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A laboratory-based study of mood and eating behavior in overweight children

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A LABORATORY-BASED STUDY OF MOOD AND EATING BEHAVIOR IN OVERWEIGHT CHILDREN

by

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ABSTRACT OF THE DISSERTATION

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Loss of control over eating refers to the sense that one cannot control what or how much one is eating. Loss of control eating is prevalent among overweight children and is associated with psychosocial impairment. Self-report data suggest that pediatric loss of control eating may be related to the experience of aversive emotions, with investigators theorizing that loss of control eating is a maladaptive means of alleviating negative mood. However, these data need to be substantiated using more objective methodology. The current study utilized a feeding laboratory paradigm to further explore the relation between mood and eating in 46 overweight girls with (LOC+; *n* = 23) and without (LOC-; *n* = 23) loss of control eating problems. Girls underwent two separate experimental mood manipulations during which they viewed either a sad or neutral film segment. Following each mood induction, girls ate *ad libitum* from a multi-item meal. LOC+ girls did not consume more food, as measured in either kilocalories or grams, after a sad mood induction relative to a neutral mood induction. However, LOC+ girls consumed a greater percentage of kilocalories from fat after a sad mood induction relative to a neutral mood induction. Negative mood on the day of the sad mood induction significantly predicted the likelihood of LOC+ girls reporting loss of control during the subsequent test meal. Contrary to expectation, there was a trend towards an interactional effect of loss of control status and mood condition on food intake in grams,

such that LOC- participants tended to consume a larger volume of food in the sad condition relative to the neutral condition, whereas LOC+ girls ate a similar volume of food regardless of mood condition. Mood improvements subsequent to the sad condition test meal were observed in the full sample. Results suggest that emotional eating episodes in children reporting loss of control eating problems may be best characterized by a subjective sense of loss of control as opposed to consumption of large amounts of food. Interventions addressing affect regulation and coping in at-risk youth may help minimize the negative sequelae associated with pediatric loss of control eating.

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Introduction

Pediatric obesity has reached epidemic proportions in the past several decades, with recent estimates suggesting that up to 17% of children and adolescents in the United States are overweight or obese (Ogden et al., 2006). In addition to myriad physical health sequelae (Dietz, 1998), pediatric obesity is associated with a host of psychosocial problems (Strauss & Pollack, 2003) including eating pathology (Goldschmidt, Passi Aspen, Sinton, Tanofsky-Kraff, & Wilfley, 2008). In particular, loss of control eating (i.e., eating that is characterized by the sense that one cannot control what or how much one is eating) is a prevalent behavior among overweight youth that is marked by physical morbidity and reduced psychosocial functioning (Goldschmidt & Wilfley, 2009; Tanofsky-Kraff, 2008), as well as increased risk for excess weight gain (Tanofsky-Kraff, Yanovski et al., 2009). Loss of control eating represents a potential point of intervention for preventing the long-term negative consequences associated with chronic obesity and disordered eating; however, little is known about the nature and proximal triggers of loss of control eating episodes in pediatric populations.

Loss of control eating has been associated with increased negative affect in both cross-sectional and prospective studies of children. However, no objective data exist to support a direct causal link between aversive affective states and episodes of loss of control eating. The current study was designed to investigate the following hypotheses: (a) that a negative mood induction will result in greater food intake than a neutral mood induction among overweight children with loss of control eating problems; (b) that there will be an interaction between loss of control eating status and mood condition, such that children with loss of control eating problems will consume more food subsequent to a negative versus neutral mood induction, whereas children without loss of control eating problems will consume similar amounts of food across negative and neutral mood conditions; and (c) that eating will result in a reduction of negative affect for children with

loss of control eating but not for children without loss of control eating, consistent with affect regulation theories of binge eating. To test these hypotheses, quantitative and qualitative aspects of the eating behavior of overweight children endorsing loss of control eating were compared to those of overweight children not endorsing loss of control eating subsequent to viewing a sad versus neutral film.

To establish the need for such a study, this introductory section first describes the problem of loss of control eating in children, highlighting the need for further research into this problematic eating behavior given its association with considerable medical and psychiatric morbidity. Next, the literature concerning affective states involved in loss of control and binge eating among both children and adults is reviewed, with particular attention to negative mood states. The introduction will then discuss why the laboratory represents an ideal setting for the current study by summarizing the findings of laboratory-based feeding studies as yet completed in individuals with loss of control and binge eating problems and how these studies have contributed to our understanding of loss of control and binge eating behavior. This summary will include studies examining binge eating disorder (BED) as well as bulimia nervosa (BN), because both disorders are characterized by binge eating; in addition, many aspects of binge eating have not yet been explored in BED because it is a relatively new diagnosis. The introduction will conclude with a description of the aims and hypotheses of the current study, as well as a review of how this research will contribute to clinical science in general and the fields of pediatric loss of control eating and obesity specifically.

Definition of Loss of Control and Binge Eating

Binge eating is the key behavior characterizing BED and BN, two eating disorders marked by considerable physical and psychosocial impairment (Hudson, Hiripi, Pope, & Kessler, 2007). Binge eating refers to “eating, in a discrete period of time (e.g.,

within any 2-hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances, accompanied by a sense of lack of control over eating during the episode (i.e., a feeling that one cannot stop eating or control what or how much one is eating)" (American Psychiatric Association, 1994). Three discrete forms of aberrant eating, marked by the presence or absence of loss of control and the consumption of objectively large amounts of food versus smaller amounts of food, have been highlighted among investigators for their empirical and clinical utility: (1) Objective binge eating is characterized by consumption of an unambiguously large amount of food, accompanied by loss of control while eating; (2) subjective binge eating is characterized by consumption of an amount of food that is *not* unambiguously large, but is perceived as large by the respondent, accompanied by loss of control while eating; and (3) objective overeating is characterized by consumption of an unambiguously large amount of food in the absence of loss of control while eating (Fairburn & Cooper, 1993).

There is currently a lack of consensus in the literature as to whether the amount of food eaten or the presence of loss of control is the crucial feature of binge eating that most strongly predicts increased distress and impairment in BN and BED (E. M. Pratt, Niego, & Agras, 1998; Rosen, Leitenberg, Fisher, & Khazam, 1986). Currently, recurrent objective binge eating is required for a diagnosis of BN or BED; however, some data show that adults reporting objective binge eating and those reporting subjective binge eating are indistinguishable on measures of distress and impairment (Jansen, Van den Hout, & Griez, 1990; Keel, Mayer, & Harnden-Fischer, 2001; Latner, Hildebrandt, Rosewall, Chisholm, & Hayashi, 2007; Mond et al., 2006). Moreover, adults appear to consider loss of control the most salient feature of binge eating (Beglin & Fairburn, 1992; E. M. Pratt, Niego, & Agras, 1998; Telch, Pratt, & Niego, 1998). Similarly, among children and adolescents, the presence of loss of control appears to be a reliable marker

of additional eating-related and general psychopathology, independent of episode size (Ackard, Neumark-Sztainer, Story, & Perry, 2003; Goldschmidt, Jones et al., 2008). Further, eating episodes of children with and without loss of control eating problems appear to be qualitatively different in terms of their dietary composition (Mirch et al., 2006; Tanofsky-Kraff, McDuffie et al., 2009) and affective correlates (Tanofsky-Kraff, Goossens et al., 2007; Tanofsky-Kraff, Theim et al., 2007). Taken together, these findings provide empirical support for studying loss of control eating episodes (i.e., objective and subjective binge eating) as a composite variable in youth.

Correlates of Loss of Control and Binge Eating in Youth

Although loss of control eating is endorsed by children across the weight spectrum, overweight (body mass index [BMI; weight in kg/height in m^2] between the 85th and 95th percentile for age and sex) and obese (BMI greater than the 95th percentile for age and sex) children are significantly more likely than their normal weight peers to engage in loss of control eating (Allen, Byrne, La Puma, McLean, & Davis, 2008; Field et al., 1999; Neumark-Sztainer, Story, French, & Resnick, 1997; Neumark-Sztainer, Story, Hannan, Perry, & Irving, 2002; Shisslak et al., 1998; Tanofsky-Kraff et al., 2004). The prevalence of this behavior appears to increase in proportion to the degree of overweight (Boutelle, Neumark-Sztainer, Story, & Resnick, 2002) and with age (Field et al., 1999). Up to 30% of overweight and obese children and adolescents report occasional or recurrent loss of control eating episodes (Ackard et al., 2003; Allen et al., 2008; Berkowitz, Stunkard, & Stallings, 1993; Britz et al., 2000; Decaluwe, Braet, & Fairburn, 2003; Eddy et al., 2007; Glasofer et al., 2006; Goossens, Braet, & Decaluwe, 2007; Isnard et al., 2003; Levine, Ringham, Kalarchian, Wisniewski, & Marcus, 2006; Tanofsky-Kraff, Faden, Yanovski, Wilfley, & Yanovski, 2005; Tanofsky-Kraff et al., 2004). Loss of control eating has been linked to excessive weight and/or body fat in both cross-

sectional (Tanofsky-Kraff et al., 2005) and prospective studies (Field et al., 2003; Tanofsky-Kraff et al., 2006; Tanofsky-Kraff, Yanovski et al., 2009). It also has been identified as a risk factor for obesity (Stice, Presnell, & Spangler, 2002), perhaps indirectly contributing to the numerous negative medical sequelae associated with overweight and obesity in children (e.g., Dietz, 1998).

Loss of control eating in children has been associated with a host of psychosocial problems. A number of studies report significantly greater eating-related and general psychopathology among children and adolescents endorsing loss of control eating as compared to their peers (Decaluwe & Braet, 2003; Goossens et al., 2007; Hilbert & Czaja, 2009; Isnard et al., 2003; Morgan et al., 2002; Tanofsky-Kraff et al., 2004). Specifically, studies have documented that children reporting loss of control eating exhibit greater levels of anxiety, depression, body image dissatisfaction, and behavioral problems than those without loss of control eating (Decaluwe et al., 2003; Hilbert & Czaja, 2009; Morgan et al., 2002; Tanofsky-Kraff et al., 2004). Adolescent loss of control eating also is associated with greater depressive symptoms, body dissatisfaction, substance abuse, and low self-esteem (Ackard et al., 2003; Berkowitz et al., 1993; Fulkerson, Sherwood, Perry, Neumark-Sztainer, & Story, 2004; Johnson, Grieve, Adams, & Sandy, 1999; Ledoux, Choquet, & Manfredi, 1993; Moyer, DiPietro, Berkowitz, & Stunkard, 1997; Ross & Ivis, 1999), as well as other unhealthy weight-related behaviors such as skipping meals and dieting (Ackard et al., 2003; French, Story, Downes, Resnick, & Blum, 1995; Ledoux et al., 1993), possibly indicating a chronic cycle of restrictive dieting and loss of control eating as posited by restraint theory (Polivy & Herman, 1985). Loss of control eating shows a stronger association with these symptoms than does simple overeating (Ackard et al., 2003; Goldschmidt, Jones et al., 2008), again suggesting that loss of control may be a more important marker of pathology than the consumption of unambiguously large amounts of food.

The psychopathology associated with loss of control eating in youth may be related to the frequency and recency of reported eating episodes. A study of overweight adolescents aged 12 to 17 years (Glasofer et al., 2006) found that the severity of eating-related and general psychopathology (i.e., depressive symptoms, anxiety, behavioral problems) rose in proportion to the severity of loss of control eating problems. That is, adolescents reporting binge eating at a severity level warranting a BED diagnosis (i.e., at least two episodes of objective binge eating per week for a 6-month period) endorsed the highest levels of eating-related and general psychopathology, followed by, in descending order, those with recent but less frequent episodes of objective binge eating (i.e., 1 to 13 episodes in the past 3 months); those with a distal history of loss of control eating episodes, with or without overeating (i.e., objective or subjective binge eating, respectively, occurring greater than 3 months before assessment); and those with no history of loss of control eating episodes. Another study among children aged 8 to 13 years (Hilbert & Czaja, 2009) found that those reporting a high frequency of loss of control eating (i.e., an average of 33 loss of control eating episodes over the past 3 months) exhibited more pathological eating behavior and higher levels of eating-related psychopathology than those reporting a low frequency of loss of control eating (i.e., an average of four loss of control eating episodes over the past 3 months). Thus, it appears that not only the presence of loss of control eating, but also the timing and recurrence of aberrant eating episodes, may be useful markers of additional forms of psychopathology.

Aside from predicting the onset of obesity, as previously mentioned (see p. 9), loss of control eating in children may also be a risk factor for the development of a full-syndrome eating disorder. Although there are currently no longitudinal data examining the impact of pediatric loss of control eating on later development of an eating disorder, several studies have shown that eating disorder symptoms in childhood and

adolescence tend to persist into adulthood and may predict the onset of full-syndrome eating disorders (Attie & Brooks-Gunn, 1989; Kotler, Cohen, Davies, Pine, & Walsh, 2001; Marchi & Cohen, 1990). Furthermore, retrospective studies indicate that, compared to those who initiated binge eating in adulthood, adults with BED whose binge eating problems began during childhood also report an earlier onset of BED and overweight (Abbott et al., 1998; Grilo & Masheb, 2000; Spurrell, Wilfley, Tanofsky, & Brownell, 1997); endorse greater eating disorder and general psychopathology (Marcus, Moulton, & Greeno, 1995); and tend to exhibit greater negative emotionality, although only at a trend level (Binford, Pederson Mussell, Peterson, Crow, & Mitchell, 2004). Thus, it is appears that loss of control and binge eating behaviors originating in childhood may lead to greater severity of eating disorder symptoms later in life, including full-syndrome eating disorders.

There is evidence that binge eating in adulthood adversely affects the outcome of weight-loss treatment, both in terms of adherence and long-term weight loss (de Zwaan, Nutzinger, & Schoenbeck, 1992; Kalarchian et al., 2002; Keefe, Wyshogrod, Weinberger, & Agras, 1984; Marcus, Wing, & Hopkins, 1988; Sherwood, Jeffery, & Wing, 1999; Yanovski, Gormally, Lesser, Gwirtsman, & Yanovski, 1994). There is, however, a paucity of similar research with children. This is an area greatly in need of research given the adverse health consequences associated with childhood obesity (Dietz, 1998), and the tendency of childhood obesity to track into adulthood (Freedman et al., 2004; Guo, Roche, Chumlea, Gardner, & Siervogel, 1994; Guo, Wu, Chumlea, & Roche, 2002). In one recent study among overweight children and adolescents aged 7 to 17 years (Braet, 2006), baseline global eating disorder symptoms were found to be a negative prognostic indicator of weight loss subsequent to inpatient pediatric weight-loss treatment. This was in spite of the sustained reductions in binge eating and eating disorder symptoms achieved in treatment. However, loss of control eating was not

specifically explored as a predictor of weight loss outcomes. In a more recent study, Goldschmidt, Stein et al. (2007) found no impact of loss of control eating on family-based weight loss treatment outcome; however, those findings are limited by a very small sample size. Another study using a family-based treatment approach for overweight and obese children aged 8 to 13 years (Levine et al., 2006) found that participants reporting subjective binge eating did not significantly differ from those who did not report aberrant eating in terms of amount of weight lost. These findings are difficult to interpret given the higher drop-out rates among children reporting subjective binge eating (50% attrition) compared to those not reporting subjective binge eating (30% attrition). Additionally, no children in the sample reported objective binge eating, precluding conclusions about the role of episode size, combined with loss of control, in weight loss treatment outcome. Nevertheless, these latter findings suggest that the presence of loss of control eating problems may impact weight loss treatment, albeit perhaps indirectly through increased attrition. Clearly additional research is needed to elucidate the effects of loss of control eating on pediatric weight-loss treatment outcome to determine whether children with loss of control eating problems require different or additional care.

In summary, loss of control eating in youth is associated with impairment across a number of psychosocial domains as well as with overweight and obesity, marking it as a significant health problem warranting clinical and empirical attention. Despite these findings, very little research has examined treatments for loss of control eating in youth (M. Jones et al., 2008; Tanofsky-Kraff, Wilfley et al., 2007). Interventions addressing binge eating in adults often target proximal triggers for binge eating episodes (e.g., dieting, interpersonal distress; Wilfley, 2002). Whether similar interventions could impact loss of control eating among youth first requires identification of triggers for loss of control eating that are relevant to this younger age group. As such, additional research is

needed to clarify the nature and antecedents of loss of control eating in youth to inform prevention and treatment options that may minimize the risk of further harm to individuals endorsing such behavior.

The Role of Negative Affect in Loss of Control and Binge Eating

The Affect Regulation Model

Negative affect is believed to play a key role in loss of control eating among both children and adults. Theoretically, binge eating has been viewed as a maladaptive method of affect regulation. For example, binge eating may provide a distraction from external stressors by aiming cognitive resources away from aversive emotions and toward eating-related stimuli (Heatherton & Baumeister, 1991), or enable a "trade-off" whereby aversive emotions preceding binge eating (e.g., anger) are replaced by less aversive emotions subsequent to binge eating (e.g., guilt; Kenardy, Arnow, & Agras, 1996). In basic behavioral terms, eating has been shown to stimulate the reward systems of the brain, including the dopaminergic, serotonergic, and opioidergic systems, resulting in mood improvements and overall reductions in negative affect (e.g., stress, irritability; see Gibson, 2006 for a review). Repeated pairings of eating and distress relief may cause some vulnerable individuals to rely on food for its mood-improving properties, contributing to the onset and/or maintenance of binge eating problems.

