



Published in final edited form as:

Clin Obes. 2016 February ; 6(1): 68–72. doi:10.1111/cob.12127.

Eating Behaviors are Different in Youth with Obesity and Severe Obesity

Amy C. Gross, Ph.D.¹, Claudia K. Fox, M.D., MPH¹, Kyle D. Rudser, Ph.D.², Allison M.H. Foy, B.A.¹, and Aaron S. Kelly, Ph.D.^{1,3}

¹Department of Pediatrics, University of Minnesota Medical School, and University of Minnesota Masonic Children's Hospital, Minneapolis, MN

²Division of Biostatistics, School of Public Health, University of Minnesota, Minneapolis, MN

³Department of Medicine, University of Minnesota Medical School, Minneapolis, MN

Abstract

Objective—The study purposes were to: 1) investigate eating behaviors among patients in a pediatric weight management clinical practice, and 2) compare eating behavior phenotypes between children with severe obesity and obesity.

Method—This was a retrospective cross-sectional study using data collected during clinical encounters. Participants were included if they were 2-12 years old, had a BMI 95th percentile, and if a parent/guardian completed the Child Eating Behavior Questionnaire (CEBQ).

Results—Participants (n=149) were children with severe obesity (n=108) and obesity (n=41). The mean Satiety Responsiveness score was significantly lower for children with severe obesity than for children with obesity. Girls with severe obesity had significantly higher Enjoyment of Food and significantly lower Satiety Responsiveness and Slowness in Eating than girls with obesity.

Discussion—The findings demonstrate the potential clinical utility of the CEBQ for informing tailored treatment strategies through identifying eating behavior phenotypes.

Keywords

pediatric obesity; severe obesity; Child Eating Behavior Questionnaire

Introduction

Severe obesity, defined as BMI 120% of the 95th percentile or BMI 35 kg/m²¹, is the most rapidly growing pediatric obesity subgroup, and recent estimates suggest that this disease afflicts up to 6% of all children and adolescents in the United States². Compared to

Address for Correspondence: Amy C. Gross, Ph.D., University of Minnesota, Discovery Clinic, 2512 S 7th Street – 3rd Floor, Minneapolis, MN 55454, Phone: 612-624-9865, acgross@umn.edu.

Conflicts of Interest Statement

Dr. Kelly serves as a consultant for Takeda and Novo Nordisk but does not accept personal or professional income for his services. The authors have no additional conflicts of interest to report.

youth with BMIs in the obese range (i.e., BMI 95th percentile but less than 120% of the 95th percentile¹), those with severe obesity have higher rates of immediate and long-term metabolic and cardiovascular comorbidities¹. It stands to reason that youth with obesity and severe obesity may also differ in etiological factors, including psychosocial functioning and/or eating behaviors.

The Child Eating Behavior Questionnaire (CEBQ) is an assessment of eating styles which may be etiologically related to weight gain. Though the questionnaire developers acknowledge that obesity is genetically influenced, the CEBQ can be used to determine differences in eating styles that “could be part of the behavioural phenotype that mediates the genetically determined effects³.” The CEBQ is comprised of food approach scales (i.e., Food Responsiveness, Emotional Over-Eating, and Enjoyment of Food) and food avoidant scales (i.e., Satiety Responsiveness, Slowness in Eating, Emotional Under-Eating, and Food Fussiness). Prior research has demonstrated significant associations between adiposity and these scales, such that increasing weight or waist circumference is associated with increased scores on food approach scales and decreased scores on food avoidant scales, particularly Satiety Responsiveness and Slowness in Eating⁴⁻⁸. However, these studies generally used relatively small samples of children with obesity and most did not include children with severe obesity⁴. Further, these studies most commonly included community samples of children. Though some of the aforementioned studies included some participants from clinical populations⁵, to the authors’ knowledge, no study has evaluated children’s eating behaviors in a purely clinical sample of weight management treatment seeking youth with obesity and severe obesity. Identification of eating styles among treatment seeking youth may shed light on the etiology of a patient’s weight gain and inform the treatment approach. For example, an individual with low satiety might be treated behaviorally by learning acceptance or mindfulness techniques to tolerate feelings of hunger or pharmacologically to target homeostatic mechanisms of appetite regulation.

