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Children's descriptions of the foods consumed during loss of control eating episodes *

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Abstract

Binge and loss of control (LOC) eating appear to be common among youth; however, little is known about the foods consumed during such eating episodes. Two-hundred forty-nine children, age 6–18 years, were interviewed to determine if they engaged in eating episodes with LOC over the past month. In the absence of reported LOC eating, overeating episodes or normal meals without LOC were recorded. Participants were asked to describe the type and quantity of foods eaten during an episode. Eighty-one children reported LOC eating episodes and 168 reported no such episodes (No LOC). Although total energy intake did not differ between LOC and No LOC episodes, LOC episodes consisted of a lower percentage of calories from protein (14.1 ± 0.7 v. $18.0 \pm 0.7\%$, $p < .001$) and a higher percentage from carbohydrates (49.7 ± 1.6 v. $45.2 \pm 1.1\%$, $p < .05$). Specifically, LOC episodes consisted of a higher percentage of calories from snacks (13.0 ± 2.7 v. $7.4 \pm 1.2\%$, $p < .05$) and desserts (17.9 ± 3.1 v. $12.8 \pm 1.5\%$, $p < .05$). The quality of LOC episodes may help explain why LOC eating promotes excessive weight gain among children who report such episodes.

Keywords

Child; Obesity; Binge and loss of control eating; Energy intake; Macronutrient intake

1. Introduction

A sizable percentage of youth report eating episodes during which they experience a loss of control (LOC) over eating. Studies report that between 10 and 30% of overweight children and adolescents endorse LOC eating (Decaluwe & Braet, 2003; Greenfeld, Quinlan, Harding,

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Glass, & Bliss, 1987; Isnard et al., 2003; Morgan et al., 2002; Tanofsky-Kraff, Faden, Yanovski, Wilfley, & Yanovski, 2005; Tanofsky-Kraff et al., 2004). Children who report binge eating, defined as eating an objectively large amount of food while experiencing LOC, are heavier and endorse more symptoms of anxiety and depression than those who do not binge eat (Decaluwe & Braet, 2003; Isnard et al., 2003; Johnson, Grieve, Adams, & Sandy, 1999). Furthermore, such children gain more weight and fat mass over time than youth who report no binge eating episodes (Field et al., 2003; Stice, Cameron, Killen, Hayward, & Taylor, 1999; Stice, Presnell, & Spangler, 2002; Tanofsky-Kraff et al., 2006). However, the mechanism by which LOC eating predicts weight gain remains unclear, given that episodes of LOC eating may not always contain more energy than episodes without LOC.

According to the DSM-IV-TR research criteria for binge eating disorder (American Psychiatric Association, 2000), binge eating occurs when an unambiguously large amount of food is ingested in concert with a sense of LOC while eating. The Eating Disorder Examination (EDE; Fairburn & Cooper, 1993) and the EDE adapted for children (Bryant-Waugh, Cooper, Taylor, & Lask, 1996) require conservative coding of an eating episode size, often minimizing the distinction between objective bulimic episodes (an “unambiguously large” amount of food with reported LOC) and subjective bulimic episodes (not “unambiguously large” amount of food with reported LOC) in children (Tanofsky-Kraff, in press). This potential lack of distinction may explain why, for young children, LOC while eating rather than the amount of food ingested appears to be the factor most often associated with increased eating-related emotional distress, increased general psychopathology (Tanofsky-Kraff et al., 2005), and greater body weight compared with those who do not report LOC episodes (Morgan et al., 2002; Tanofsky-Kraff et al., 2004). It has therefore been proposed that the research criteria for binge eating disorder in children exclude the requirement for eating an unambiguously large amount of food, but retain the criterion of LOC to define a binge episode (Marcus & Kalarchian, 2003).