Affect regulation theory generally includes an allusion to dietary restraint as playing a key role in the choice of eating as the mode of modulating affect. In this model, physiological and psychological deprivation arises as a consequence of food restriction, that is, avoiding certain types of food, limiting the amount of food consumed, and/or abstaining from eating for long periods of time. Binge eating is presumed to occur as a response to this deprivation, subsequent to cravings and/or perceived lapses in dietary restraint (e.g., the dieter feels that he or she has already "blown it" by breaking a self-

imposed dietary rule, so he or she binges before re-initiating strict dietary limitations; Polivy & Herman, 1985). This model appears relevant to a subset of binge eaters, particularly those with BN, whose dieting usually precedes their binge eating in the onset of the disorder (Brewerton, Dansky, Kilpatrick, & O'Neil, 2000; Bulik, Sullivan, Carter, & Joyce, 1997; Haiman & Devlin, 1999). However, approximately half of individuals with BED report binge eating prior to their first attempts at dieting (Abbott et al., 1998; Grilo & Masheb, 2000; Manwaring et al., 2006; Spurrell et al., 1997), and in one study only 8.7% of weight loss treatment-seeking individuals with BED reported being on a strict diet when their binge eating problems began (Wilson, Nonas, & Rosenblum, 1993). Thus, dieting may not play as central a role in BED as it does in BN.

Further, the role of dieting in the binge eating behaviors of children has been considered questionable (Marcus & Kalarchian, 2003). Although a significant proportion of children endorsing loss of control eating also report dieting to lose weight, this may be a function of their higher rates of overweight. Several studies have reported no differences between overweight children with and without loss of control eating in rates of dieting (Claus, Braet, & Decaluwe, 2006; Decaluwe & Braet, 2003; Decaluwe et al., 2003; Glasofer et al., 2006; Morgan et al., 2002). Tanofsky-Kraff et al. (2005) found that approximately 80% of overweight children with loss of control eating had dieted in their lifetime; however, only 33% reported dieting before engaging in loss of control eating, whereas 66% reported that loss of control eating occurred prior to dieting, and 66% also reported becoming overweight before either dieting or engaging in loss of control eating. More recent qualitative data show that only approximately 10% of children had eaten a forbidden food and only approximately 30% had been restricting their food intake prior to an episode of loss of control eating (Tanofsky-Kraff, Goossens et al., 2007). Similarly, there is evidence that individuals with BED whose binge eating began in childhood are more likely than those whose binge eating began in adulthood to report that their first

episode of binge eating occurred prior to their first diet (Marcus et al., 1995). These data suggest that dieting may be a function of overweight and/or binge eating, rather than a cause of such problems, and that the role of dietary restraint in binge eating may be one of maintenance rather than causality. Because of these limited data supporting dietary restraint as a proximal antecedent to loss of control eating in youth, dietary restraint will not be a focus of the current study.

Support for the Affect Regulation Model in Adults

The affect regulation model of binge eating has been supported by both self-report and experimental data in studies of adults. Negative emotions, including sadness, anger, hopelessness, and worry, have been identified as frequent antecedents to binge eating in individuals with recurrent binge eating problems (Abraham & Beumont, 1982; Arnow, Kenardy, & Agras, 1992; Cooper & Bowskill, 1986; Davis, Freeman, & Solyom, 1985; Greeno, Wing, & Shiffman, 2000; Johnson, Schlundt, Barclay, Carr-Nangle, & Engler, 1995; Schlundt, Johnson, & Jarrell, 1985; Stickney & Miltenberger, 1999). Telch et al. (1998) found that one-third of women with BED considered eating to relieve negative affect as a key criterion in defining a binge. Negative affect also appears to distinguish binge eating from non-binge eating individuals, in that those with binge eating problems report negative emotions to be more distressing and to occur more frequently than do controls, both in relation to and outside of binge eating episodes (Greeno et al., 2000; Kenardy et al., 1996; Wolff, Crosby, Roberts, & Wittrock, 2000). Furthermore, among individuals with binge eating problems, higher levels of negative affect are predictive of more severe binge eating problems (Henderson & Huon, 2002). These findings are corroborated by laboratory-based data, which suggest that induction of a negative mood predicts greater likelihood of engaging in loss of control or binge eating in obese adults (Agras & Telch, 1998; Chua, Touyz, & Hill, 2004; Telch & Agras, 1996a).

Further support for the affect regulation model comes from evidence suggesting that binge eating may serve to modulate negative affect (Deaver, Miltenberger, Smyth, Meidinger, & Crosby, 2003; Stein et al., 2006; Stickney, Miltenberger, & Wolff, 1999). Currently, the literature is mixed regarding the timing of distress relief. Some studies have reported a decrease in negative emotions from the onset to termination of a binge episode (Stickney et al., 1999), while others have found a pattern whereby negative emotions are alleviated during the binge but rebound afterwards (Abraham & Beumont, 1982; Deaver et al., 2003). These discrepant findings may be explained by the trade-off model (Kenardy et al., 1996), which proposes that the highly aversive emotions preceding binge eating episodes (e.g., anxiety, depression) are traded for less aversive emotions subsequent to the episode (e.g., guilt, shame). Nevertheless, the literature consistently supports an alleviation of negative emotions over the course of binge eating episodes.

The Role of Negative Affect in Loss of Control and Binge Eating Among Youth

There is evidence that by middle childhood children are able to identify likely outcomes of emotional expression and make decisions to suppress or express emotions accordingly (termed "display rules"; Fuchs & Thelen, 1988; D. C. Jones, Abbey, & Cumberland, 1998; Zeman & Garber, 1996; Zeman & Shipman, 1997). Family socialization contributes to the development of expectancies regarding emotional expression, for example, through modeling and parental reactions to emotion expression (Zeman, Cassano, Perry-Parrish, & Stegall, 2006). Thus, children who are predisposed to experience negative affect and whose families discourage expression of such emotions may seek alternative, sometimes maladaptive, coping strategies.

Simultaneously, during pre-adolescence, children are learning to regulate their own eating behavior, whereas earlier in childhood eating may have been under the

primary control of caretakers. In infancy and early childhood, children have demonstrated the ability to base intake on internal hunger and satiety cues (Birch & Deysher, 1986); however, with increases in age children become more sensitive to external food cues such as the mere presence of food, palatability, and parental encouragement or discouragement of eating (i.e., disinhibited eating; Birch & Davison, 2001; Birch & Fisher, 1998), marking this as a crucial period in the development of eating pathology.

It is currently unclear how early experiences of affect regulation and childhood eating behavior interact to result in the initiation of binge or loss of control eating. Consequently, a model is proposed whereby children who are predisposed towards negative affect, and whose families discourage the expression of negative emotions, may initiate the use of eating as a strategy to regulate affective distress via parental modeling and feeding practices. In support of this framework, as previously mentioned, children endorsing loss of control eating are more likely than their weight-matched peers to endorse symptoms of anxiety and depression (Decaluwe & Braet, 2003; Goossens et al., 2007; Isnard et al., 2003; Morgan et al., 2002; Tanofsky-Kraff et al., 2004). Prospective data appear to confirm that negative affect precedes and predicts binge eating in youth (Stice & Agras, 1998; Stice, Killen, Hayward, & Taylor, 1998; Stice, Presnell, Shaw, & Rohde, 2005), suggesting that children who develop binge eating problems may be predisposed to experience negative emotions overall.

In addition to evidence supporting a more distal relationship between binge eating and negative affect in children, some preliminary data also suggest a more proximal relationship whereby children with loss of control eating problems binge eat *in response to* negative affect. An adaptation of the Emotional Eating Scale for children and adolescents (Tanofsky-Kraff, Theim et al., 2007) suggests that three subscales assessing eating in response to negative emotions (i.e., anxiety, anger, and frustration;

depressive symptoms; and feeling unsettled) reliably distinguish between children with and without loss of control eating episodes. Specifically, children with loss of control eating scored higher on all three subscales than those without loss of control eating, even after accounting for BMI. Moreover, recent qualitative data (Tanofsky-Kraff, Goossens et al., 2007) indicate that children experiencing loss of control eating are more likely than children reporting objective overeating or no pathological eating episodes to experience negative emotions before eating. Other self-report data suggest that youth with loss of control eating problems are more likely to utilize dysfunctional coping strategies than their peers (Czaja, Rief, & Hilbert, 2009; Sierra Baigrie & Lemos Giraldez, 2008), and that such coping strategies are related to greater depressive symptomatology. Thus, it appears that that youth with loss of control eating have difficulties with affect regulation in general, and that the experience of negative affect may be a proximal antecedent to their loss of control eating episodes.

Despite these intriguing findings, a major limitation of these studies is their reliance on retrospective recall. To date, only one study has attempted to examine the proximal relation between loss of control eating and negative affect in children using "real time" measurement via ecological momentary assessment, a method used to sample individuals' experiences as they occur in their natural environment (Hilbert, Rief, Tuschen-Caffier, de Zwaan, & Czaja, 2009). Results indicate that eating episodes of children reporting loss of control eating problems were preceded by less happiness relative to eating episodes of children who did not report loss of control eating. However, within-group analyses revealed no specific effect for lower happiness before loss of control versus non-loss of control episodes among children reporting loss of control eating problems. Among youth with loss of control eating problems, negative mood did not directly precede loss of control episodes. However, these children reported more sadness on days in which they engaged in loss of control eating, as compared to non-

loss of control days of non-loss of control eaters. Although this study provides some support for affect regulation models of loss of control eating in children, results are still based on self-report data, suggesting the need for more objective examination of the relation between loss of control eating and negative mood.

Questions remain about how children come to rely upon eating, rather than some other behavior, as a coping response for alleviating negative affect. Knowledge about learning processes may fill this gap in the literature. Parental modeling has been found to have a potent effect on the development of a multitude of behaviors, including binge eating (Stice, 1998). Indeed, maternal disinhibition has been found to predict childhood overeating (Stice, Agras, & Hammer, 1999) and eating in the absence of hunger, which may be viewed as a form of disinhibited eating (Cutting, Fisher, Grimm-Thomas, & Birch, 1999). Thus, mothers who engage in eating as an affect regulation strategy may indirectly promote the use of this coping response in their children. Eating as a coping strategy may be further promoted through use of food as a reward, perhaps cementing an association between eating and positive emotions, such as happiness or excitement, which may then be actively substituted for negative emotions via eating. Indeed, parental use of food as a reward has been shown to increase children's preference for (Birch, Zimmerman, & Hind, 1980) and consumption of those foods (Birch, McPhee, Shoba, Steinberg, & Krehbiel, 1987). Providing a putative link between parental feeding behaviors in childhood and the later development of binge eating problems, a recent retrospective study (Puhl & Schwartz, 2003) found that adult binge eaters, to a larger extent than non-binge eaters, recalled parental use of food rules to control their behavior in childhood (e.g., providing food to ameliorate depression, loneliness, or anxiety). A related follow-up study (Puhl & Schwartz, 2006) showed that recalling parental use of food as a reward in childhood was associated with greater severity of binge eating problems and lower self-efficacy to control overeating in adult females. Taken together,

these data suggest that children may learn at an early age to soothe or reward themselves with food, thus setting the stage for the development of eating as a coping strategy for negative affect.

In summary, negative affect appears to play a key role in loss of control and binge eating among both adults and children. However, aside from evidence suggesting a relationship between negative affectivity and later development of binge eating problems, little research has explored whether negative affect is a direct antecedent to binge eating episodes among youth, and the small body of work that does support this relationship is based upon retrospective and/or self-report data. The purpose of the current study is to provide objective evidence to substantiate these findings. It is hypothesized that, similar to adults, children may engage in loss of control or binge eating episodes as a strategy for alleviating experiences of low mood (e.g., sadness.) To test this hypothesis, the current study sought to explore eating behavior in children with and without loss of control eating problems following induction of a sad versus neutral mood.

The feeding laboratory paradigm lends itself nicely to exploring this hypothesis. Until recently, research on correlates of loss of control eating in youth has relied upon self-report methodology, which is prone to social desirability bias and may not access attitudes or behaviors beyond an individual's explicit awareness (Dovidio & Fazio, 1992; Nisbett & Wilson, 1977). Furthermore, self-report methodology is prone to recall bias (De Los Reyes & Kazdin, 2005), a construct which is particularly problematic in the measurement of eating behaviors (Westerterp & Goris, 2002). Children may be especially poor at self-reporting their psychiatric symptoms (Parker, 1984), as they may have limited insight into their symptoms, lack cognitive readiness for such an undertaking, or fail to understand complex concepts (Ricciardelli & McCabe, 2001). In contrast, feeding laboratory methodology enables direct observation of eating behaviors,

as well as experimental manipulation of mood states, without interference from these confounding variables.

Feeding Laboratory Studies of Loss of Control and Binge Eating

As noted above, the use of feeding laboratory studies for examining binge eating was initially conceived of as an alternative to the less objective self-report methods traditionally employed. Studies of this type generally involve inviting participants into the laboratory for either an overnight, in-clinic visit or for a single- or multi-day visit that requires attendance only for the administration of the test meal (generally 2 to 3 hours). Participants may be instructed to engage in an overnight fast, to adhere to their normal meal pattern, or to refrain from eating for varying lengths of time prior to completing the test meal. Upon arrival at the laboratory, participants may be required to consume a pre-load of high- or low-calorie solid or liquid food (e.g., milkshake), or no pre-load, prior to administration of the test meal. Participants are then typically instructed to "let go and eat as much as you like" of a single- or multi-item test meal, usually consisting of highly palatable foods typically consumed during a binge. Experimenters are usually absent during the test meal to minimize participant embarrassment or self-consciousness. Prior to administration of the test meal, food items are weighed and the kilocalorie and macronutrient content of each item calculated; upon completion of the meal, items are re-measured so that the amount consumed (i.e., in terms of kilocalories, amount in grams, and/or macronutrient content) can be estimated and used as a dependent variable. Ratings of hunger, satiety, and loss of control, among other variables, are usually obtained as well, and may be utilized as covariates or examined in relation to other psychological or physiological measures. See Table 1 for full details of feeding laboratory studies conducted in loss of control and binge eating populations to date.

Table 1

Feeding Laboratory Studies of Eating Behavior in Individuals with Binge Eating Problems

Citation	Meal type	Population* and condition	Mean intake	Main findings
Agras & Telch, 1998	Multi-item buffet	Obese BED (*N* = 60)		Deprivation > no deprivation across mood conditions
		No deprivation/neutral mood	907 (717) kcal	
		14-hour deprivation/neutral mood	2081 (887) kcal	
		No deprivation/negative mood	1716 (1223) kcal	
		14-hour deprivation/negative mood	1708 (885) kcal	
Anderson, Williamson, Johnson, & Grieve, 2001	Ice cream	Obese BED (*n* = 8)	1308.0 (532.2) kcal	BED > non-BED
		Obese non-BED (*n* = 8)	661.3 (367.3) kcal	
		Non-obese, non-BED (*n* = 8)	515.2 (258.2) kcal	
Chua et al., 2004	Chocolate	Obese BED (*N* = 40)		Sad film > neutral film across restraint groups
		High restraint/sad film	71 g	
		High restraint/neutral film	35 g	
		Low restraint/sad film	53 g	
		Low restraint/neutral film	52 g	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Cooke, Guss, Kissileff, Devlin, & Walsh, 1997	Multi-item meal	Obese BED (*n* = 10)	1515 (392.9) kcal	BED > non-BED
		Obese non-BED (*n* = 10)	1115 (317.6) kcal	
Geliebter et al., 1992	Liquid meal	BN (*n* = 9)	870 (115) ml	BN > non-BN
		Non-BN (*n* = 9)	488 (58) ml	
Geliebter, Hassid, & Hashim, 2001	Liquid meal	Obese BED (*n* = 30)	1032 (429) g	BED > non-BED
		Obese non-BED (*n* = 55)	737 (399) g	
Goldfein, Walsh, LaChaussee, Kissileff, & Devlin, 1993	Ice cream and multi-item meal	Obese BED (*n* = 10)		BED multi-item meal > non-BED multi-item meal BED ice cream meal = non-BED ice cream meal
		Multi-item meal	1514.7 (392.9) kcal	
		Ice cream	742.5 (245.4) kcal	
		Obese non-BED (*n* = 10)		
		Multi-item meal	1115.2 (317.6) kcal	
		Ice cream	781.0 (423.0) kcal	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Gosnell et al.,	One or two binge	Obese BED (*n* = 5)		BED = non-BED
2001	foods, presented in	1 food, 2 X quantity	1769 (1399) kcal	2 foods > 1 food
	2 X or 4 X the	1 food, 4 X quantity	1825 (1238) kcal	4 X quantity > 2 X quantity
	quantity of a typical	2 foods, 2 X quantity	2005 (1601) kcal	
	binge	2 foods, 4 X quantity	2501 (1625) kcal	
		Obese non-BED (*n* = 5)		
		1 food, 2 X quantity	944 (841) kcal	
		1 food, 4 X quantity	1020 (883) kcal	
		2 foods, 2 X quantity	1205 (945) kcal	
		2 foods, 4 X quantity	1609 (1662) kcal	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Guss, Kissileff, Devlin, Zimmerli, & Walsh, 2002	Multi-item meal	Obese BED (*n* = 21)		BED > non-BED for binge and normal meals
		Binge	2143 kcal	BED binge > BED normal
		Eat normally	1472 kcal	
		Obese non-BED (*n* = 14)		
		Binge	1174 kcal	
		Eat normally	1049 kcal	
		Normal-weight control (*n* = 7)		
		Binge	1323 kcal	
		Eat normally	1146 kcal	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Guss, Kissilef, Walsh, & Devlin, 1994	Multi-item meal or ice cream	Obese BED (*n* = 10)		BED multi > obese multi
		Ice cream	764.5 (251.4) kcal	BN multi > BED multi
		Multi-item meal	1514.7 (392.9) kcal	BN multi > BED, obese, non-obese multi
		BN (*n* = 8)		
		Ice cream	1389.9 (612.0) kcal	BN ice cream > obese, non-obese
		Multi-item meal	2679.7 (2137.2) kcal	BN + BED > controls for all meals
		Obese controls (*n* = 10)		
		Ice cream	787.6 (426.0) kcal	
		Multi-item meal	1115.2 (317.6) kcal	
		Non-obese controls (*n* = 8)		
		Ice cream	307.8 (44.4) kcal	
		Multi-item meal	1093.5 (418.9) kcal	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Hadigan, Kissileff, & Walsh, 1989	Multi-item meal	BN (*n* = 11)		BN binge > non-BN binge
		Binge	3469 (1347) kcal	Binge > normal for both groups
		Eat normally	1198 (1689) kcal	
		Non-BN (*n* = 10)		
		Binge	1412 (277) kcal	
		Eat normally	856 (265) kcal	
Hadigan, Walsh, Devlin, LaChaussee, & Kissileff, 1992	Macaroni and beef	BN (*n* = 12)		BN binge meal > non-BN binge meal after both preloads
		Smaller preload, normal meal	662.2 (106.6) g	
		Smaller preload, binge	1450 (486) g	BN binge meal after large preload < BN binge meal after small preload
		Larger preload, normal meal	654.1 (150.0) g	
		Larger preload, binge	1297 (517) g	
		Non-BN (*n* = 8)		Non-BN normal meal after large preload < non-BN normal meal after small preload
		Smaller preload, normal meal	568.3 (161.5) g	
		Smaller preload, binge	754 (217) g	
		Larger preload, normal meal	470.1 (190.6) g	
		Larger preload, binge	692 (253) g	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Halmi & Sunday, 1991	Liquid meal	AN/restricting (*n* = 29)		Pre-treatment covered = uncovered for all groups AN/restricting = AN/binge-purge = BN = controls in pre-treatment uncovered condition
		Food covered	~240 cc	
		Food uncovered	~270 cc	
		AN/binge-purge (*n* = 25)		
		Food covered	~230 cc	
		Food uncovered	~230 cc	
		BN (*n* = 30)		
		Food covered	~260 cc	
		Food uncovered	~250 cc	
		Controls (*n* = 19)		
		Food covered	~230 cc	
		Food uncovered	~280 cc	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Hetherington & Rolls, 1991	Multi-item buffet following preload	AN (*n* = 10)		AN, control dieters < all other groups after all preloads For BN, intake after large cracker preload > BN intake after small cracker preload For all other groups, intake after large cracker preload < intake after small cracker preload
		1% cottage cheese preload	~200 kcal	
		Larger cheese/cracker preload	~145 kcal	
		Smaller cheese/cracker preload	~250 kcal	
		BN (*n* = 10)		
		1% cottage cheese preload	~700 kcal	
		Larger cheese/cracker preload	~900 kcal	
		Smaller cheese/cracker preload	~750 kcal	
		Control non-dieters (*n* = 10)		
		1% cottage cheese preload	~680 kcal	
		Larger cheese/cracker preload	~550 kcal	
		Smaller cheese/cracker preload	~750 kcal	
		Control dieters (*n* = 11)		
		1% cottage cheese preload	~450 kcal	
		Larger cheese/cracker preload	~330 kcal	
		Smaller cheese/cracker preload	~420 kcal	
		Overweight dieters (*n* = 10)		