Given the paucity of research on eating behaviors of treatment seeking youth with obesity and the potential intervention implications, the purposes of this study were twofold: 1) to investigate eating behaviors among patients receiving care in a pediatric weight management clinical practice, and 2) to compare eating behavior phenotypes between children with severe obesity and obesity. The authors hypothesized that patients with severe obesity compared to obesity would have higher scores on the food approach scales and lower scores on the food avoidant scales.

Materials and Methods

Study Design and Participants

This was a retrospective cross-sectional study using data collected during routine clinical encounters. Participants were 2-12 year old children who were patients in the Healthy You! University of Minnesota Masonic Children’s Hospital Pediatric Weight Management Clinic during 2012 and 2013. Children were included if they had a BMI 95th percentile and if a parent/guardian completed the CEBQ as part of the intake protocol. Data were included from participants whose parents/guardians provided permission for use of medical records

for research. This study was approved by the University of Minnesota's Institutional Review Board.

Measures

The participants' BMI from the first clinical appointment was abstracted from the medical record. Trained rooming staff measured height and weight using standard clinical procedures, which was used to calculate BMI. Obesity was defined as BMI $\geq 95^{\text{th}}$ percentile but less than 120% of the 95th percentile (age and sex specific), and severe obesity was defined as BMI $\geq 120\%$ of the 95th percentile or BMI $\geq 35 \text{ kg/m}^2$, whichever is lower¹.

Parents/guardians of all patients were instructed to complete the CEBQ prior to the first clinical appointment. The CEBQ is a validated parent-report form of children's eating behaviors^{3,9}, and prior studies have used it to assess eating behaviors of children 2–12 years old^{3,5}. The CEBQ has 35 items that parents/guardians answer using a 5-point Likert scale (1=never to 5=always). The questionnaire includes food approach and food avoidant scales. The food approach scales used in this study included Food Responsiveness, Emotional Over-Eating, and Enjoyment of Food. The Food Responsiveness scale has 5 items that focus on appetite and external cues for food intake⁹ (e.g., "If allowed to, my child would eat too much"). The Emotional Over-Eating scale has 4 items that refer to increased consumption based on a negative emotional state (e.g., "My child eats more when anxious"). The Enjoyment of Food scale has 4 items related to desire to eat (e.g., "My child loves food"). The food avoidant scales included Satiety Responsiveness, Slowness in Eating, Emotional Under-Eating, and Food Fussiness. Satiety Responsiveness refers to perceiving fullness and ceasing eating upon recognizing the feeling (e.g., "My child gets full before his/her meal is finished"); this scale has 5 items. The Slowness in Eating scale has 4 items that describe the rate of consumption with higher scores on the scale indicating slower eating (e.g., "My child eats slowly"). The Emotional Under-Eating scale has 4 items related to consuming less when in a negative mood and more when in a positive mood (e.g., "My child eats less when angry" or "My child eats more when happy"). The Food Fussiness scale includes 6 items related to picky eating or hesitancy to try new foods (e.g., "My child refuses new foods at first").

Parents/guardians provided additional information regarding sex, ethnicity and socioeconomic status prior to the first clinical appointment. Proxy variables to identify socioeconomic status included indication of whether or not a child received free or reduced-price lunch at school, and the level of education of the parent/guardian, with higher education including any post-secondary training.

Data Analysis

For the CEBQ, mean scores for each scale were calculated. When a response to a question was missing, the average of complete responses within each scale was used as long as at least 75% of the questions within the scale had responses.

Descriptive statistics of patient characteristics were tabulated separately by group and included the mean and standard deviation for continuous variables and frequency for categorical variables. Adjusted ratios of mean scores between the groups with severe obesity and obesity were adjusted for age, sex, parent's highest level of education (beyond high

school/GED vs. not), and socioeconomic status (eligible for free/reduced school lunch vs. not). These were estimated using generalized linear regression with a log link and robust variance estimation for confidence intervals and P-values. Because prior studies showed differences in eating behaviors of boys and girls^{6,8}, adjusted ratios for each sex subgroup were estimated similarly, with an interaction. Results were considered statistically significant at $p < 0.05$. All analyses were conducted using R v3.1.1¹⁰.