Most of the aforementioned pediatric studies of LOC eating episodes have concentrated on the quantity of energy consumed, but have not analyzed the types of foods eaten during such episodes. The adult literature contains several self-report and laboratory studies of binge eating that include analyses of macronutrient content (Guss, Kissileff, Devlin, Zimmerli, & Walsh, 2002; Hetherington, Altemus, Nelson, Bernat, & Gold, 1994; Raymond, Neumeyer, Warren, Lee, & Peterson, 2003; Weltzin, Hsu, Pollice, & Kaye, 1991; Yanovski et al., 1992) and food types (Cooke, Guss, Kissileff, Devlin, & Walsh, 1997; Hadigan, Kissileff, & Walsh, 1989; Rosen, Leitenberg, Fischer, & Khazam, 1986). Some analyses of the macronutrient content of adults' reported binge episodes suggest that on days with binge episodes, obese individuals with binge eating disorder report consuming a lower percentage of calories from protein (Rossiter, Agras, Telch, & Bruce, 1992) and a higher percentage of calories from fat (Raymond et al., 2003; Rossiter et al., 1992; Yanovski & Sebring, 1994) than on days when no binge eating took place. Some, but not all studies examining intake under laboratory conditions (Cooke et al., 1997; Guss et al., 2002) have found that when participants are instructed to binge eat, obese adults with binge eating disorder (Yanovski et al., 1992) or normal weight adults with bulimia nervosa (Hetherington et al., 1994) consume meals with a higher percentage of energy from fat and less from protein than adults without binge eating symptomatology.

Prior studies of adults have also examined the types of foods ingested during binge episodes. Allison and Timmerman found that adults' binge episodes, as recorded in food diaries, were characterized primarily by high-fat meats, sweets, and salty snacks (Allison & Timmerman, in press). Several reports of women with bulimia nervosa have also found greater intake of snack foods and desserts during binge eating episodes (Hadigan et al., 1989; Kales, 1990; Rosen et al., 1986).

Similar studies examining the macronutrients and food types that comprise LOC eating episodes in children are limited. Morgan et al. found that 33 overweight, 6- to 10-year-old children who self-reported LOC eating episodes indicated that those episodes tended to consist of a smaller percentage of energy from protein than episodes described by 10 children who reported eating large amounts of food without LOC (Morgan et al., 2002). These data should be interpreted cautiously because only a small number of episodes were analyzed, and episodes were assessed via questionnaire rather than interview.

To our knowledge, no prior studies have examined the macronutrient content or the types of foods reported by children as ingested during LOC or binge eating episodes. A broader understanding of the variety of foods ingested during LOC episodes may offer parents and pediatric healthcare providers the opportunity to limit the availability of such foods or to teach children to consume them in moderation. Therefore, structured interviews were used to determine the presence of LOC eating episodes and to examine the macronutrient composition and food types of reported eating episodes in a large cohort of girls and boys. It was hypothesized that episodes during which LOC was reported would contain a higher percentage of energy from fat and a lower percentage from protein than episodes without LOC. Moreover, it was hypothesized that, similar to adults' reported binge eating episodes, children's LOC episodes would contain more snack and dessert foods than episodes without LOC.

2. Method

2.1. Participants

Subjects were 249² children and adolescents aged 6–18 years ($M \pm SD$; 12.2 ± 2.7 y) participating in non-intervention, metabolic protocols ($n=140$) or in obesity treatment studies ($n=109$). Youth in the non-intervention protocols were recruited through two waves of notices mailed to parents of 1st through 5th grade children in the Montgomery County and Prince George's County, Maryland school districts and by two mailings to local family physicians and pediatricians. This group was enriched with overweight (BMI, kg/m^2 , ≥ 95 th percentile for age and sex), but otherwise healthy, children by design. Recruitment and inclusion and exclusion criteria are described elsewhere (Tanofsky-Kraff et al., 2004). Adolescents seeking obesity treatment were recruited from two sources. A group of 74 overweight African American ($n=45$) and Caucasian ($n=29$) adolescents aged 12–17 years were assessed prior to entry into an obesity treatment program for adolescents with at least one obesity-related health comorbidity at the National Institutes of Health (Safety and Efficacy of Xenical in Children and Adolescents with Obesity-Related Diseases, 2005). Recruitment and inclusion and exclusion criteria for this study have been reported previously (McDuffie et al., 2002). The remaining 35 participants were healthy but overweight children aged 7–12 years who were assessed prior to entry into an obesity treatment study at the San Diego State University and University of California, San Diego (Childhood Obesity Treatment: A Maintenance Approach, 2005).

2.2. Procedure and assessment

All subjects received written explanations of the purposes, procedures, and potential hazards of the study prior to participation. Children provided written assent and parents gave written consent for participation, and all protocols were Institutional Review Board-approved.