Citation	Meal type	Population* and condition	Mean intake	Main findings
		1% cottage cheese preload	~740 kcal	
		Larger cheese/cracker preload	~600 kcal	
		Smaller cheese/cracker preload	~800 kcal	
Hetherington, Altemus, Nelson, Bernat, & Gold, 1994	Food intake over 4 days	BN (*n* = 10)	10035 (2701) kcal/day	BN > non-BN
		Non-BN (*n* = 10)	1924 (102) kcal/day	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Hetherington, Stoner, Andersen, & Rolls, 2000	Multi-item buffet	AN/binge-purge (*n* = 9)		BN inpatient deprived > BN inpatient non-deprived
		19-hour deprivation	~1500 kcal	
		No deprivation	~1250 kcal	
		BN inpatient (*n* = 10)		
		19-hour deprivation	~1250 kcal	
		No deprivation	~750 kcal	
		BN outpatient (*n* = 9)		
		19-hour deprivation	~1250 kcal	
		No deprivation	~1150 kcal	
		Control dieters (*n* = 10)		
		19-hr deprivation	~1000 kcal	
		No deprivation	~900 kcal	
		Control non-dieters (*n* = 11)		
		19-hour deprivation	~1150 kcal	
		No deprivation	~1000 kcal	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Kaye et al.,	Multi-item vending	BN (*n* = 21)		BN binge day > controls
1992	machine	Binge day	7100.9 (9546.4) kcal	BN binge day > BN non-binge day
		Non-binge day	2335.2 (2571.0) kcal	
		Controls (*n* = 11)		
		Day 1	1844.4 (618.7) kcal	
		Day 2	1831.1 (436.5) kcal	
Kissileff, Walsh,	Liquid meal, multi-	BN (*N* = 8)		No statistical comparisons across
Kral, & Cassidy,	item meal, and ice	Liquid meal, eat normally	636.9 (514.2) kcal	conditions
1986	cream	Multi-item, eat normally	3076.8 (2485.4) kcal	
		Multi-item, binge	4476.8 (2154.0) kcal	
		Ice cream, binge	1335.8 (1018.7) kcal	
Kissileff et al.,	Liquid meal	BN (*n* = 11)	1597 (626.5) g	BN > control
1996		Control (*n* = 11)	1004 (362.5) g	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Kissileff,	Liquid meal	BN (*n* = 13)		BN > control
Zimmerli,		Eat at a fast rate	1205.8 (109.7) g	Control fast > control slow
Torres, Devlin,		Eat at a slow rate	1195.0 (109.7) g	BN fast = BN slow
& Walsh, 2008		Control (*n* = 14)		
		Eat at a fast rate	824.0 (106.5) g	
		Eat at a slow rate	655.3 (106.5) g	
LaChaussee,	Multi-item meal and	BN (*n* = 8)		BN binge > control binge for both
Kissileff, Walsh,	ice cream	Multi-item, binge	2697.7 (2137.2) kcal	meals
& Hadigan,		Multi-item, nonbinge	729.2 (658.0) kcal	BN nonbinge = control nonbinge
1992		Ice cream, binge	1389.9 (612.0) kcal	for both meals
		Ice cream, nonbinge	469.8 (669.0) kcal	
		Control (*n* = 8)		
		Multi-item, binge	1093.6 (418.9) kcal	
		Multi-item, nonbinge	958.2 (311.9) kcal	
		Ice cream, binge	307.8 (44.4) kcal	
		Ice cream, nonbinge	243.5 (145.5) kcal	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Latner, 2003	Multi-item buffet	BED (*n* = 11)		Intake after carbohydrate > intake after protein for BN and BED
		High-protein preload	Not reported	
		High-carbohydrate preload	Not reported	
		BN (*n* = 7)		
		High-protein preload	Not reported	
		High-carbohydrate preload	Not reported	
Mirch et al., 2006	Multi-item buffet	Overweight 6 to 12-year-olds with binge eating problems (*n* = 10)		Binge eating > no binge eating for both meals
		Post-fast	1748.3 (581) kcal	
		Post-breakfast	1874.1 (560) kcal	
		Overweight 6 to 12-year-olds without binge eating problems (*n* = 50)		
		Post-fast	1309.2 (595) kcal	
		Post-breakfast	1275.1 (566) kcal	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Munsch, Biedert, Meyer, & Margraf, 2008	Multi-item taste test	BED (*N* = 69)		Negative mood = neutral mood
		Balanced meal plan/negative mood	103.65 g	Balanced meal plan = unbalanced meal plan
		Unbalanced meal plan/negative mood	113.18 g	No interaction between meal plan and mood condition
		Balanced meal plan/neutral mood	114.66 g	
		Unbalanced meal plan/neutral mood	65.76 g	
Nederkoorn, Smulders, Havermans, & Jansen, 2004	Single-item meal	BN (*n* = 51)		BN = control
		Exposure to favorite binge food	315 (289) kcal	
		Control (*n* = 20)		
		Exposure to favorite snack food	316 (274) kcal	
Raymond, Bartholome, Lee, Peterson, & Raatz, 2007	Multi-item meal	BED (*n* = 12)	2151.3 (430.6) kcal	BN > control
		Obese controls (*n* = 8)	1608.9 (700.1) kcal	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Rolls et al., 1992	Multi-item meal	AN/binge-purge (*n* = 9)		BN > AN, controls across conditions No preload > high-calorie preload for all groups AN high-calorie preload < AN low-calorie preload
		High-calorie preload	1118.8 (469.0) kj	
		Low-calorie preload	1845.6 (444.3) kj	
		No preload	1792.0 (343.9) kj	
		BN (*n* = 9)		
		High-calorie preload	2597.8 (553.5) kj	
		Low-calorie preload	3929.6 (1042.6) kj	
		No preload	4767.2 (1086.6) kj	
		Non-dieting controls (*n* = 9)		
		High-calorie preload	1658.1 (262.8) kj	
		Low-calorie preload	2458.9 (301.7) kj	
		No preload	2943.9 (323.4) kj	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Rolls, Hetherington, Stoner, & Andersen, 1997	Multi-item buffet following yogurt preloads	BN (*n* = 12)		BN < controls for all test meals
		High-carbohydrate preload	~750 kcal	
		High-fat preload	~800 kcal	
		Control preload	~750 kcal	
		Control (*n* = 12)		
		High-carbohydrate preload	~1250 kcal	
		High-fat preload	~1200 kcal	
		Control preload	~1000 kcal	
Rossiter, Agras, Telch & Bruce, 1992		Non-purging BN (*n* = 22)		Binge day > non-binge day
		Binge episode	602 kcal	
		Binge day	2400 kcal/day	
		Non-binge day	1500 kcal/day	
Sunday & Halmi, 1996	Multi-item meal	AN/restricting (*n* = 26)	760.2 (608.3) kcal	ED variance > control variance
		AN/binge-purge (*n* = 13)	1143.7 (967.0) kcal	AN-restricting > non-dieting
		BN (*n* = 26)	644.5 (580.3) kcal	controls
		Dieting controls (*n* = 16)	676.2 (267.3) kcal	AN/binge-purge > non-dieting
		Non-dieting controls (*n* = 19)	527.0 (207.7) kcal	controls

Citation	Meal type	Population* and condition	Mean intake	Main findings
Tanofsky-Kraff, McDuffie et al., 2009	Multi-item buffet	Overweight 8 to 17-year-olds with loss of control (*n* = 50)		Binge meal > normal meal across groups
		Instructed to binge	~1450 kcal	Loss of control = no loss of control across conditions
		Instructed to eat normally	~1300 kcal	
		Overweight 8 to 17-year-olds without loss of control (*n* = 127)		
		Instructed to binge	~1450 kcal	
		Instructed to eat normally	~1300 kcal	
Telch & Agras, 1996a	Multi-item buffet	Obese BED (*n* = 30)		BED > non-BED across conditions
		Negative mood	1053 (675) kcal	
		Neutral mood	1241 (825) kcal	
		Obese non-BED (*n* = 30)		
		Negative mood	593 (364) kcal	
		Neutral mood	628 (594) kcal	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Telch & Agras, 1996b	Multi-item buffet	BN (*n* = 26)		6-hour deprivation > 1-hour deprivation for all groups BN = BED = controls across conditions
		1-hour deprivation	743 (1442) kcal	
		6-hour deprivation	1334 (1065) kcal	
		BED (*n* = 26)		
		1-hour deprivation	424 (558) kcal	
		6-hour deprivation	887 (459) kcal	
		Obese controls (*n* = 26)		
		1-hour deprivation	340 (213) kcal	
		6-hour deprivation	725 (290) kcal	
Vogele & Florin, 1997	Multi-item snack	BED (*n* = 30)		BED = non-BED
		Exposure to liked snack	219.9 (152.9) kcal	
		Non-BED (*n* = 30)		
		Exposure to liked snacks	227.0 (158.3) kcal	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Walsh, Kissileff, Cassidy, & Dantzic, 1989	Multi-course meal and ice cream	BN (*n* = 12)		BN binge > non-BN binge for both meals
		Multi-course nonbinge	1309 (1518) kcal	
		Multi-course binge	3031 (1658) kcal	BN multi-course binge > BN multi-course non-binge
		Ice cream nonbinge	353 (289) kcal	
		Ice cream binge	1328 (874) kcal	
		Non-BN (*n* = 10)		
		Multi-course nonbinge	856 (265) kcal	
		Multi-course binge	1412 (277) kcal	
		Ice cream nonbinge	448 (262) kcal	
		Ice cream binge	530 (176) kcal	
Weltzin, Hsu, Pollice, & Kaye, 1991	Multi-item vending machine	BN (*n* = 24)		BN > non-BN
		Daily intake	4446 (584) kcal	
		Non-BN (*n* = 11)		
		Daily intake	1845 (649) kcal	

Citation	Meal type	Population* and condition	Mean intake	Main findings
Yanovski et al.,	Multi-item meal	Obese BED (*n* = 10)		BED > non-BED for both meals
1992		Binge	2963 kcal	BED binge > BED normal meal
		Normal meal	2343 kcal	
		Obese non-BED (*n* = 9)		
		Binge	2017 kcal	
		Normal meal	1640 kcal	

Note: BED = binge eating disorder; BN = bulimia nervosa; AN = anorexia nervosa; kcal = kilocalories; g = grams; cc = cubic centimeters; kj = kilojoules
*Unless otherwise noted, samples are limited to adults.

Feeding Laboratory Studies in Adult Populations

Despite concerns about the artificiality of the laboratory setting, there is evidence that feeding laboratory methodology is a valid form of measurement for binge eating in adults (Walsh & Boudreau, 2003). Individuals with BN and BED have been shown to consume significantly more food than controls, in terms of volume (i.e., amount eaten measured in grams) and energy (i.e., kilocalories), when instructed to binge on either single- or multiple-item meals (e.g., Goldfein, Walsh, LaChaussee, Kissileff, & Devlin, 1993; Guss, Kissilef, Walsh, & Devlin, 1994; Hetherington, Altemus, Nelson, Bernat, & Gold, 1994; Kissileff, Walsh, Kral, & Cassidy, 1986; LaChaussee, Kissileff, Walsh, & Hadigan, 1992; Mitchell, Crow, Peterson, Wonderlich, & Crosby, 1998; Walsh, Kissileff, Cassidy, & Dantzic, 1989). Even when not explicitly asked to binge, obese women with BED consume significantly more food and report feeling significantly more out of control than obese women without BED (Anderson, Williamson, Johnson, & Grieve, 2001; Geliebter, Hassid, & Hashim, 2001). Thus, despite providing a potentially different picture of eating behavior in comparison with a more naturalistic setting, feeding laboratory methods have provided evidence that the eating behavior of individuals with eating disorders is distinct from that of controls.

Feeding laboratory studies facilitate direct observation not only of overall intake of binge meals and normal meals, but also of the pattern of such meals. Research has shown that meal and food selection patterns of individuals with eating disorders differ from those of individuals without eating disorders. An early laboratory-based study analyzing the daily eating behavior of individuals with or without BN (Hetherington et al., 1994) showed that individuals with BN had significantly higher total daily kilocalorie intake and consumed significantly less energy from protein and significantly more energy from fat than controls. During binges, BN patients have also been shown to consume dessert and snack foods both earlier in the meal and in greater quantities than controls

(Hadigan, Kissileff, & Walsh, 1989). Similar results have been reported for BED patients, who were shown in one study to consume more fat, less protein, and more dessert and snack foods during binge meals than those without BED (Yanovski et al., 1992). However, the data in this regard appear to be mixed, with two studies (Cooke, Guss, Kissileff, Devlin, & Walsh, 1997; Goldfein et al., 1993) showing that individuals with BED are largely similar to controls in the types of foods consumed during binges.

The rate of eating during test meals of individuals with eating disorders relative to controls may also distinguish binge meals from non-binge meals (LaPorte, 1996). It has been hypothesized that individuals with eating disorders binge eat at a rapid rate to avoid discovery, or to limit the absorption of calories before purging in the case of BN (Fairburn, 1995). Indeed, it has been demonstrated that individuals with BN binge eat at a faster rate than controls (Hadigan et al., 1989; Kissileff et al., 1986), whereas individuals with BED binge eat at a slower rate than controls (Goldfein et al., 1993). In contrast, Telch and Agras (1996b) found no differences in BN, BED or control participants' rate of eating. However, only 1% of participants rated the eating episode as a binge; thus, the rate of eating observed in this study may not reflect the rate of eating during an actual binge episode. In a related study, Kissileff et al. (2008) demonstrated that rate of eating does not influence binge size in BN, as participants consumed the same amount of a liquid yogurt shake whether instructed to eat at a fast or slow rate. This study especially highlights the utility of feeding laboratory methodology in helping to elucidate directionality in binge eating episodes, by demonstrating that binge eating may be *associated with* but not necessarily *caused by* increased rate of eating.

The laboratory setting also enables a proximal examination of emotional and behavioral antecedents and consequences of binge eating. Feeding laboratory data have demonstrated that binge eating in BN is commonly preceded by negative mood states, including anxiety and depression, which appear to improve for some subjects

subsequent to the binge episode (Hetherington et al., 1994; Hetherington, Spalter, Bernat, Nelson, & Gold, 1993; Kaye, Gwirtsman, George, Weiss, & Jimerson, 1986). Similar findings have been reported with regard to binge eating in BED as well. Two separate laboratories have found that women with BED were significantly more likely to binge eat, according to their own and/or the investigators' standards, following induction of negative mood as opposed to a neutral mood (Agras & Telch, 1998; Chua et al., 2004). In contrast, Telch and Agras (1996a) found that individuals with BED did not increase their food intake relative to controls subsequent to experimental induction of a negative mood state, nor was there evidence of increased food intake for BED patients in negative mood states relative to neutral mood states. However, there was a significant positive association between negative mood ratings and the likelihood of both experiencing loss of control and of labeling the eating episode a binge, indicating that mood has a role in the participant's subjective experience of binge eating. Thus, although the role of negative mood in the binge eating episodes of individuals with BED remains unclear, feeding laboratory methods may help explicate the nature of the relationship.