Results

There were 149 participants, ages 2-12 years (mean 9.0 ± 2.5 years), included in the study (Table 1). Of these, 108 (72%) were categorized as having severe obesity and 41 (28%) as having obesity. There were 63 males (42%), including 48 (44%) with severe obesity and 15 (37%) with obesity. Eighty-six females participated (58%), which included 60 (56%) with severe obesity and 26 (63%) with obesity. For the overall sample, mean scores on individual food approach scales were generally higher than food avoidant scales. The one exception was that Food Fussiness had a mean score that was higher than Emotional Over-Eating. However, the emotionally related approach scale, Emotional Over-Eating, was higher than the emotionally related avoidant scale, Emotional Under-Eating.

The mean Satiety Responsiveness score for patients with severe obesity was 12% lower compared to patients with obesity [ratio of 0.88, 95% CI: (0.80, 0.96), $P=0.006$] when adjusting for age, sex, parent's highest education, and socioeconomic status (Table 2). Other CEBQ scales were not statistically significantly different between groups.

When differences between groups were evaluated by sex, there were statistically significant ratios of average scores among girls with severe obesity compared to obesity on the approach scale Enjoyment of Food [1.10 (1.01, 1.21), $P=0.031$], and avoidant scales Satiety Responsiveness [0.80 (0.71, 0.90), $P<0.001$] and Slowness in Eating [0.84 (0.71, 1.00), $P=0.047$] when adjusting for age, parent's highest education, and socioeconomic status (Table 3). Parents of girls with severe obesity reported 10% higher food enjoyment but 20% lower satiety and 16% lower slowness in eating (i.e., they reported eating faster) than parents of girls with obesity. There were no statistically significant differences in eating behaviors between boys with severe obesity and obesity. In an exploratory analysis, there was not a significant interaction with age for any of the CEBQ domains.

Discussion

This study showed that pediatric patients with obesity or severe obesity seeking medical weight management generally demonstrated greater food approach than food avoidant eating styles. Patients with severe obesity compared to obesity had significantly lower Satiety Responsiveness, suggesting they are less likely to respond to physical cues of fullness. Results also demonstrated significant differences for females; girls with severe obesity had greater Enjoyment of Food and lower Satiety Responsiveness and Slowness in Eating than girls with obesity.

Current findings are consistent with previous research showing negative relationships of Satiety Responsiveness with BMI and waist circumference^{4,6-8}. Prior studies have also

documented significant associations between Emotional Over-Eating and Slowness in Eating with BMI and waist circumference. Although the current results regarding Emotional Over-Eating and Slowness in Eating were not statistically significant, the difference between groups was of similar magnitude as Satiety Responsiveness. Unlike previous research, the current investigation found no significant findings related to Emotional Under-Eating, Food Responsiveness or Food Fussiness⁶⁻⁸. Furthermore, current results showed statistically significant differences in some of the eating behavior domains for females but not males. The differences between the findings in the current study and those reported in previous investigations may be due to differences in cohort composition. First, prior studies examined a range of children with normal weight status to obesity and excluded children with severe obesity, whereas the current study participants were children with obesity and severe obesity. Second, the current study was comprised of clinically referred patients as opposed to a community sample or combined community and clinical sample. Perhaps patients who are clinically referred to specialty weight management share similar eating behaviors regardless of weight status. That is, those that are referred may have environmental factors (e.g., motivation, prior experience with primary care intervention) or biological factors (e.g., medical comorbidities) that differ from a non-referred group which influence their eating behaviors.