The Eating Disorder Examination (EDE; $n=98$) version 12OD/C.2 (Fairburn & Cooper, 1993) or the EDE adapted for children (ChEDE; $n=151$; Bryant-Waugh et al., 1996) was

²Two-hundred fifty-one participants were interviewed. However, two subjects who met criteria for bulimia nervosa were excluded from the present analyses.

administered to each subject as previously described (Tanofsky-Kraff et al., 2004). On the basis of their responses to the EDE or ChEDE, participants were categorized as engaging in LOC episodes (children reporting objective or subjective bulimic episodes) or having no LOC episodes (children reporting objective overeating episodes—an unambiguously large amount of food without LOC—or episodes that involved neither LOC nor overeating). Children who engaged in more than one type of episode were categorized by the most pathological eating behavior described. Objective bulimic episodes were considered the most pathological, subjective bulimic episodes intermediate, and objective overeating the least pathological episode for the purposes of this study. A normal meal was recorded for children who reported none of these types of episodes.

Weight and height were measured as described previously (Nicholson et al., 2001) using calibrated electronic instruments. Body mass index (BMI, kg/m^2) standard deviation (BMI-Z) scores were calculated according to the Centers for Disease Control and Prevention 2000 standards (Kuczmarski et al., 2000).

2.3. Analysis of reported eating episodes

During the EDE or ChEDE interview, subjects were asked to describe the foods consumed during episodes with LOC, or if no such episodes occurred, episodes of overeating without LOC during the past month. When subjects reported no episodes with LOC and no episodes during which they overate, they were asked to describe their largest meal eaten over the past four weeks. In order to determine the amount of each food ingested, children were shown photographs depicting common foods with multiple portion sizes (Hess, 1997). Food descriptions and the amounts consumed were recorded. The energy and macronutrient content of each episode was analyzed using The Food Processor software (Version 7.82; ESHA Research, Salem, OR). In order to gain additional insight into children's food choices, foods were grouped into nine categories based upon Rosen et al. (1986): beverages; sauces, dressings and condiments; grains and cereals; fruits and vegetables; meat and protein; milk and dairy; snacks; desserts; and combination foods (e.g. pizza, hamburgers, or casseroles).

2.4. Statistical analysis

Comparisons between groups (LOC v. No LOC) were performed using analysis of covariance (ANCOVA). The logarithmic transformation of total calories and the square root arcsine of percent of total calories were used for analyses so that these data approximated a normal distribution. To determine relevant covariates, we entered age, race, socioeconomic status (SES; Hollingshead, 1975), sex, BMI-Z score and treatment-seeking status into each full model. Only BMI-Z score served as a significant covariate for any model. Means $\pm$ standard errors are reported, with means adjusted for ANCOVA models given where appropriate.

3. Results

Subject demographics are provided in Table 1. Based upon their EDE or ChEDE interviews, 19.7% ($n=49$) of children reported engaging in objective bulimic episodes, 12.9% ($n=32$) reported subjective bulimic episodes, 33.3% ($n=83$) reported objective overeating episodes, and 34.1% ($n=85$) of the children reported engaging in no such episodes over the past month. All episodes analyzed were reported as a meal or snack. For those children engaging in objective bulimic episodes over the past month, the reported frequency of episodes ranged from 1 to 40, with most children (63%) reporting only 1 such episode over the past month. Frequency of reported subjective bulimic episodes ranged from one to four in the past month, with 74% reporting only one subjective bulimic episode within the timeframe. Of those children engaging in objective overeating episodes, episode frequency ranged between 1 and 22 episodes, with 71% reporting one objective overeating episode. Three children reported no

episodes in the past month, but an objective bulimic episode in the past three months. Four children met strict DSM-IV-TR (APA, 2000) criteria for binge eating disorder.

A total of 81 children reported LOC episodes and 168 reported no such episodes. Subjects reporting LOC episodes were heavier ($p<.05$) and more likely to be seeking weight reduction treatment ($p<.05$) than those with no reported LOC.

3.1. Reported energy intake by LOC status

Total energy, macronutrient and food type intake are reported in Table 2. Reported energy intake (adjusted for BMI-Z score) did not differ between LOC episodes and No LOC episodes (1432 ± 104 kcal v. 1519 ± 84 kcal, respectively, $p=.43$). When eating episodes were compared by macronutrient composition, LOC episodes consisted of a lower percentage of calories from protein (14.1 ± 0.7 v. $18.0\pm0.7\%$, $p<.001$) and a higher percentage of calories from carbohydrate (49.8 ± 1.6 v. $45.2\pm1.1\%$, $p<.05$), but did not differ in percentage of calories from fat (37.1 ± 1.5 v. $37.5\pm0.9\%$, $p=.69$). In secondary analyses comparing those with LOC episodes to children with objective overeating ($n=83$) and no episodes ($n=85$), a main effect was found for the percentage of calories from protein ($F=8.6$, $p<.001$); following correction for multiple comparisons, children with LOC ingested significantly less protein ($14.5\pm0.9\%$) than those with objective overeating ($15.9\pm0.6\%$) and no episode ($19.2\pm1.1\%$). No differences were found between children with objective bulimic episodes ($n=49$) and subjective bulimic episodes ($n=32$) with regard to macronutrient content intake (data not shown).

