	0.44 ± 0.8	0.51 ± 0.7
Eating Concern	0.11 ± 0.3	0.12 ± 0.3	0.05 ± 0.2
Shape Concern	0.50 ± 0.9	0.52 ± 0.9	0.60 ± 0.9
Weight Concern	0.58 ± 1.0	0.85 ± 1.2	0.79 ± 1.0

Notes: Values are means (SD) unless otherwise indicated. For socioeconomic status, higher numbers represent lower social status; range = 1–5. BMI: body mass index (kg/m^2) by measured height and weight. OBE, objective binge eating; SBE, subjective binge eating; OO, objective overeating without LOC eating.

^aBMI z-score: BMI accounting for age and sex according to Centers for Disease Control.^{17,25}

^bChEDE = Eating Disorder Examination adapted for Children; subscale scores range from 0 to 6.

TABLE 2

Mixed linear regression model for predicting BMI

Predictor variables	Adjusted Estimates in Model	Standard Error	DF	95% Confidence Intervals	p
Female sex	−0.41	0.89	136	(−2.17 to 1.34)	.64
Age	2.03	0.44	239	(1.2 to 2.90)	<.0001
Age ²	−0.05	0.02	225	(−0.09 to −0.02)	.001
Years of follow-up	0.47	0.33	175	(−0.18 to 1.1)	.15
LOC eating	2.0	1.32	137	(−0.59 to 4.63)	.13
ChEDE Restraint	1.70	0.72	134	(0.27 to 3.13)	.02
ChEDE Weight Concern	3.20	0.52	136	(2.18 to 4.22)	<.0001
LOC eating by years of follow-up	0.61	0.26	152	(0.09 to 1.14)	.01

Notes: Predictor variables, other than years of follow-up, were measured at baseline. LOC eating, loss of control eating; reference group = “never” category (zero). ChEDE = Eating Disorder Examination adapted for Children.