To the authors' knowledge, this is the first study to compare eating behavior phenotypes between a purely clinical sample of children with obesity and severe obesity. As with any clinical sample, it is limited to those who present to clinic, in this case primarily children with severe obesity and relatively fewer with obesity. However, the variable eating styles found among this sample may have significant etiologic and treatment implications. It may be particularly important to examine eating styles of young girls in the clinical setting, as these seem most related to weight. The areas of food enjoyment, satiety, and eating speed may be specific targets of intervention. For example, a behavioral intervention may be used to decrease the rate of consumption for individuals who report increased eating speeds. Pharmacotherapy targeting specific eating behavior phenotypes may also be considered, such as medication that targets homeostatic mechanisms of appetite regulation for individuals endorsing low satiety responsiveness. Future studies will need to pursue these hypotheses further.

In conclusion, this study demonstrates the clinical utility of the CEBQ in terms of potentially identifying tailored treatment strategies for children with obesity and severe obesity seeking medical weight management. The findings highlight areas that may be important from an intervention standpoint, including notable differences in food enjoyment, satiety and eating speed, particularly for young girls.

Acknowledgments

AG, CF, and AK participated in study design, literature search, data interpretation, and writing of the manuscript; KR participated in study design, data analysis and interpretation, generation of tables, and writing of the manuscript; AF participated in literature search, data collection, and database management. All authors critically reviewed and approved the submitted manuscript.

This work was supported in part by funding from award UL1TR000114 of the NCATS.

References

1. Kelly AS, Barlow SE, Rao G, et al. Severe obesity in children and adolescents: Identification, associated health risks, and treatment approaches. A Scientific Statement From the American Heart Association. *Circulation*. 2013; 128:1689–1712. [PubMed: 24016455]
2. Skinner AC, Skelton JA. Prevalence and Trends in Obesity and Severe Obesity Among Children in the United States, 1999–2012. *JAMA Pediatr*. 2014; 168:561–566. [PubMed: 24710576]
3. Wardle J, Guthrie CA, Sanderson S, Rapoport L. Development of the Childrens' Eating Behaviour Questionnaire. *J Child Psychol Psychiatr*. 2001; 42:963–970.
4. Carnell S, Wardle J. Appetite and adiposity in children: Evidence for a behavioral susceptibility theory of obesity. *Am J Clin Nutr*. 2008; 88:22–29. [PubMed: 18614720]
5. Croker H, Cooke L, Wardle J. Appetitive behaviours of children attending obesity treatment. *Appetite*. 2011; 57:525–529. [PubMed: 21658420]
6. Santos JL, Ho-Urriola JA, Gonzalez A, et al. Association between eating behavior scores and obesity in Chilean children. *Nutrition J*. 2011; 10:306.
7. Viana V, Sinde S, Saxton JC. Children's Eating Behaviour Questionnaire: Associations with BMI and Portuguese children. *British Journal of Nutrition*. 2008; 100:445–450. [PubMed: 18275626]
8. Webber L, Hill C, Saxton JC, Van Jaarsveld CMH, Wardle J. Eating behaviour and weight in children. *Int J Obes*. 2009; 33:21–28.
9. Carnell S, Wardle J. Measuring behavioural susceptibility to obesity: Validation of the child eating behaviour questionnaire. *Appetite*. 2007; 48:104–113. [PubMed: 16962207]
10. A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2014. [computer program]

What is already known about this subject

- The Child Eating Behavior Questionnaire is used to measure eating styles in children.
- In non-clinical samples, there is a positive association between adiposity and food approach scales, for example Enjoyment of Food, and a negative association between adiposity and food avoidant scales, for example Satiety Responsiveness, on the Child Eating Behavior Questionnaire.

What this study adds

- In a weight management seeking clinical sample, youth with severe obesity compared to obesity had lower satiety scores.
- Girls with severe obesity compared to obesity had more food enjoyment, less satiety and faster eating.
- Identification of eating styles among patients in a pediatric weight management clinic may help identify etiology of obesity and inform intervention.

Table 1

Patient characteristics overall and by weight group. Values presented are mean (SD) or N (%) where indicated.