Examining intake by the types of foods eaten, LOC episodes consisted of a higher percentage of energy from snacks (13.2 ± 2.7 v. $7.4\pm1.2\%$, $p<.05$) and desserts (18.1 ± 3.1 v. $12.8\pm2.2\%$, $p<.05$) than No LOC episodes. No other significant food type differences were found between LOC and No LOC episodes. In follow-up analyses, a main effect was found for the percentage of calories ingested from dessert foods ($F=6.0$, $p=.003$) in that those with LOC episodes ingested a significantly greater percentage of calories from dessert compared to children endorsing no episodes (21 ± 4.3 v. $9\pm1.9\%$), following correction for multiple comparisons. No differences were found between children with objective bulimic episodes and subjective bulimic episodes with regard to food type intake (data not shown).

4. Discussion

In this investigation of overweight and normal weight children's reported food intake, we found that children who described eating episodes during which they experienced loss of control reported eating relatively fewer calories from protein and more calories from carbohydrates during these episodes. When types of foods eaten were examined, children endorsing loss of control while eating reported consuming more snacks and desserts than those who described episodes with no reported loss of control.

Our finding that reported LOC eating episodes are comprised of less protein are consistent with the preliminary findings of Morgan et al of reported episodes in a sample of overweight children (Morgan et al., 2002) and with studies of adults with binge eating disorder (Raymond et al., 2003; Rossiter et al., 1992; Yanovski et al., 1992; Yanovski & Sebring, 1994) and bulimia nervosa (Gendall, Sullivan, Joyce, Carter, & Bulik, 1997; Hetherington et al., 1994). With regard to the types of foods ingested during LOC eating episodes, our data suggesting that children who report LOC ingest a greater percentage of their intake from dessert foods compared to children without LOC is also consistent with adult literature (Allison & Timmerman, in press; Hadigan et al., 1989; Kales, 1990; Rosen et al., 1986).

The nature of binge and LOC eating among children and adolescents may be in part illuminated by our finding that such eating episodes contain less protein and more carbohydrates, desserts

and snack foods than episodes without LOC. Episodes of LOC eating may occur more often outside of normal meal circumstances, such as during celebrations or at school or restaurants, when parents may have less ability to supervise eating habits and when more palatable foods may be available. Parents' restriction of their children's intake of palatable foods, such as desserts or high-fat snacks, may play a role in children's binge eating as well. Indeed, some research has suggested that perceived parental restriction of eating is associated with disinhibited eating when children are in the presence of palatable foods (Carper, Orlet Fisher, & Birch, 2000). Similarly, our finding that LOC episodes contained more snacks and desserts than No LOC episodes suggests that children and adolescents may experience LOC when consuming foods that are thought to be less healthy or "forbidden foods," which contain more fat and refined carbohydrates. Finally, the frequencies with which individuals ingest dessert-type foods have been found to be positively associated with body weight in children (Nicklas, Yang, Baranowski, Zakeri, & Berenson, 2003). Thus, our findings suggesting that LOC eating episodes contain a higher proportion of palatable foods with high energy density may serve as a mechanism for the excess weight and adiposity that have been identified in both cross-sectional (Ackard, Neumark-Sztainer, Story, & Perry, 2003; Field, Colditz, & Peterson, 1997; Morgan et al., 2002; Neumark-Sztainer et al., 1997; Tanofsky-Kraff et al., 2004) and prospective (Field et al., 2003; Stice et al., 1999; Stice et al., 2002; Tanofsky-Kraff et al., 2006) studies of children and adolescents who report binge eating. Indeed, participants in the present investigation who reported LOC episodes had significantly greater BMI-Z scores than those without such episodes.