In terms of behavioral antecedents and consequences of binge episodes, eating behavior prior to and subsequent to binge eating has commonly been explored. Feeding laboratory methodology has enabled a direct test of the restraint theory (Polivy & Herman, 1985), which hypothesizes that dietary restraint leads to binge eating, by examining the effects of food deprivation on subsequent binge eating. For example, one early study (Telch & Agras, 1996b) observed eating behavior in BN, BED and control participants following 1 or 6 hours of food deprivation and failed to find an effect of either fasting duration or diagnosis. However, individuals with BN were found to have consumed significantly more calories *over the course of the day* (i.e., not just during the binge meal) in both deprivation conditions than the other groups, indicating that they

compensated for the deprivation period to a greater degree than did BED or control participants. A similar study compared 19 hours of deprivation to a no-deprivation condition in which standard breakfast and lunch were delivered (Hetherington, Stoner, Andersen, & Rolls, 2000). Although the BN group did not increase their food intake in the deprivation condition relative to the other groups (i.e., individuals with AN, dieters, and non-dieters), a within-group comparison showed significantly increased intake in some bulimics (i.e., in terms of kilocalorie intake, volume of food consumed, and consumption of high-energy versus low-energy foods) in the deprivation condition compared to the non-deprivation condition.

By manipulating the amount and energy density of a pre-load provided before the actual test meal, feeding laboratory methods have also enabled direct tests of the abstinence violation effect (Marlatt & Gordon, 1985). When applied to eating disorders, the abstinence violation effect posits that binge eating occurs in response to perceived lapses in dietary restraint. Contrary to this hypothesis, BN patients have been shown to compensate for a pre-load by subsequently decreasing consumption during binge and regular test meals (Hadigan et al., 1989; Hetherington & Rolls, 1991; Rolls et al., 1992; Rolls, Hetherington, Stoner, & Andersen, 1997). Studies of this type have not yet been undertaken with BED patients.

Explorations of physiological aspects of binge eating may elucidate factors contributing to the onset and/or maintenance of disordered eating symptoms, for example, by demonstrating appetite disturbances in eating disordered individuals relative to controls. Feeding laboratory studies are particularly useful in this regard, as they allow for measurement of physiological variables immediately preceding, following, or during a binge. Such studies have shown that patients with BN and BED appear to have disturbed hunger and satiety mechanisms. BN patients were shown to have significantly lower levels of fullness after consuming the same amount of a test meal as

controls (Geracioti & Liddle, 1988; Kissileff et al., 1996). They also consumed nearly twice as much food as controls during a binge meal, despite reporting similar sensations of hunger and satiety (Hadigan, Walsh, Devlin, LaChaussee, & Kissileff, 1992).

These findings are supported by more objective measures of gastric capacity, rate of gastric emptying, and rate of cholecystokinin release, all of which predict greater test meal intake in participants with BN and BED (Devlin et al., 1997; Geliebter & Hashim, 2001; Geliebter et al., 1992). In BED, the amount of food consumed during a binge is positively correlated with BMI (Guss, Kissileff, Devlin, Zimmerli, & Walsh, 2002), implying that the increased gastric capacity seen in the overweight or obese (Geliebter, 1988) may promote binge eating in psychologically vulnerable individuals. In support of this hypothesis, BED patients have been shown to have increased gastric capacity relative to obese controls, which in turn accounted for a significant portion of the variance in test meal intake (Geliebter, Yahav, Gluck, & Hashim, 2004).

In the 20 years since its inception, feeding laboratory methodology has been refined and expanded to study eating behaviors under a variety of conditions. This methodology appears to be valid and useful for studying the eating behavior of adults with eating disorders, yet relatively little work has been conducted with youth populations. Intuitively, there is reason to believe that laboratory methods would be as effective in eliciting loss of control eating in youth as in adults. Children may be less self-conscious about their eating problems, thus lessening the potential for inhibition in the laboratory setting. They also may feel more at ease eating alone, without fearing criticism from parents or peers. Furthermore, because the feeding laboratory paradigm has been used to study childhood eating behavior in non-clinical populations for several decades, there is considerable research that supports its use (Tanofsky-Kraff, Haynos, Kotler, Yanovski, & Yanovski, 2007).

Feeding Laboratory Studies in Youth Populations

To date, few studies have examined qualitative aspects of loss of control and binge eating in children and adolescents. The first of these studies (Theim et al., 2007) did not utilize feeding laboratory methodology but nevertheless warrants consideration due to the paucity of qualitative studies on loss of control and binge eating in children. This study relied upon self-report methodology in analyzing the quantity and content of eating episodes retrospectively reported by overweight children and adolescents aged 6 to 18 years. Collecting detailed information on participants' most pathological eating episodes (i.e., with objective binge eating being most pathological, subjective binge eating being moderately pathological, objective overeating being least pathological, and normal meals being non-pathological), the authors compared the episodes of children reporting loss of control episodes and those not reporting loss of control episodes. Although the two groups did not significantly differ in terms of overall reported kilocalorie intake, the eating episodes of children reporting loss of control consisted of significantly more kilocalories from snack and dessert food than those of children not reporting loss of control. In addition, the eating episodes of children reporting loss of control contained a significantly higher percentage of energy from carbohydrates and a significantly lower percentage of energy from protein than those of children not reporting loss of control; the two groups did not differ in percentage of energy from fat. The authors suggest that children may experience loss of control when exposed to "forbidden foods" such as snacks, desserts, and those high in carbohydrates, and conclude that the composition of their eating episodes may contribute the greater weight gain seen in this population relative to those without loss of control.

These findings are clearly limited by the retrospective, self-report nature of the data. Furthermore, the collapsing of eating episodes into loss of control versus no-loss of control groups, rather than true absence of an effect of disordered eating status, could

have resulted in the lack of significant differences in overall kilocalorie consumption between the two groups. That is, the large amount of food consumed, by definition, during objective overeating episodes could have inflated the mean kilocalorie content of non-loss of control episodes such that any true differences in kilocalorie content (i.e., between all loss of control episodes and normal eating episodes, or objective binge eating episodes and normal eating episodes) would have been obscured. However, these findings do provide initial support that the eating episodes of children endorsing loss of control differ qualitatively from those not endorsing loss of control.

Another study of this type (Mirch et al., 2006) used *in vivo* feeding laboratory methodology to examine the effects of binge eating status on energy intake and satiety of overweight children during a buffet meal. In this study, overweight 6- to 12-year-old children, with or without a history of objective binge eating, were instructed to eat "as much as [they] would like" following both an overnight fast and a standard breakfast shake. In both meal conditions (i.e., post-fast and post-breakfast), children reporting binge eating consumed significantly more kilocalories than non-binge eating children. In the post-fast meal condition, children with binge eating problems reported a significantly greater desire to eat before the post-fast meal and a significantly earlier onset of hunger following the post-fast meal than non-binge eating children. The two groups did not differ in terms of self-reported hunger and fullness before or after the post-fast meal, meal duration, rate of eating, macronutrient content of foods eaten during the meal, or desire to eat immediately following the post-fast meal.

Similar results were observed in the post-breakfast condition. Children with binge eating problems reported significantly greater desire to eat before the post-breakfast meal than non-binge eating children, but did not significantly differ from non-binge eating children in terms of hunger and fullness before or after the meal, meal duration, rate of eating, macronutrient content of foods eaten during the meal, or desire to eat

immediately following the meal. During the breakfast shake meal, binge eating and non-binge eating children did not significantly differ in terms of hunger or fullness before or after the shake, desire to eat before or after the shake, or duration of the shake meal. These results suggest that binge eating children may exhibit eating profiles similar to non-binge eating children during “normal” meals. However, children with binge eating problems reported a significantly earlier onset of hunger after consuming the shake than non-binge eating children, possibly indicating a disturbance in appetite or interpretation of appetitive signals, and thereby contributing to their subsequently greater intake during the post-breakfast meal. In support of this hypothesis, children with binge eating problems also endorsed significantly greater levels of eating disinhibition, indicating greater susceptibility to responding to external food cues.

A more recent follow-up study included a larger age range (8 to 17 years; Tanofsky-Kraff, McDuffie et al., 2009). In this study, children and adolescents reporting loss of control eating (i.e., objective or subjective binge eating) were compared with controls reporting no loss of control during laboratory binge meals (i.e., instructions to “let yourself go and eat as much as you want”) and normal meals (i.e., instructions to “eat as you would at a normal meal”). Although there was no main effect of loss of control status on overall kilocalorie intake, youth with loss of control consumed less energy from protein and more from carbohydrates than those without loss of control, regardless of meal condition. Furthermore, children and adolescents reporting loss of control ate more dessert and snack foods, and fewer dairy products and meats, than those not reporting loss of control, regardless of condition. There was also a main effect of meal condition on overall energy intake, such that participants ate more when instructed to binge than when instructed to eat a normal meal, indicating that they were able to distinguish between a normal meal and a binge meal.

Although Tanofsky-Kraff, McDuffie et al.'s (2009) null findings regarding the impact of loss of control eating on energy intake contradict Mirch and colleagues' (2006) aforementioned findings, differences across studies could be attributed to the study populations. Specifically, Mirch et al. included only children reporting *objectively large* loss of control episodes, whereas Tanofsky-Kraff, McDuffie et al. included youth reporting loss of control episodes *regardless of size*. Thus, youth reporting subjective binge eating may have eaten smaller amounts of food during the laboratory test meals, in effect lowering the group mean for the loss of control group.

Another group (Birch, Fisher, & Davison, 2003; Fisher & Birch, 1999, 2002) has utilized feeding laboratory methods to examine "eating in the absence of hunger" in children. In these studies, participants were served a standard lunch in which they were allowed to consume as much or as little as they wanted. Following the lunch meal, ratings of hunger and satiety were obtained to ensure that participants were not hungry. Participants were then shown various toys and containers of snack foods. They were instructed that they could either play with the toys or eat any foods they liked while the experimenter left the room for 10 minutes. In the earliest of these studies (Fisher & Birch, 1999), 3- to 6-year-old children consumed an average of 216 kilocalories (range = 0 - 476 kilocalories) of snack food after having eaten a standard lunch until they were "full." Similar results were obtained for girls tested at age 5 years and again at age 7 years. During the snack meal, girls consumed an average of 125 kilocalories (range = 0 – 436 kilocalories) and 169 kilocalories (range = 0 – 498 kilocalories) at their respective ages after reporting being at least "half-full" from the lunch meal. The most recent study (Birch et al., 2003) tested girls longitudinally at ages 5, 7 and 9 years, demonstrating mean energy intakes of 125 kilocalories, 174 kilocalories, and 225 kilocalories, respectively, at the snack meal. Because the purpose of these studies was not to examine loss of control eating in children, participants did not have known diagnoses of

BED nor did they report on the subjective experience of loss of control during the laboratory snack meals. Nonetheless, these results demonstrate that children are able to eat in the absence of hunger, a possible precursor to binge eating (Marcus & Kalarchian, 2003), when exposed to highly palatable foods in a laboratory setting.

To summarize, feeding laboratory studies have contributed considerably to our knowledge of eating behavior in individuals with binge eating problems across the age and weight spectrum. Adult studies indicate that negative mood can be experimentally manipulated to elicit binge eating episodes in the laboratory (Agras & Telch, 1998; Chua et al., 2004; Telch & Agras, 1996a). Furthermore, preliminary evidence suggests that the feeding laboratory paradigm is a valid method for eliciting binge eating episodes in children (Mirch et al., 2006). Thus, the feeding laboratory appears to be a viable method for exploring proximal affective correlates of loss of control eating in youth.

Aims and Hypotheses

The current study utilized a feeding laboratory paradigm to examine loss of control eating in overweight and obese children subsequent to experimental mood inductions. The aims and hypotheses of the study are as follows:

1. The primary aim of this study was to examine whether negative affect precipitates loss of control or binge eating among children. To determine whether negative affect is a proximal antecedent to loss of control eating episodes in children, the test meal intake of children endorsing loss of control episodes following a sad mood induction was compared with their test meal intake following a neutral mood induction. It was hypothesized that children with loss of control eating would consume more, both in terms of kilocalories and volume (i.e., amount eaten in grams), following a sad mood induction than a neutral mood induction.

2. The secondary aim of this study was to determine whether eating in response to negative affect is specific to children reporting loss of control eating behaviors. To establish whether negative mood would relate to increased food intake only in children reporting loss of control eating as compared to children without loss of control, the interactional effects of loss of control status and mood condition on subsequent food intake were examined. Consistent with previous literature (Mirch et al., 2006; Telch & Agras, 1996a), it was hypothesized that children with loss of control eating problems would consume more, in terms of kilocalories and volume, when exposed to a sad mood induction relative to a neutral induction; in contrast, it was hypothesized that children without loss of control eating problems would consume similar amounts of food, whether exposed to a sad or neutral mood induction. Children with loss of control eating problems were expected to consume more than children without loss of control eating problems, regardless of mood condition.

3. An exploratory aim of this study was to determine whether, as posited by affect regulation theory, loss of control eating in children results in an alleviation of negative mood. To investigate the relevance of this model to pediatric loss of control eating, the pattern of mood changes before the mood induction, after the mood induction, and after the test meal was compared in children with and without loss of control eating. It was hypothesized that, in support of the affect regulation model, children with loss of control eating would be observed to significantly decrease their negative affect scores from post-negative mood induction to post-test meal (i.e., to experience more positive mood *after the meal* as compared to *after the sad mood induction*). In contrast, the mood scores of children without loss of control eating were expected to remain relatively constant from post-mood induction to post-test meal.

Significance of Proposed Research

Loss of control eating is a frequently reported behavior in children and adolescents, and it is associated with numerous adverse health consequences (Goldschmidt & Wilfley, 2009; Tanofsky-Kraff, 2008). Most notably, loss of control eating in children is associated with overweight and obesity (Field et al., 2003; Tanofsky-Kraff et al., 2006; Tanofsky-Kraff et al., 2005), the negative physical and psychosocial sequelae of which are well-established (Dietz, 1998). Given that loss of control and binge eating appear to be quite refractory in adults, even following a treatment-induced reduction in overeating (Smith, Marcus, & Kaye, 1992), it is important to elucidate the nature of this behavior in younger populations in which intervention may have the greatest potential to positively impact eating pathology (B. M. Pratt & Woolfenden, 2002; Reas, Schoemaker, Zipfel, & Williamson, 2001; Stice & Shaw, 2004).

As outlined above, feeding laboratory methodology has proved useful for examining various aspects of loss of control and binge eating under tightly controlled conditions, and with the benefits of direct observation uncomplicated by the biases inherent in self-report methodology. Given that laboratory paradigms have been utilized for the study of loss of control and binge eating in children (Mirch et al., 2006; Tanofsky-Kraff, McDuffie et al., 2009), a logical next step is to utilize the feeding laboratory paradigm to obtain more objective data on the nature and antecedents of loss of control eating in children. Exploring negative affect as a proximal antecedent to loss of control eating in children is especially pertinent in light of literature that suggests both proximal and distal relationships between negative affect and loss of control eating in youth.

Although research has documented a relationship between childhood loss of control eating and negative affect in general, little is known about the specific types of emotions that precipitate loss of control episodes in youth. Because the intent of this study was to manipulate sadness, results could provide useful information regarding

whether sadness is a significant emotion involved in childhood loss of control eating episodes. Further, if findings confirm that a negative mood induction elicits increased test meal intake in children with loss of control eating, these findings could pave the way for future research into other emotional precursors of loss of control eating in youth (e.g., anger, stress, loneliness).

Collecting objective data about emotional precursors to loss of control eating in children may also inform intervention research by providing information about potential treatment directions. If a sad mood induction is found to predict greater food intake in children with loss of control eating, a treatment focused on appropriate affect regulation strategies would presumably benefit children with loss of control eating problems. Given that research on treatment options for loss of control eating in children is in its infancy, with few funded studies underway (Tanofsky-Kraff, Yanovski et al., 2008) and only one published study to date (M. Jones et al., 2008), the proposed study has the potential to greatly impact this newly developing literature. Similarly, the proposed study has the potential to guide prevention research by underscoring the value of teaching vulnerable children effective coping strategies before loss of control eating is initiated.

Exploring emotional precursors of binge eating could also provide useful information about the pathways of weight gain seen in children with loss of control eating (Tanofsky-Kraff et al., 2006; Tanofsky-Kraff, Yanovski et al., 2009). Because perceived daily life stress increases and intensifies with age (Ge, Lorenz, Conger, Elder, & Simons, 1994; Larson & Ham, 1993), children who have initiated a recurrent pattern of loss of control eating in response to negative emotions may be even more likely to engage in loss of control eating with the increased demands encountered throughout childhood and adolescence, leading to continued weight gain. The proposed study could assist investigators in understanding the weight gain trajectories observed in children with loss

of control eating, as well as suggest a treatment focus for clinicians delivering weight loss interventions to children with loss of control eating problems.

In summary, this study has the potential to contribute in significant ways to the growing body of literature on loss of control eating in children. This will be the first study, to the author's knowledge, to examine *in vivo* eating behavior in children with and without loss of control eating problems following two distinct mood inductions in a laboratory setting. This will also be the first attempt to explore the affect regulation model of loss of control eating in children via direct observation rather than self-report.