Covariate	Overall (N=149)	Obese (N=41)	Severe Obese (N=108)
Male	63 (42.3%)	15 (36.6%)	48 (44.4%)
Qualified for Reduced lunch	50.3%	18 (43.9%)	57 (52.8%)
- reduced lunch not reported	4 (2.7%)	1 (2.4%)	3 (2.8%)
Higher Education	79 (53.0%)	61.0%	54 (50.0%)
- higher education not reported	21 (14.1%)	7 (17.1%)	14 (13.0%)
White/Caucasian	70 (47.0%)	18 (43.9%)	52 (48.1%)
Non-Hispanic/Latino	66 (44.3%)	17 (41.5%)	45.4%
- ethnicity not reported	51 (34.2%)	15 (36.6%)	36 (33.3%)
Age (in years)	8.97 (2.47)	9.14 (2.38)	8.91 (2.51)
BMI	29.3 (5.77)	25.0 (5.8)	30.9 (4.88)
CEBQ			
- Food Responsiveness (FR)	3.44 (1.02)	3.29 (0.82)	(1.09)
- missing FR	4 (2.68%)	1 (2.44%)	3 (2.78%)
- Emotional Over-Eating (EOE)	2.67 (1.09)	2.46 (0.99)	1.11)
- missing EOE	4 (2.68%)	0 (0.0%)	4 (3.7%)
- Enjoyment of Food (EF)	4.13 (0.77)	4.03 (0.71)	0.79)
- missing EF	1 (0.67%)	1 (2.44%)	0 (0.0%)
- Satiety Responsiveness (SR)	2.23 (0.6)	2.36 (0.45)	0.64)
- missing SR	2 (1.34%)	0 (0.0%)	2 (1.85%)
- Slowness in Eating (SE)	2.13 (0.84)	2.27 (0.87)	2.08 (0.83)
- Emotional Under-Eating (EUE)	2.49 (0.81)	2.46 (0.82)	(0.82)
- missing EUE	8 (5.37%)	2 (4.88%)	6 (5.56%)
- Food Fussiness (FF)	2.89 (0.93)	2.8 (1.02)	0.89)
- missing FF	4 (2.68%)	2 (4.88%)	2 (1.85%)

Table 2

Ratio of CEBQ domain scores between severe obesity and obesity adjusted for age, sex, parent's highest level of education (beyond high school/GED vs. not), and socioeconomic status (eligible for free/reduced school lunch vs. not).

Domain	Model N	Ratio of Means: Severe Obese vs. Obese (95% CI)	P-value
Food Responsiveness	123	1.05 (0.95, 1.16)	0.298
Emotional Over-Eating	122	1.12 (0.97, 1.29)	0.126
Enjoyment of Food	126	1.06 (0.99, 1.13)	0.105
Satiety Responsiveness	124	0.88 (0.80, 0.96)	0.006
Slowness in Eating	126	0.87 (0.75, 1.02)	0.079
Emotional Under-Eating	119	1.06 (0.92, 1.21)	0.451
Food Fussiness	124	1.04 (0.91, 1.20)	0.530

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 3

Ratio of mean CEBQ domain scores between severe obesity and obesity for each sex adjusted for age, race, parent's highest level of education (beyond high school/GED vs. not), and socioeconomic status (eligible for free/reduced school lunch vs. not).

Domain	Group	Model N	Ratio of Means (95% CI)	P-value
Food Responsiveness	Females	123	1.11 (0.98, 1.25)	0.089
	Males		0.96 (0.81, 1.13)	0.586
Emotional Over-Eating	Females	122	1.14 (0.98, 1.33)	0.098
	Males		1.07 (0.80, 1.45)	0.637
Enjoyment of Food	Females	126	1.10 (1.01, 1.21)	0.031
	Males		0.97 (0.88, 1.07)	0.596
Satiety Responsiveness	Females	124	0.80 (0.71, 0.90)	<0.001
	Males		1.01 (0.88, 1.17)	0.841
Slowness in Eating	Females	126	0.84 (0.71, 1.00)	0.047
	Males		0.92 (0.68, 1.26)	0.611
Emotional Under-Eating	Females	119	1.03 (0.86, 1.22)	0.769
	Males		1.10 (0.87, 1.41)	0.424
Food Fussiness	Females	124	0.96 (0.82, 1.13)	0.659
	Males		1.22 (0.95, 1.57)	0.118