Our finding that episodes of LOC eating did not differ from those without LOC with regard to total energy content was somewhat unexpected, particularly given the significant group differences in mean BMI-Z score. This finding may be the result of how children were grouped; those who described objective and subjective overeating LOC episodes were compared to children who did and who did not engage in overeating episodes, potentially minimizing the difference in caloric intake. The greater proportion of snack and dessert foods consumed during LOC episodes may be representative of an overall diet containing more energy-dense foods than the diet of children with no LOC episodes. Furthermore, the finding that LOC eating episodes contain less protein may also possibly contribute to weight gain. A diet lower in protein may be less satiating, causing children to consume more total energy throughout the day. Data suggest that subjects who consume a meal higher in protein report less hunger (Poppitt, McCormack, & Buffenstein, 1998) and that a diet higher in protein may increase satiety (Weigle et al., 2005) and decrease perceived hunger (Nickols-Richardson, Coleman, Volpe, & Hosig, 2005). However, given that the present investigation only examined one eating episode per subject as opposed to each child's daily dietary intake, this potential explanation should be interpreted cautiously and requires further exploration. Finally, systematic under-reporting of quantities consumed may also have affected the results. Heavier children have previously been shown to have greater error in reported energy intake (Bandini, Schoeller, Cyn, & Dietz, 1990). Accuracy of recall of energy consumed also decreases during adolescence (Bandini et al., 2003).

The present study is limited in that participants were not recruited in a population-based fashion. Families in the studied sample chose to respond to our notices and thus may be more health-conscious than the general population, limiting the external validity of the study. Similarly, the recent eating habits of treatment-seeking children and adolescents may also be distinct because such children have chosen to attempt weight loss. Furthermore, food descriptions were based upon child recall, which has been demonstrated to be imperfect (Bryant-Waugh et al., 1996). However, recall was bolstered by detailed review of the circumstances surrounding reporting eating episodes and the assistance of a book of photographed foods and portion sizes. Finally, we only assessed the reported food intake of one eating episode per child. Future investigations should include measurement of daily food

intake in addition to episodes of LOC in order to capture a broader understanding of the overall dietary consumption of children. Strengths include the use of interview methodology to establish the presence of disordered eating episodes, the relatively large and diverse sample, which included African American, Hispanic and Caucasian children, and the involvement of both normal weight and overweight participants.

In conclusion, children and adolescents who report episodes during which they report loss of control over their eating describe qualitatively different food intake during such episodes compared to youth who do not describe loss of control eating. These findings may help explain why children who report loss of control eating are heavier and potentially at risk for excessive weight gain.

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Table 1Sample demographics by LOC status^a

	Children reporting eating episodes with LOC (N=81)	Children reporting eating episodes without LOC (N=168)
Treatment-seeking (%)	56% *	38%
Age (y)	12.0 (2.7)	12.2 (2.6)
Sex	37% Male 63% Female	49% Male 51% Female
Race	54% White 38% Black 7% Other	55% White 40% Black 5% Other
BMI-Z ^b	2.0 (0.8) *	1.6 (1.1)
Overweight (%) ^c	73% *	57%

*
 $p < .05$.^aValues are expressed as frequency for categorical variables and mean (SD) for continuous variables.^bBMI, body mass index (a measure of weight in kilograms divided by the square of height in meters); BMI-Z is a standard deviation score for children's BMI accounting for age and sex, calculated according to a Centers for Disease Control formula (Kuczmarski et al., 2000).^cOverweight was defined as BMI $\geq$ 95th percentile for age and sex (Kuczmarski et al., 2000).

Table 2
Macronutrient and food type composition of reported eating episodes^d

	Episodes with reported LOC (N=81)	Episodes without reported LOC (N=168)
Total energy intake (kcal)	1425.9 (933.2)	1519.3 (1091.5)
Macronutrients (%)		
Protein	14.2 (6.1) **	18.0 (9.0)
Carbohydrates	49.8 (14.8) *	45.2 (14.5)
Fat	37.1 (13.9)	37.5 (11.8)
Food types (%)		
Beverages	2.4 (6.1)	4.4 (8.3)
Sauces, dressings and condiments	2.1 (5.3)	2.0 (5.1)
Grains and cereals	16.0 (27.8)	10.3 (19.5)
Fruits and vegetables	4.4 (12.3)	4.3 (9.9)
Meat and protein	13.6 (22.6) ***	20.7 (26.6)
Milk and dairy	1.1 (5.0)	1.6 (5.4)
Snacks	13.2 (24.2) *	7.4 (15.9)
Desserts	18.1 (28.0) *	12.8 (19.7)
Combination foods	29.2 (32.8)	36.5 (34.1)

*
 $p < .05$.

**
 $p < .001$.

 $p = .06$.

^d Values are expressed as mean (SD).