Methods

Participants

Participants consisted of two groups: (1) 23 overweight and obese females, aged 6 to 12 years, endorsing loss of control eating within the past 3 months (LOC+); and (2) 23 overweight and obese females, aged 6 to 12 years, without any history of loss of control eating (LOC-). The 6 to 12 year age range was selected because a similar protocol was successfully implemented with children of the same age group (Mirch et al., 2006). In addition, including children under the age of 12 years was purported to help minimize the potential confounding effects of pubertal status on food intake (Bull, 1988). Females were selected because feeding laboratory procedures have been well-validated in pre-adolescent girls (e.g., Birch et al., 2003; Fisher & Birch, 2002), and also to minimize possible differences between groups that could be attributed to sex. The proposed sample sizes provided 80% power to detect a 500 kilocalorie difference between sad and neutral mood induction conditions (UCLA Department of Statistics, 2004), assuming equal variances and using mean and standard deviation estimates for eating episodes reported by others (Agras & Telch, 1998; Mirch et al., 2006).

The mean age of participants was 10.47 years (*SD* = 1.90). Children self-identified as African-American (56.5%, *n* = 26), White (30.4%, *n* = 14), Native-American (2.2%, *n* = 1), or Biracial/Other (10.9%, *n* = 5). Participants' BMIs ranged from 22.47 to 48.41 kg/m^2 (*M* = 29.38, *SD* = 5.94), with corresponding BMI z-scores ranging from 1.15 to 2.97 (*M* = 2.20, *SD* = 0.43). On average, participants were at the 97.79th age- and sex-adjusted percentile for BMI (*SD* = 2.69), with a BMI percentile range of 87.39 to 99.85. According to self-report, the majority of accompanying parents were female (93.5%, *n* = 43), and most were married (58.7%, *n* = 27) versus single, divorced, or separated (41.3%, *n* = 19). Most parents were overweight or obese (93.5%, *n* = 43), with an average BMI of 36.22 (*SD* = 10.80). LOC+ and LOC- participants did not differ on any of these aforementioned variables (*p*s $\geq$ .22). Full participant demographic characteristics are reported in Table 2.

Inclusion/Exclusion Criteria

Children were included if their BMI was at or above the 85th percentile for age and sex, according to Centers for Disease Control and Prevention growth chart data (Kuczmarski et al., 2000). To be included in the LOC+ group, children had to report having experienced at least one episode of loss of control eating over the past 3 months, to establish the presence of current eating pathology. Children in the LOC- group could not report any history of loss of control eating. Children were excluded if they (a) were currently taking any medications known for their appetite-enhancing or -inhibiting properties (e.g., weight-loss drugs such as sibutramine; appetite stimulants such as megace; antidepressants such as fluoxetine; attention deficit/hyperactivity disorder medications such as methylphenidate; corticosteroids such as prednisone); (b) had conditions affecting appetite or requiring food restrictions (e.g., diabetes mellitus; thyroid disease; hypoglycemia), or limiting their ability to sustain attention

Table 2.
Demographic Characteristics of Study Participants

Variable	LOC- (*n* = 23)	LOC+ (*n* = 23)	Total (*N* = 46)
Child			
Age	10.26 (1.98)	10.68 (1.83)	10.47 (1.90)
Grade in school	4.22 (1.88)	4.91 (2.07)	4.57 (1.98)
Ethnicity, % (*n*)			
Black	52.2 (12)	60.9 (14)	56.5 (26)
White	39.1 (9)	21.7 (5)	30.4 (14)
Native-American	0 (0)	13.0 (1)	2.2 (1)
Other	8.7 (2)	4.3 (3)	10.9 (5)
z-BMI	2.13 (0.46)	2.27 (0.39)	2.20 (0.43)
BMI percentile	97.31 (3.24)	98.27 (1.96)	97.79 (2.69)
Parent			
Parent BMI	34.47 (7.85)	37.97 (13.05)	36.22 (10.80)
Parent marital status, % (*n*)			
Married/remarried	65.2 (15)	52.2 (12)	58.7 (27)
Single/Divorced	34.8 (8)	47.8 (11)	41.3 (19)

Note: For all variables, *M* (*SD*) are reported unless otherwise specified. LOC+ = at least one loss of control eating episode in the past 3 months; LOC- = no history of loss of control eating

during the mood induction procedure (e.g., attention deficit/hyperactivity disorder); (c) adhered to a food-restricting diet precluding consumption of greater than 50% of food items that were presented during the standard breakfast and test meals (e.g., for medical or religious purposes); (d) reported moderately or greatly disliking greater than 50% of food items that were presented during the standard test meal; (e) were currently psychotic or suicidal; or (f) had a current diagnosis of BN.

Recruitment

Children were recruited through local schools, children's hospitals, pediatrician referrals, media advertisements (e.g., Craig's List), phone logs from previous studies (when the participant had given permission for further contact), and community organizations (e.g., local branches of the YMCA, Volunteer for Health). Potential participants were instructed to call a study hotline for further information on taking part in a research study on eating behavior. All eligible participants were offered a $25 gift card at each study visit ($75 total) for their participation and free group Behavioral Weight Loss treatment at a later date.

One-hundred eighty-four families contacted the study with interest in participation or were provided by Volunteer for Health or previous study phone logs as possibly eligible and interested in participating. Of this number, 125 girls were excluded prior to the baseline study visit (see Figure 1). An additional 13 girls were excluded after the in-person assessment. The remaining 46 girls were considered eligible for participation and completed all study visits.

Procedure

Each eligible participant completed three study visits on three separate days at Washington University School of Medicine (see Appendix A for a stamped copy of the

Potential Participants (*N* = 184)

Reason for Exclusion Before Randomization	
	n
Unable to contact for phone screen	47
Ineligible BMI (< 85th percentile)	28
No longer needed (on waitlist at end of study)	17
No longer interested	11
Failed to attend baseline visit	8
Unable to schedule baseline visit	7
Outside of age range	6
Medical condition affecting appetite or attention	4
Weight- or appetite-affecting medication	3
Dietary restrictions	1
Transportation difficulties	1
TOTAL EXCLUDED	**133**

Included Participants	
	n
Loss of control	23
No loss of control	23
TOTAL INCLUDED	**46**

Reason for Exclusion After Randomization	
	n
Dropped out	3
Failed to comply with experimental protocol	2
TOTAL EXCLUDED	5
GRAND TOTAL EXCLUDED	**138**

Figure 1. Study flow

original Human Studies Committee approval document). Attendance of a parent was required at all three study sessions.

Pre-Study Eligibility Screening

Participants were pre-screened for initial study eligibility via a telephone script delivered to a parent. After the full sample of overweight controls was recruited, potential participants who met basic study entry criteria per the phone screen (e.g., weight criteria) were instructed to complete the Youth Eating Disorder Examination-Questionnaire independently at their homes before scheduling the first assessment visit. This provided an initial screen for the presence of loss of control eating. The Youth Eating Disorder Examination-Questionnaire includes detailed instructions on rating episodes of loss of control eating and has demonstrated good agreement with the gold standard Child Eating Disorder Examination in assessing binge eating among adolescents (Goldschmidt, Doyle, & Wilfley, 2007). The Youth Eating Disorder Examination-Questionnaire was used only as a screening measure and was not included in statistical analyses.

Visit 1: In-person Screening and Assessment

Participants who met initial study criteria were invited to the Washington University School of Medicine Weight Management and Eating Disorders Program for a baseline study visit which lasted one to two hours. This first visit consisted of assenting and consenting children and parents, respectively, to participate in the study (see Appendices B and C for assent and consent forms). In addition, a semi-structured interview and all questionnaire measures assessing stable variables (e.g., food preferences; see Table 3 for a full schedule of assessments) were completed. An experimenter was available to assist younger children and those with comprehension

Table 3
Schedule of Assessments

Domain	Measure	Respondent*	Study visit						
			1	2			3		
				Pre-film	Post-film	Post-test meal	Pre-film	Post-film	Post-test meal
Overweight status	Height	C, P	X						
	Weight	C, P	X						
Demographics	Age/date of birth	C	X						
	Grade	C	X						
	Ethnicity	C	X						
	Pubertal status figured drawings	C	X						
	Medications	P_C	X						
	Medical problems	P_C	X						
	Psychiatric treatment	P_C	X						
Eating	ChEDE	C	X						
	EDE-Q	P	X						
	EES-C	C	X						
	FSQ	C	X						

Domain	Measure	Respondent*	Study visit						
			1	2			3		
				Pre-film	Post-film	Post-test meal	Pre-film	Post-film	Post-test meal
	VAS hunger, fullness, desire to eat, nausea, and loss of control	C		X		X	X		X
	Feelings about test meal	C				X			X
Mood	Face scale	C		X	X	X	X	X	X
	Mood scale	C		X		X	X		X
General Psycho-pathology	CDI	C	X						
	STAIC Trait Scale	C	X						
	CBCL	P_C	X						

Note: ChEDE = Child Eating Disorder Examination; EDE-Q = Eating Disorder Examination-Questionnaire; EES-C = Emotional Eating Scale for Children and Adolescents; FSQ = Food Scale Questionnaire; VAS = visual analogue scale; STAIC = State and Trait Anxiety Questionnaire; CDI = Children's Depression Inventory; CBCL = Child Behavior Checklist.
*C = child; P = parent; P_C = parent reporting on child

difficulties in completing questionnaires. Children endorsing clinically significant levels of psychopathology at this session (e.g., depression) were given appropriate referrals, but still had the opportunity to participate in the study.

At the end of their first study visit, after study eligibility criteria were met, participants were given detailed instructions regarding procedures for the second and third study visits (i.e., study visits involving buffet test meals). Participants were told to cease eating or drinking at midnight the night before each of the two remaining study visits. They were given a standard 240 kilocalorie breakfast meal comprised of one 37 g Kellogg's Nutri-grain® bar (140 kilocalories) and one 200 g Juicy Juice® apple juice box (100 kilocalories), to be consumed at home the morning of each of the two remaining study visits. Participants were informed that they could substitute an approximately equal amount of milk for the juice if so desired, but no participants chose to do so. Participants were instructed to eat the breakfast meal promptly at 8:30 a.m. and not to eat or drink anything except water after consumption of the meal. Participants were also instructed to refrain from physical activity and from using any substances (e.g., non-prescribed medications) that might interfere with food intake on the day of testing. If illness developed which might affect appetite or taste sensations (e.g., upper respiratory infection), participants were instructed to reschedule their test meals; however, rescheduling for this reason was not necessary for any participants.

Visits 2 and 3: Experimental Mood Manipulations and Buffet Test Meals

Study visits 2 and 3 took place at the Pediatric Clinical Research Unit at St. Louis Children's Hospital. The mean number of days between the baseline (i.e., first) and second study visits was 11.61 (*SD* = 6.1). The mean number of days between the second and third study visits, which both consisted of the experimental affect manipulation and buffet test meal, was 10.74 (*SD* = 5.63). Both the second and third

study visits were scheduled at approximately 11:00 a.m. to experimentally control for time of day and to coincide with lunch. These sessions were typically scheduled on weekends to accommodate children's school schedules, except during school breaks when they were arranged on weekdays.

In preparation for study sessions, test meal food items were purchased in standard quantities for each participant. Consistent with Mirch et al. (2006), these foods varied in macronutrient content and energy density, and covered a range of taste categories (e.g., sweet, salty; for a full list of foods and amounts, see Appendix D). All food items were arranged on plain white servingware in an identical array for each participant. Beverages were served in opaque pitchers so that participants could not determine how much they had consumed. All foods were located within reaching distance of the participant's seat.

Upon arrival at the second and third study sessions, parents were queried about their child’s food intake and any physical activity in which their child engaged prior to having arrived at the study session, to ensure compliance with instructions. Participants were directed to a small room equipped with a table, chair, and portable DVD player. They were instructed to complete questionnaires assessing mood, hunger levels, and other state variables (see Appendices H, I, and J). For children under age 7, the experimenter read questionnaire items aloud and instructed the participant to circle the appropriate response choice. The experimenter then read participants a brief set of instructions to orient them to the film and to encourage their full attention (see Appendix E). Children were then left alone to watch a brief segment of either a sad or neutral film.

Film clips were selected as the method of mood induction because they have been shown to reliably produce the desired mood in children, are relatively rapid to administer, require little participant effort, and present few ethical concerns (Brenner, 2000). The sad and neutral film clips were matched for time (4 minutes 20 seconds). The

sad film clip depicted a scene from the movie *The Champ* (Metro-Goldwyn-Mayer, 1979) in which a boy watches his father die; this movie has been validated for use in eliciting sadness (Gross & Levenson, 1995), and has been used extensively in mood induction studies with children and adults (Rottenberg, Ray, & Gross, 2007). The neutral clip depicted a series of scenes from the movie *Winged Migration* (Sony Pictures Classics, 2003). The scenes showed various types of birds in their natural settings. *Winged Migration* is consistent with expert recommendations to elicit neutral moods by using relaxing and engaging films that depict scenes from nature and feature uplifting music (Rottenberg et al., 2007). The order of film presentations (sad vs. neutral) was counterbalanced across participants. Children were required to use headphones while viewing the films to minimize distractions and promote focused attention. Subsequent to viewing the film clips, participants were administered the Face Scale and asked to select from an assortment of emotionally valenced faces the face that best corresponded to their current mood state (Lorish & Maisiak, 1986).

Participants were then led to a separate room, no more than 20 feet from the room where they had viewed the film, in which the buffet meal was arranged. Two conference rooms with similar décor were used for all test meals. When possible, participants completed the test meal in the same room for both the sad and the neutral mood induction. Only one participant completed her test meals in different rooms. She was later excluded as an outlier and her data were not included in any statistical analyses (see p. 82). Both conference rooms were equipped with a long table and chairs. Books and other distracting objects were removed from the rooms prior to test meals to encourage children to eat rather than engage in other activities. After children were introduced to the test meal room, they were instructed to “Please let yourself go and eat as much as you like. You may eat as much of anything as you like, but you do not have to eat anything you don’t like.” Participants were instructed to open the door

when they were finished eating so that the experimenter could retrieve them. Time spent eating was measured from the time the investigator left the room to the time the participant opened the door.

Upon completing the test meal, participants were led back to the room in which they had watched the films, where they were instructed to complete the remaining questionnaires. As with questionnaires completed before the film administration, younger children were read questionnaire items and response choices by the experimenter. For all participants, the experimenter then administered a semi-structured interview assessing children's experience during the experimental procedures. This interview also included several questions about film content to assess attention during film administration (see Appendix K).

Measures

Food Intake

The primary outcome variable of food intake at the test meals was determined by both total volume eaten in grams and total kilocalorie consumption. Both kilocalorie intake and total food intake in grams were measured to maintain consistency with previous feeding laboratory studies (see Table 1). Furthermore, although food intake in grams is relevant to DSM-IV, which quantifies binge eating as consumption of a large *amount* of food (i.e., independent of caloric content; American Psychiatric Association, 1994), kilocalorie intake is important to measure because of its relationship to weight gain and obesity. To determine food intake, each food item was weighed before and after the test meal using an XP-3000 Series Compact Balance Scale (Denver Instruments, Gottingen, Germany). Unfinished combined food items (e.g., sandwiches) were taken apart so that each individual food item could be weighed separately.

Kilocalorie and macronutrient content of foods consumed was determined using Nutritionist Pro Diet Analysis software (Axxya Systems, Stafford, TX, 2007).

Anthropometric Measures

Height and weight measurements were obtained in triplicate via stadiometer and calibrated balance beam scale, respectively. Participants were instructed to remove extra clothing (e.g., jackets) and shoes. The mean of the three measurements was used to determine BMI. Child BMI, z-BMI, and percent overweight were calculated using Centers for Disease Control and Prevention growth charts and accompanying procedures (Kuczmarski et al., 2000).

Demographic Variables

Demographic data obtained from child participants included name, date of birth, phone number, email address, age, grade in school, and ethnicity. Parents also completed a demographic questionnaire consisting of their contact information (names, addresses, work and home phone numbers), sex, and marital status.

Child Eating Disorder Examination

The Child Eating Disorder Examination 12.0 (Bryant-Waugh, Cooper, Taylor, & Lask, 1996) was used to assess eating disordered behaviors and attitudes. The Child Eating Disorder Examination is a semi-structured, interviewer-based instrument aimed at assessing the key behavioral and attitudinal correlates of eating disorders. The Child Eating Disorder Examination is based on the adult Eating Disorder Examination, with modifications including the use of simpler language appropriate for a younger audience and the addition of a card-sort task to supplement items addressing overvaluation of shape and weight. The Child Eating Disorder Examination has adequate reliability and

validity (Bryant-Waugh et al., 1996; Decaluwe & Braet, 2004; Watkins, Frampton, Lask, & Bryant-Waugh, 2005).

Eating Disorder Examination Questionnaire

The Eating Disorder Examination-Questionnaire (Fairburn & Beglin, 1994), a self-report questionnaire version of the adult Eating Disorder Examination, was administered to the accompanying parent of child participants. The Eating Disorder Examination-Questionnaire subscales appear to have adequate internal consistency and test-retest reliability (Luce & Crowther, 1999; Mond, Hay, Rodgers, Owen, & Beumont, 2004). In addition, the Eating Disorder Examination-Questionnaire has shown good agreement with the gold standard Eating Disorder Examination in its measurement of attitudes and some behaviors (e.g., compensatory behaviors) associated with eating disorders, across both eating disordered and non-eating disordered samples (Black & Wilson, 1996; Carter, Aime, & Mills, 2001; Fairburn & Beglin, 1994; Grilo, Masheb, & Wilson, 2001).

Emotional Eating Scale for Children and Adolescents

The Emotional Eating Scale (Arnow et al., 1992), a 26-item scale assessing the tendency to eat in response to a range of negative emotions (e.g., anger), has demonstrated adequate reliability and validity (Arnow et al., 1992; Waller & Osman, 1998). A youth-adapted form of the measure, the Emotional Eating Scale for Children and Adolescents, also appears to have adequate construct validity, test-retest reliability, and discriminant validity (Tanofsky-Kraff, Theim et al., 2007). See Appendix F for a copy of the Emotional Eating Scale for Children and Adolescents.

Food Scale Questionnaire

A modified version of the Food Scale Questionnaire (Epstein, Saad, Giacomelli, & Roemmich, 2005) was used to assess test food-liking. Items consisted of the 28 foods and beverages presented during the standard buffet meal, with Likert-type responses ranging from 1 (do not like) to 5 (like very much). Liking of each food and beverage item presented in the buffet meal was assessed separately. Forty additional filler food and beverage items were intermixed with the buffet meal items so that children could not deduce the types of foods that would be presented during the buffet meal. Food Scale Questionnaire scores in the current study were based only upon liking of the 28 foods presented during the buffet meal. See Appendix G for a copy of the Food Scale Questionnaire.

Eating Scales

An adapted form of the Food Scale Questionnaire with Likert-type responses (Epstein et al., 2005) was used to assess hunger, fullness, desire to eat, nausea, and loss of control before presentation of the film clips, and after administration of the test meal. Likert scales have been found to be of comparable reliability to visual analogue scales, although children appear to find scales with Likert-type anchors preferable and easier to complete (Van Laerhoven, Van Der Zaag-Loonen, & Derkx, 2004). See Appendix H for a copy of the Eating Scales.

Face Scale

The Face Scale is a brief, nonverbal measure which assesses mood via a sequence of seven emotionally valenced faces. The Face Scale was adapted from the Wong-Baker FACES Pain Rating Scale (Wong & Baker, 1988), a visual analog scale to assess pain in children, by using labels describing varying degrees of happiness and sadness rather than labels describing varying degrees of pain. The Wong-Baker FACES

Pain Rating Scale has been shown to have good reliability and validity (Bieri, Reeve, Champion, Addicoat, & Ziegler, 1990; Keck, Gerkensmeyer, Joyce, & Schade, 1996). A test of a nine-item emotional Face Scale in 4-year-olds produced a split-half reliability of .75 for mood valence (Lay, Waters, & Park, 1989). See Appendix I for a copy of the Face Scale.

Mood Scales

An adapted form of the Food Scale Questionnaire with Likert-type responses (Epstein et al., 2005) was used to assess the eight distinct mood states before presentation of the film clips and after administration of the test meal. As noted above, Likert scales appear to have good reliability and are acceptable to children. See Appendix J for a copy of the Mood Scales.

Feelings Questionnaire

An exit questionnaire was administered to participants upon completion of each test meal to determine their sense of loss of control during the test meal, emotions about the film and about their intake at the test meal, and to ascertain how comparable the test meal was to a typical eating episode in the naturalistic setting. Additional questions inquired about content of the film viewed to ensure that children attended to the film. The questionnaire was adapted from a similar questionnaire used by Fisher and Birch (2000). See Appendix K for a copy of the Feelings Questionnaire.

Figured Drawings

Figured drawings of Tanner sexual stages were used to assess pubertal status. This less-invasive method for assessing pubertal stage has been well-validated in pre-adolescent children (Duke, Litt, & Gross, 1980; Neinstein, 1982; Schlossberger, Turner,

& Irwin, 1992). Although self-ratings of breast development were overestimated by overweight girls, pubic hair ratings were found to be concordant with actual pubic hair stage in this population (Bonat, Pathomvanich, Keil, Field, & Yanovski, 2002); thus, only pubic hair ratings were obtained in the current study. See Appendix L for a copy of the Figured Drawings.

Children's Depression Inventory

The Children's Depression Inventory (Kovacs, 1985) is a widely used measure for assessing depressive symptoms in youth. The Children's Depression Inventory is well-established in terms of its test-retest reliability, internal consistency, and construct validity (Sitarenios & Kovacs, 1999). It has been found to correlate modestly with clinician reports of depression (Kazdin, 1989) and to distinguish between children with depression and those with other forms of psychopathology (Carlson & Cantwell, 1980).

State and Trait Anxiety Inventory for Children

Participants were asked to complete the Trait Scale of the State and Trait Anxiety Inventory for Children (Spielberger, 1973). The State and Trait Anxiety Inventory for Children is considered the gold standard, with multiple studies supporting its reliability and validity (Spielberger, 1989).

Achenbach's Child Behavior Checklist

Achenbach's Child Behavior Checklist (Achenbach, 1991) was administered to parents of child participants. The Child Behavior Checklist contains 120 items assessing a range of behavioral and emotional problems to generate eight clinical subscales, internalizing and externalizing scales, a total problems scale, and a competence scale.

The Child Behavior Checklist has demonstrated good reliability and validity (Achenbach, 1991; Achenbach & Elderbrock, 1991).

Statistical Analyses

Data were double-entered and analyzed using SPSS 16.0 for Windows. Statistical significance for all tests was set at $p < .05$.

Preliminary Analyses

The primary outcome measure of total food intake (i.e., kilocalorie consumption and amount eaten in grams) at each test meal was screened for outliers by group (i.e., LOC+ vs. LOC-). Outliers were defined as individuals with extreme scores at one or both test meals (i.e., > 2.5 standard deviations from their respective group means). Outliers were excluded from all analyses utilizing food intake data.

To examine whether randomization order (i.e., whether the participant was administered the sad mood induction first versus the neutral mood induction first) differentially impacted food intake at the sad versus neutral test meal, two separate repeated-measures ANOVAs were conducted. In both ANOVAs, kilocalorie intake or amount eaten in grams in each mood condition was entered as the dependent variable and randomization order was entered as the between-subjects factor. To examine whether timepoint (i.e., food intake at the first versus second test meal, regardless of the corresponding mood condition) impacted eating behavior, two separate paired sample t-tests were conducted comparing kilocalorie intake and amount eaten in grams at each participant's first and second test meal.

Descriptive Analyses

Study completers versus non-completers. Randomized study completers were compared to non-completers on the normally distributed continuous variable of z-BMI using independent samples t-tests; for the skewed continuous variables of BMI percentile, age, grade in school, and parent BMI, non-parametric Mann-Whitney U-tests were performed to test group differences (Kolmogorov-Smirnoff normality tests, age and parent BMI: $p < .05$; all others $p < .01$). Chi-square tests were used to compare study completers and non-completers on the categorical variables of ethnicity, loss of control eating status, and parent marital status.

Demographic comparisons of LOC+ and LOC- study completers. Among study completers, LOC+ participants were compared to LOC- participants on the normally distributed continuous variables of age and z-BMI using independent samples t-tests; non-parametric Mann-Whitney U-tests were performed to test group differences regarding the continuous variables of BMI percentile, child grade, and parent BMI (Kolmogorov-Smirnoff normality tests, age and parent BMI: $p < .05$; BMI percentile: $p < .001$).

Psychosocial comparisons of LOC+ and LOC- study completers. MANOVA was used to compare LOC+ and LOC- girls on the following psychosocial measures: State and Trait Anxiety Inventory for Children trait anxiety; Children's Depression Inventory depression; Child Behavior Checklist internalizing and externalizing problems; Emotional Eating Scale for Children and Adolescents total score; and Child Eating Disorder Examination restraint, eating concern, weight concern and shape concern subscale scores.

Correlations between baseline and pre-mood induction variables, and food intake. The relation between participants' food intake (i.e., energy intake in kilocalories, and amount of food eaten in grams) at each test meal, and the baseline variables of age, z-BMI, Tanner pubertal status, Food Scale Questionnaire food liking, State and Trait Anxiety Inventory for Children trait anxiety, Children's Depression Inventory depression, Child Behavior Checklist total behavior problems score, Emotional Eating Scale for Children and Adolescents total emotional eating score, and Child Eating Disorder Examination restraint and global severity was computed using Pearson correlations. The relation between food intake and pre-mood induction hunger, fullness, and desire to eat in each mood condition was also examined using Pearson correlations. That is, pre-mood induction variables in the sad condition were correlated with food intake in the sad condition only, whereas pre-mood induction variables in the neutral condition were correlated with food intake in the neutral condition only. Pearson correlations were also computed to examine concordance in food intake across the mood conditions.

Adherence to the experimental protocol. Frequencies were computed to determine the number of participants who did and did not comply with instructions to consume a standard prescribed breakfast meal prior to each test meal. To determine whether compliance with these instructions affected food intake, participants who did and did not report complying with these instructions were compared on kilocalorie intake and amount eaten in grams in each test meal condition using t-tests.

Frequencies were computed to determine the number of participants who were and were not able to appropriately respond to questions about film content, which were administered to assess attention to each film. To examine whether attention influenced mood state after the films, participants who were and were not able to answer questions

about film content were compared on post-mood induction Face Scale scores using t-tests.

Manipulation Check

To confirm that all children experienced significantly greater negative affect following the sad film than the neutral film, a 2 X 2 repeated-measures ANCOVA, controlling for loss of control status, was performed. Face Scale score served as the dependent variables, whereas Time (pre-mood induction vs. post-mood induction) and Mood Condition (sad vs. neutral) served as independent variables.

Primary Analyses

Hypothesis I: Children with loss of control eating will consume more, both in terms of kilocalories and volume (i.e., amount eaten in grams), following a sad mood induction than a neutral mood induction (see Figure 2). Repeated-measures ANCOVA was conducted within the LOC+ group to compare food intake in the sad and neutral mood conditions, with mood condition (sad vs. neutral) as the within-subjects factor. Separate models were run for food intake as measured by kilocalorie consumption (controlling for z-BMI) and total amount eaten in grams (controlling for age).

Hypothesis II: Children with loss of control eating problems will consume more, in terms of kilocalories and volume, when exposed to a sad mood induction relative to a neutral induction; in contrast, children without loss of control eating problems will consume similar amounts of food, whether exposed to a sad or neutral mood induction. Children with loss of control eating problems will consume more than children without loss of control eating problems, regardless of mood condition (see Figure 3). Within the full sample, a repeated-measures ANCOVA was used to examine the interaction of loss

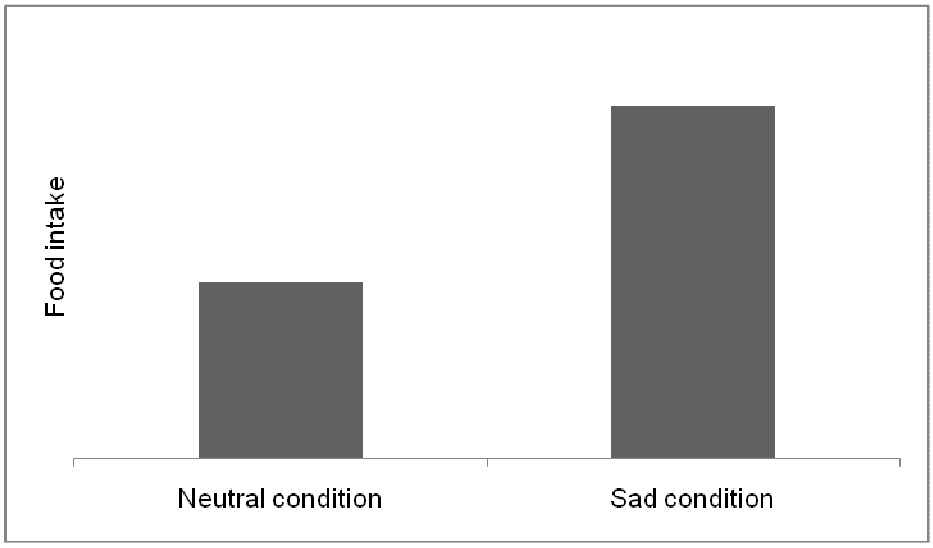

Figure 2. Hypothesized intake of children with loss of control eating problems in sad and neutral mood conditions

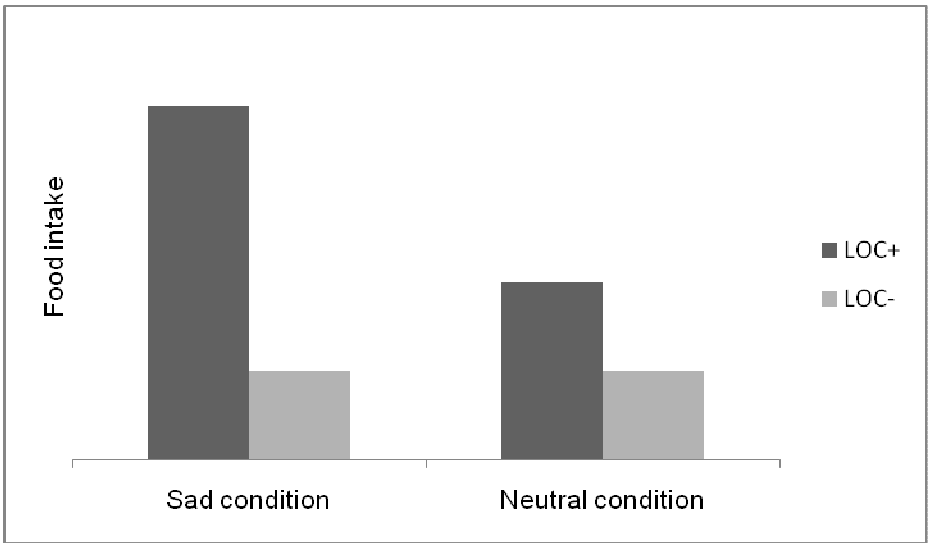

Figure 3. Hypothesized interaction between loss of control eating status and mood condition

of control eating status and mood condition, with loss of control eating status (LOC+ vs. LOC-) as the between-subjects factor, and mood condition (sad vs. neutral) as the within-subjects factor. Separate models were run for energy intake as measured by kilocalorie consumption (controlling for z-BMI) and total amount eaten in grams (controlling for age).

Hypothesis III: In support of the affect regulation model, children with loss of control eating will be observed to significantly decrease their negative affect scores from post-negative mood induction to post-test meal (i.e., to experience more positive mood after the meal as compared to after the sad mood induction). In contrast, the mood scores of children without loss of control eating will remain relatively constant from post-mood induction to post-test meal (see Figure 4). Within the full sample, a repeated-measures ANOVA was conducted using Face Scale score as the dependent variable, with loss of control status (LOC+ vs. LOC-) as the between-subjects factor and time (pre-mood induction vs. post-mood induction vs. post-test meal) as the within-subjects factor.

Post-Hoc Group Confirmatory Analyses

To confirm whether children appeared to be accurately reporting on their loss of control status during the baseline study visit, two t-tests were conducted comparing the food intake, measured in both kilocalories and grams, of LOC+ and LOC- children in the neutral film condition. It was expected that the LOC+ group would consume significantly more food than the LOC- group, indicating that self-report of loss of control episodes is a marker for aberrant eating behavior in children.

Exploratory Analyses

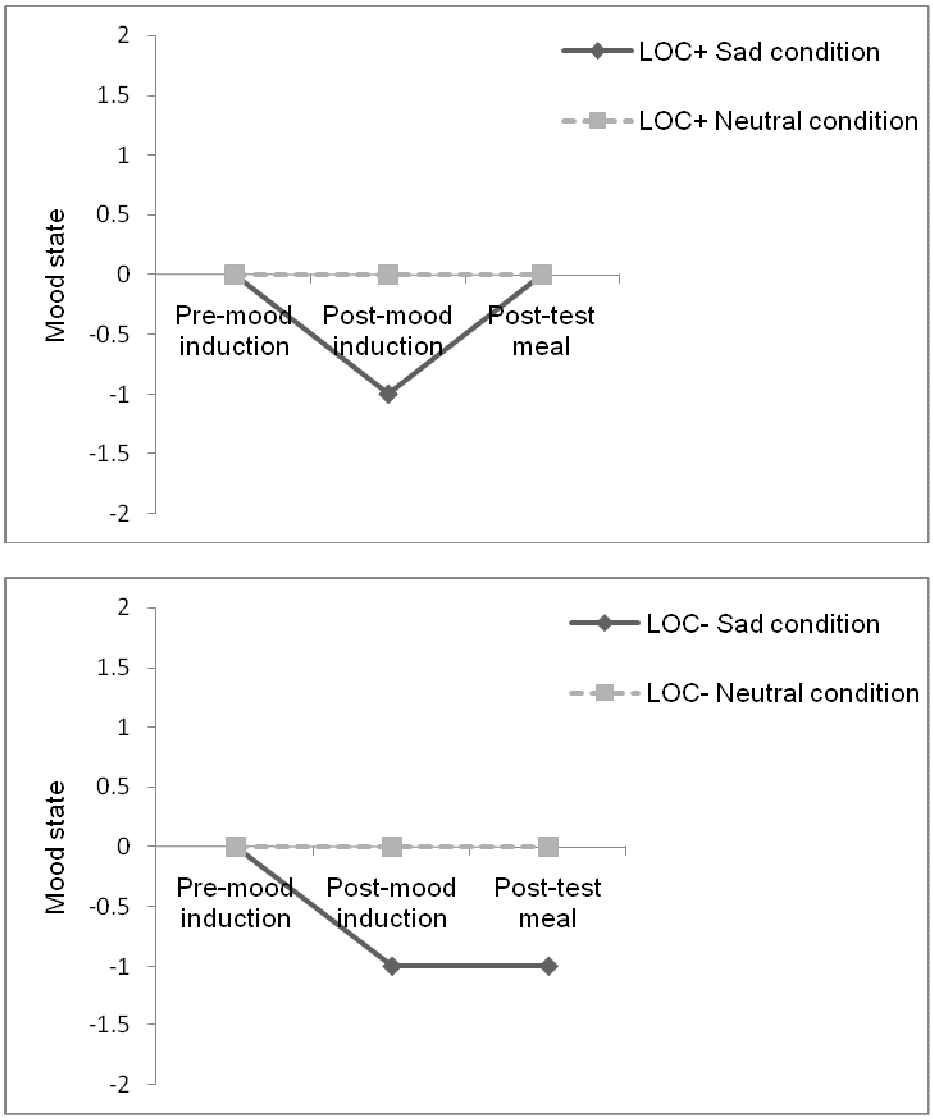

Figure 4. Hypothesized mood patterns of children with and without loss of control eating in sad and neutral mood conditions

To further explore the relationship between mood and eating behavior among LOC+ children, several sets of additional analyses were undertaken. Repeated-measures ANCOVA was conducted within the LOC+ group to compare macronutrient content of test meals in the sad and neutral mood conditions, with mood condition (sad vs. neutral) as the within-subjects factor. Separate models were run for the dependent variables of percentage energy intake from protein, percentage energy intake from carbohydrates, and percentage energy intake from fat (all controlling for z-BMI). Within the full sample, repeated-measures ANCOVA was used to examine the interactional effects of loss of control eating status and mood condition with regard to macronutrient composition of test meals. In these analyses, loss of control eating status (LOC+ vs. LOC-) was the between-subjects factor and mood condition (sad vs. neutral) was the within-subjects factor. Separate models were run for the dependent variables of percentage energy intake from protein, percentage energy intake from carbohydrates, and percentage energy intake from fat (all controlling for z-BMI).

Linear regression was used to examine the relation between post-mood induction Face Scale score, and food intake in the sad condition for LOC+ girls only. For the dependent variable of kilocalorie intake, the first block contained child z-BMI and pre-mood induction Face Scale score, and the second block contained post-mood induction Face Scale score. For the dependent variable of food intake in grams, the first block contained child age and pre-mood induction Face Scale score, and the second block contained post-mood induction Face Scale score.

Two separate linear mixed model analyses were used to examine the interactional effects between post-mood induction Face Scale score and mood condition on food intake within the full sample. Both models specified mood condition and post-mood induction Face Scale score as fixed effects and subjects as a random factor, and both included pre-mood induction Face Scale scores as a covariate. For the dependent

variable of kilocalorie intake, z-BMI was also included as a covariate, whereas for the dependent variable of food intake in grams, age was also included as a covariate. As an additional test of the interactional effects between mood state and mood condition on food intake, correlations between post-mood induction Face Scale score and food intake in each mood condition were compared to one another using Fisher's r-to-z transformations. Two such comparisons were undertaken. In the first comparison, the partial correlation between post-(sad) mood induction Face Scale score and sad condition kilocalorie intake (controlling for pre-[sad] mood induction Face Scale score and z-BMI) was compared to the partial correlation between post-(neutral) mood induction Face Scale score and neutral condition kilocalorie intake (controlling for pre-[neutral] mood induction Face Scale score and z-BMI). In the second comparison, the partial correlation between post-(sad) mood induction Face Scale score and sad condition food intake in grams (controlling for pre-[sad] mood induction Face Scale score and age) was compared to the partial correlation between post-(neutral) mood induction Face Scale score and neutral mood condition food intake in grams (controlling for pre-[neutral] mood induction Face Scale score and age).

A chi-square analysis was conducted to examine LOC+ girls' likelihood of reporting loss of control in the sad versus neutral film condition. Logistic regression was used to examine the relation between mood and likelihood of reporting a sense of loss of control in the sad mood condition among LOC+ girls. For the dichotomous dependent variable of loss of control (yes vs. no) during the test meal in the sad condition, the first block contained pre-(sad) mood induction Face Scale score, and the second block contained post-(sad) mood induction Face Scale score.

Results

Preliminary Analyses

Based on means and standard deviations for the primary outcome of kilocalorie intake and amount eaten in grams, examined separately for each group (LOC+ vs. LOC-) and mood condition (sad vs. neutral), two cases were determined to have kilocalorie intake and/or intake in grams > 2.5 standard deviations above their respective group mean for each of their test meals. One of these cases completed both of her test meals an hour later than directed. The other case did not consume the standard breakfast meal prior to one of her test meals. Thus, both of these outliers were excluded from the food intake outcome analyses. Although analyses yielded similar results with and without these outliers, the food intake data reported henceforth do not include these outliers. However, these cases were included in descriptive analyses and MANOVA comparisons of LOC+ and LOC- girls with regard to baseline psychosocial variables.

There was no main effect for randomization order on food intake as measured in either kilocalories, $F(1, 42) = 0.05$, $p = .83$, or food intake in grams, $F(1, 42) = 0.06$, $p = .81$. Thus, order of mood inductions (i.e., sad first versus neutral first) did not impact overall food intake across mood conditions. Randomization order also did not differentially impact food intake in the sad versus neutral mood conditions for either kilocalories, $F(1, 42) = 0.28$, $p = .60$, or food intake in grams $F(1, 42),= 0.30$, $p = .59$. That is, order of mood inductions (i.e., sad first versus neutral first) did not impact how much participants ate in the sad condition relative to the neutral condition. Finally, there was no session effect on food intake as measured in kilocalories, $t(43) = 0.60$, $p = .55$, or food intake in grams $t(43) = 0.48$, $p = .64$. That is, food intake did not significantly differ from the first to second test meal.

Descriptive Analyses

Study Completers Versus Non-Completers

For the continuous dependent variables of age, grade in school, z-BMI, BMI percentile, and parent BMI, there were no significant differences between randomized study completers (n = 46) and non-completers (n = 5; ps $\geq$ .24). For the categorical variables of ethnicity, loss of control eating status, and parent marital status, chi-square tests revealed no significant differences between completers and non-completers (ps $\geq$ .21). Thus, study completers appear to be a representative sample of overweight girls with and without loss of control eating problems.

Demographic Comparisons of LOC+ and LOC- Study Completers

Among study completers (n = 46), there were no significant differences between LOC+ and LOC- participants regarding the continuous variables of age, grade in school, z-BMI, BMI percentile, or parent BMI (ps $\geq$ .22). Chi-square tests revealed that the two groups also did not differ on the categorical variables of ethnicity or parent marital status (ps $\geq$ .48). Table 2 provides full demographic descriptions of study completers.

Psychosocial Comparisons of LOC+ and LOC- Study Completers

Regarding psychosocial differences between LOC+ and LOC- study completers, the full MANOVA model was significant, $F(9, 36) = 3.54$, $p = .003$. See Table 4 for full MANOVA results.

Correlations between Baseline and Pre-Mood Induction Variables, and Food Intake

Among study completers whose energy intake data were within normal limits (n = 44), z-BMI was significantly related to kilocalorie intake in both the sad and neutral film conditions (rs = .34, ps $\leq$ .03), but was not related to food intake in grams in either the sad (r = .24, p = .12) or neutral (r = .25, p = .11) mood condition. In contrast, age was related to food intake in grams in both the sad (r = .42, p = .005) and neutral (r = .38, p =

Table 4.
Psychosocial Characteristics of Participants With and Without Loss of Control Eating Problems

Variable	LOC+ (*n* = 23)	LOC- (*n* = 23)	*F*-values
Full MANOVA model	---	---	*F* (9, 36) = 3.54**
ChEDE Restraint	1.43 (0.91)	0.95 (1.05)	*F*(1, 44) = 2.72
ChEDE Eating Concern	1.05 (0.85)	0.39 (0.60)	*F*(1, 44) = 9.25**
ChEDE Weight Concern	3.16 (1.07)	1.71 (1.11)	*F*(1, 44) = 20.22***
ChEDE Shape Concern	2.51 (1.23)	1.12 (0.96)	*F*(1, 44) = 18.24***
EES-C	2.41 (0.60)	2.14 (0.84)	*F*(1, 44)= 1.50
CDI	8.35 (4.92)	5.22 (5.42)	*F*(1, 44) = 4.21*
STAIC—Trait Scale	39.00 (7.17)	32.48 (5.31)	*F*(1, 44) = 12.30**
CBCL Internalizing	58.96 (10.38)	49.09 (10.15)	*F*(1, 44) = 10.63**
CBCL Externalizing	55.35 (9.77)	48.39 (10.59)	*F*(1, 44) = 5.36*

Note: For all variables, *M* (*SD*) are reported. LOC+ = at least one loss of control eating episode in the past 3 months; LOC- = no history of loss of control eating; ChEDE = Child Eating Disorder Examination; EES-C = Emotional Eating Scale for Children and Adolescents; CDI = Children's Depression Inventory; STAIC = State and Trait Anxiety Scale for Children; CBCL = Achenbach's Child Behavior Checklist
*$p < .05$; **$p \leq .01$; ***$p \leq .001$

.012) film conditions, but was not related to kilocalorie intake in either the sad (r = .10, p = .52) or neutral (r = .17, p = .27) mood condition. Kilocalorie intake across mood conditions was strongly correlated (r = .76, p < .001), as was food intake in grams (r = .75, p < .001). See Table 5 for correlations between food intake and baseline and pre-mood induction variables.

Adherence to Experimental Protocol

Participants complied with instructions to consume a standard prescribed breakfast meal on the majority of test meal occasions (94.3%, n = 83 out of 88 test meal occasions; i.e., 2 test meals for each of 44 included participants). Non-compliers did not significantly differ from compliers in terms of test meal intake in either the sad (kilocalorie intake: $t(42) = 0.79$, p = .44; food intake in grams: $t(42) = 1.79$, p = .08) or neutral condition (kilocalorie intake: $t(42) = 0.71$, p = .48; food intake in grams: $t(42) = 0.30$, p = .77).

In the neutral condition, all participants were able to answer the question assessing attention to the mood induction film by naming at least two distinct types of birds depicted in the film. However, a number of participants (27.3%, n = 12) were unable to answer the parallel question in the sad condition by generating the name of the boy in the film. All of these participants were able to recall a general summary of the film that included major plot points (e.g., “The father died”). Furthermore, there were no differences between participants who were and were not able to answer the question assessing attention in terms of post-mood induction Face Scale score, $t(42) = 0.58$, p = .57. Thus, participants appear to have been appropriately affected by the sad mood induction regardless of whether they were able to recall specific details of the film.

Manipulation Check

Table 5.
Correlations between Food Intake, and Baseline and Pre-Mood Induction Variables

Variable	Sad condition: kilocalorie intake (*r*)	Sad condition: intake in grams (*r*)	Neutral condition: kilocalorie intake (*r*)	Neutral condition: intake in grams (*r*)
Baseline demographic and psychosocial variables				
z-BMI	.34*	.25	. 34*	.24
Age	.10	.42**	.17	.38*
Tanner pubertal status	.22	.20	.18	.21
FSQ	.13	-.03	.02	-.05
ChEDE Restraint	-.03	-.07	.03	.05
ChEDE Global Severity	.18	.08	.26	.18
EES-C	-.16	-.28	-.25	-.23
CDI	.05	.00	.19	.01
STAIC-Trait Scale	.06	-.05	.06	-.10
CBCL Total	.27	.13	.36*	.17
Pre-mood induction variables				
Hunger	-.03	-.01	.20	.00

Variable	Sad condition: kilocalorie intake (*r*)	Sad condition: intake in grams (*r*)	Neutral condition: kilocalorie intake (*r*)	Neutral condition: intake in grams (*r*)
Fullness	-.22	-.16	-.02	.04
Desire to eat	-.05	-.19	.16	.03

Note: FSQ = Food Scale Questionnaire; ChEDE = Child Eating Disorder Examination; EES-C = Emotional Eating Scale for Children and Adolescents; CDI = Children's Depression Inventory; STAIC = State and Trait Anxiety Scale for Children; CBCL = Achenbach's Child Behavior Checklist
*$p < .05$; **$p \leq .01$; ***$p \leq .001$

The results of the 2 X 2 repeated-measures ANCOVA (Time [pre-mood induction vs. post-mood induction] X Mood Condition [sad vs. neutral]) conducted on Face Scale scores, controlling for loss of control status, revealed significant main effects for both time, $F(1, 44) = 47.26$, $p < .001$, and mood condition, $F(1, 44) = 17.91$, $p < .001$, and a significant interactional effect of Time X Mood Condition, $F(1, 44) = 28.36$, $p < .001$ (see Figure 5). These results indicate that, after the mood inductions, participants in the sad mood condition reported significantly greater negative affect than participants in the neutral mood condition. Thus, the experimental manipulation of mood appears to have been effective.

Primary Analyses

Hypothesis 1

Within the LOC+ group, the repeated-measures ANCOVAs (controlling for z-BMI and age, respectively) were not significant for energy intake as measured by either total amount eaten in kilocalories, $F(1, 20) = 0.66$, $p = .43$ (see Figure 6), or total amount eaten in grams, $F(1, 20) = 0.13$, $p = .72$ (see Figure 7). Thus, neither the quantity nor kilocalorie composition of food LOC+ girls consumed differed across sad and neutral film conditions. All aforementioned results remained the same when examining only girls who reported objective binge eating in the past 3 months ($n = 7$).

Hypothesis 2

Within the full sample, the repeated-measures ANCOVA for kilocalorie intake revealed neither main effects for loss of control status, $F(1, 41) = 2.44$, $p = .13$, or mood condition, $F(1, 41) = 0.61$, $p = .44$, nor an interactional effect between loss of control status and mood condition, $F(1, 41) = 0.60$, $p = .44$ (see Figure 8). When comparing girls reporting objective binge eating over the past 3 months, to those reporting no loss of

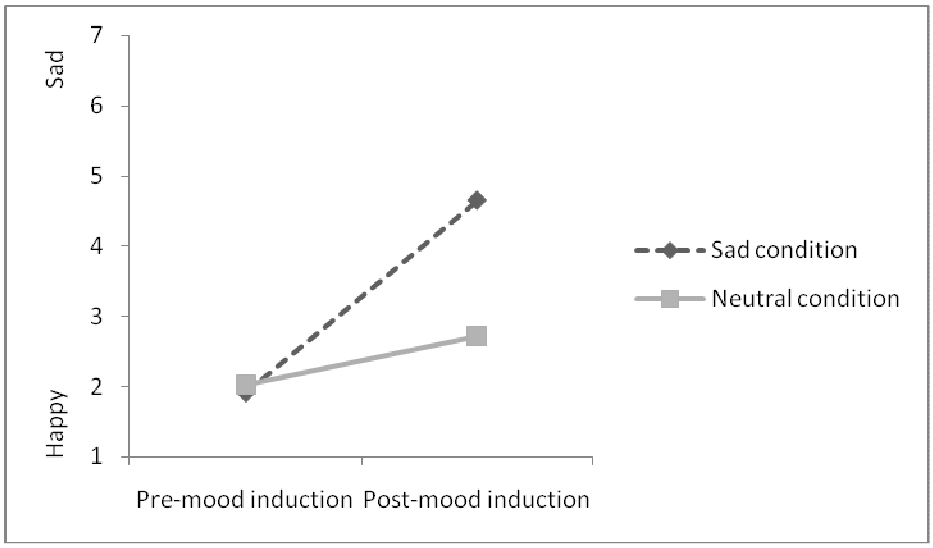

Figure 5. Changes in mood patterns before and after mood inductions in sad and neutral mood conditions

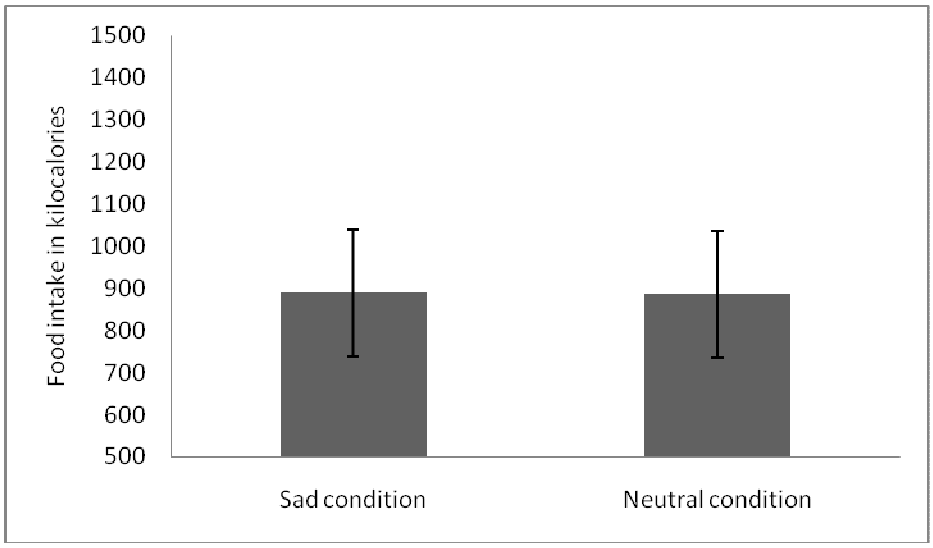

Figure 6. Mean kilocalorie intake in sad and neutral mood conditions among participants reporting loss of control eating problems

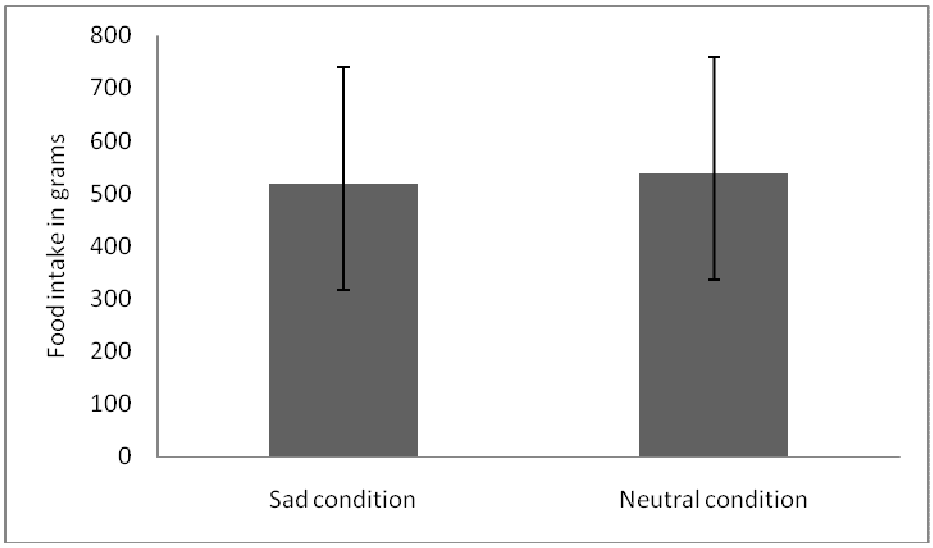

Figure 7. Mean food intake in grams in sad and neutral mood conditions among participants reporting loss of control eating problems

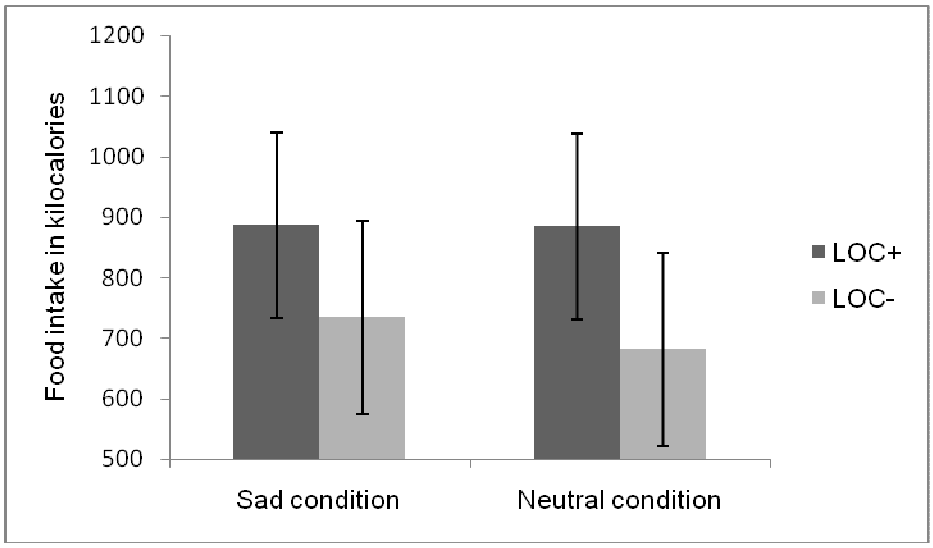

Figure 8. Mean kilocalorie intake during sad and neutral mood conditions among participants with and without loss of control eating problems

control, the main effect for mood condition remained non-significant, $F(1, 27) = 0.00$, $p = .98$, as did interactional effect between binge eating status and mood condition, $F(1, 27) = 0.98$, $p = .33$. However, the main effect for binge eating status was significant, $F(1, 27) = 4.38$, $p < .05$, such that girls reporting objective binge eating consumed significantly more kilocalories across both mood conditions, relative to girls reporting no loss of control.

The repeated-measures ANCOVA for food intake in grams also revealed no main effects for loss of control status, $F(1, 41) = 0.70$, $p = .41$ or mood condition, $F(1, 41) = 1.01$. $p = .32$. However, there was a trend towards an interactional effect of loss of control status and mood condition, $F(1, 41) = 3.89$, $p = .06$, such that LOC- participants consumed a larger amount of food in grams in the sad condition than in the neutral condition, whereas LOC+ participants demonstrated no differences in food intake in grams between the sad and neutral mood conditions (see Figure 9). When comparing only girls reporting objective binge eating in the past 3 months to those reporting no loss of control, the interactional effect of loss of control status and mood condition in regards to food intake in grams was significant, $F(1, 27) = 6.75$, $p = .02$, with a similar pattern as noted in the full sample comparisons above. Main effects for binge eating status, $F(1, 27) = 2.91$, $p = .10$, and mood condition, $F(1, 27) = 0.06$, $p = .82$, remained non-significant.

Hypothesis 3

The full repeated-measures ANOVA model examining changes in Face Scale scores over the course of the experiment revealed a significant two-way interaction between timepoint (pre-mood induction, post-mood-induction, post-test meal) and mood condition (sad versus neutral), $F(2, 41) = 24.34$, $p < .001$. However, the three-way interaction between timepoint (pre-mood induction, post-mood-induction, post-test meal),

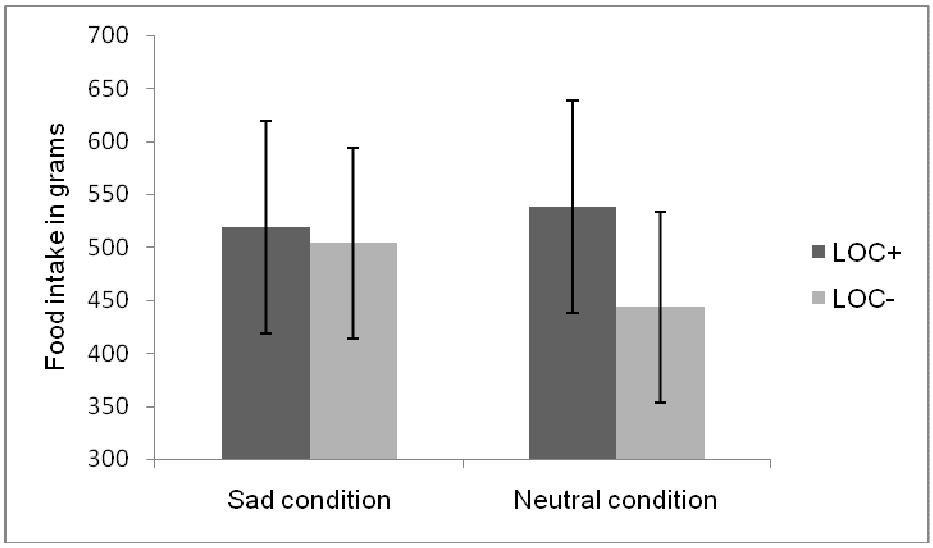

Figure 9. Mean food intake in grams during sad and neutral mood conditions among participants with and without loss of control eating problems

mood condition (sad versus neutral), and loss of control eating status (LOC+ versus LOC-) was not significant, $F(1, 41) = 0.15$, $p = .86$ (see Figure 10). These results indicate that, in the full sample, the pattern of change in Face Scale scores significantly differed across mood conditions over time. However, these effects did not differ by loss of control group. In effect, LOC+ and LOC- girls demonstrated similar changes in Face Scale scores over the course of the experiment across both mood conditions.

Post-Hoc Group Confirmatory Analyses

T-tests revealed that LOC+ girls ate significantly more kilocalories, $t(42) = 2.7$, $p = .04$, but not grams, $t(42) = 1.60$, $p = .12$, than LOC- girls in the neutral film condition. When these analyses were re-run comparing girls reporting objective binge eating ($n = 7$) to those reporting no loss of control eating ($n = 22$), findings regarding kilocalorie intake dropped to a trend level, $t(27) = 1.86$, $p = .08$, and findings regarding food intake in grams remained non-significant, $t(27) = 1.45$, $p = .16$. However, the lack of kilocalorie differences between girls reporting objective binge eating and those reporting no loss of control eating was likely due to the decreased sample size, given that the effect size for this comparison was large (Cohen's $d = .85$).

Exploratory Analyses

Repeated-measures ANCOVA, controlling for z-BMI, revealed that LOC+ participants consumed a significantly greater percentage of energy from fat in the sad condition ($M = 44.6\%$, $SD = 6.7$) relative to the neutral condition ($M = 43.5\%$, $SD = 6.6$), $F(1, 20) = 5.50$, $p = .03$. There were no significant differences between the sad and neutral conditions in terms of percentage of energy from protein, $F(1, 20) = 0.00$, $p = .98$, or from carbohydrates $F(1, 20) = 3.35$, $p = .08$. All aforementioned results remained the same when examining only girls who reported objective binge eating in the past 3

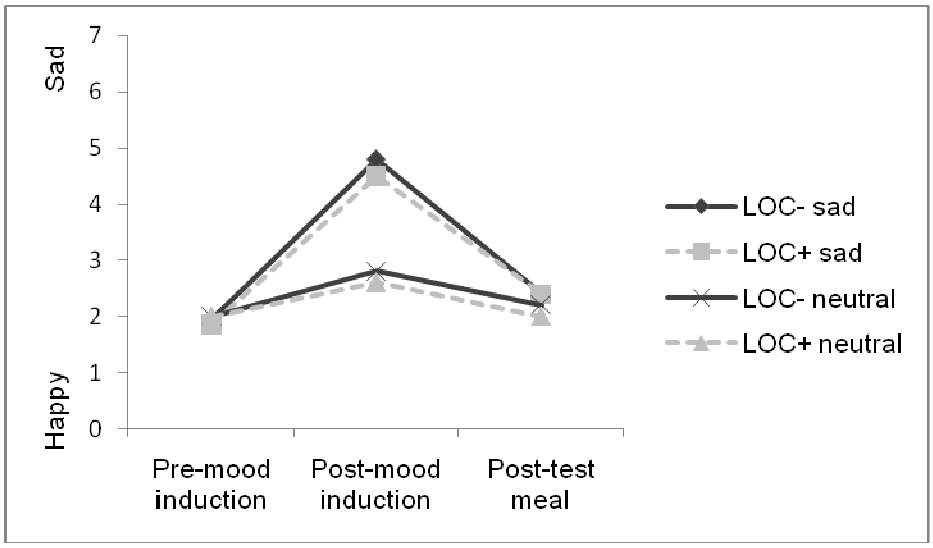

Figure 10. Patterns of mood change among participants with and without loss of control eating problems in sad and neutral mood conditions

months (n = 7), except that findings regarding percentage energy intake from fat, while in the same direction, dropped to a trend level, $F(1, 5) = 5.28$, $p = .07$.

Within the full sample, the repeated-measures ANCOVA for percentage energy intake from fat revealed neither main effects for loss of control status, $F(1, 41) = 3.10$, $p = .09$, or mood condition, $F(1, 41) = 0.00$, $p = .95$, nor an interactional effect between loss of control status and mood condition, $F(1, 41) = 0.53$, $p = .47$, after controlling for z-BMI. Similarly, the repeated-measures ANCOVA for percentage energy intake from protein revealed no main effects for loss of control status, $F(1, 41) = 0.02$, $p = .89$, or mood condition, $F(1, 41) = 0.36$, $p = .55$, nor an interactional effect between loss of control status and mood condition, $F(1, 41) = 2.19$, $p = .15$. Regarding percentage energy intake from carbohydrates, the repeated-measures ANCOVA demonstrated no main effects for loss of control status, $F(1, 41) = 2.48$, $p = .12$, or mood condition, $F(1, 41) = 0.16$, $p = .70$, and no interactional effect between loss of control status and mood condition, $F(1, 41) = 0.06$, $p = .81$. All aforementioned results remained the same when comparing only girls who reported objective binge eating in the past 3 months (n = 7) to those reporting no loss of control (ps $\geq$ .25).

There was a trend for the full linear regression model including z-BMI, pre-mood induction Face Scale score, and post-mood induction Face Scale score to predict kilocalorie intake, $F(3, 18) = 2.79$, $p = .07$. However, most of the variance was accounted for by z-BMI ($\beta = 0.54$, $t = 2.68$, $p = .02$). The linear regression model including age, pre-mood induction Face Scale score, and post-mood induction Face Scale score was not significant in predicting food intake in grams, $F(3, 18) = 1.47$, $p = .26$. When these regressions were rerun only in girls reporting objective binge eating, the models predicting kilocalorie intake and food intake in grams were both non-significant (ps $\geq$ .19).

Within the full sample, the linear mixed model analysis for kilocalorie intake

revealed neither a main effect for post-mood induction Face Scale score, $F(1, 84) = 0.12$, $p = .73$, nor an interactional effect between post-mood induction Face Scale score and mood condition, $F(1, 84) = 0.15$, $p = .70$. Similarly, for the dependent variable of food intake in grams, there was neither a main effect for post-mood induction Face Scale score, $F(1, 84) = 0.00$, $p = .97$, nor an interactional effect between post-mood induction Face Scale score and mood condition, $F(1, 84) = 0.19$, $p = .67$. The partial correlation between post-(sad) mood induction Face Scale score and sad condition kilocalorie intake, controlling for pre-(sad) mood induction Face Scale score and z-BMI, was not significant, $r(44) = .00$, $p = .99$, nor was the partial correlation between post-(neutral) mood induction Face Scale score and neutral condition kilocalorie intake, controlling for pre-(neutral) mood induction Face Scale score and z-BMI, $r(44) = -.03$, $p = .86$. Moreover, these correlations did not significantly differ from one another, $z = 0.14$, $p = .89$. The partial correlation between post-(sad) mood induction Face Scale score and sad condition food intake in grams, controlling for pre-(sad) mood induction Face Scale score and age, was not significant, $r(44) = -.01$, $p = .95$, nor was the partial correlation between post-(neutral) mood induction Face Scale score and neutral condition food intake in grams, controlling for pre-(neutral) mood induction Face Scale score and age, $r(44) = -.20$, $p = .19$. Again, these correlations did not significantly differ from one another, $z = 0.81$, $p = .38$.

No LOC- girls reported loss of control in either sad or neutral mood condition. Most LOC+ girls did not report loss of control in either the sad or the neutral mood condition (59.1%, $n = 13$); however, those who did report loss of control were more likely than expected to have experienced a sense of loss of control in both mood conditions (22.7%, $n = 5$) as opposed to only in the sad condition (9.9%, $n = 2$) or only in the neutral condition (9.9%, $n = 2$). The corresponding chi-square test was significant, $\chi^2(1, N = 22)$

= 7.43, p = .01. When examining only girls reporting objective binge eating, the chi-square test was no longer significant, $\chi^2(1, N = 7) = 1.22$, p = .27.

Logistic regression revealed that the full model, including pre-mood induction Face Scale score, and post-mood induction Face Scale score, predicted an increased likelihood of LOC+ girls reporting loss of control in the sad condition, $\chi^2(2, N = 22) = 7.08$, p = .03 (see Table 6). Most of the model's predictive power was accounted for by pre-mood induction Face Scale score, $\chi^2(1, N = 22) = 7.07$, p = .008. When the logistic regression analysis was re-run only in girls reporting objective binge eating, the overall model was no longer significant, p = .13.

Discussion

The current study examined the relation between mood and eating behavior among overweight girls with and without loss of control eating problems. Although there was no differential effect of the mood inductions (i.e., sad versus neutral) on objectively measured kilocalorie intake or amount eaten in grams among girls reporting loss of control eating (LOC+), a greater percentage of energy intake from fat was observed in the sad condition relative to the neutral condition among LOC+ girls. Furthermore, for LOC+ girls, mood state on the day of the sad mood induction significantly predicted self-reported loss of control during the subsequent buffet meal. Within the full sample of overweight girls, there was a trend towards an interaction between loss of control eating status and mood condition with regard to intake in grams, such that girls without loss of control eating problems (LOC-) consumed a greater amount of food in grams in the sad condition relative to the neutral condition, whereas LOC+ girls ate similar amounts of food regardless of whether they were exposed to a sad or a neutral mood. Similar interactions were not noted for food intake as measured in kilocalories. Finally, although the sad mood induction resulted in significantly more affective distress (i.e., sadness)

Table 6

Summary of Logistic Regression Analysis for Variables Predicting LOC+ Girls' Likelihood of Reporting Loss of Control While Eating in the Sad Condition Test Meal

Predictor	χ^2	df	*p*-value
Full regression model	7.08	2	.03
Pre-mood induction Face Scale	7.07	1	.008
Post-mood induction Face Scale	0.006	1	.94

than the neutral mood induction across loss of control groups, mood improvements were observed subsequent to completion of the test meals for the full sample. Overall, results provide some support for negative affect as a proximal determinant of eating behavior among overweight girls with loss of control eating problems; however, emotional eating in this population appears to be expressed in the subjective experience of loss of control (i.e., likelihood of reporting loss of control while eating when experiencing a negative mood), rather than the objective amount of food consumed.

Consistent with previous literature (Decaluwe & Braet, 2003; Goldschmidt, Jones et al., 2008; Goossens et al., 2007; Hilbert & Czaja, 2009; Isnard et al., 2003; Morgan et al., 2002; Tanofsky-Kraff et al., 2004), LOC+ girls reported significantly greater levels of psychosocial impairment than LOC- girls. Moreover, analyses of test meal data revealed greater kilocalorie intake for LOC+ girls relative to LOC- girls subsequent to a neutral mood induction, and when examining only girls reporting objective binge eating (i.e., consumption of an unambiguously large amount of food accompanied by loss of control), there was a significant main effect for these girls to consume more kilocalories across mood conditions, relative to overweight controls. These latter results replicate earlier test meal data suggesting that children with binge eating problems consume more kilocalories in a laboratory setting than children without aberrant eating (Mirch et al., 2006). Finally, while approximately 40% of LOC+ girls reported feeling out of control while eating during one or both test meals, no girls in the LOC- group reported feeling out of control during either test meal. Taken together, findings suggest that the ascertainment of loss of control eating status in the current study was valid, given convergence with other measures of psychopathology and with objective test meal data. Furthermore, the LOC+ sample appears to be representative of similar samples from previous studies.

Relation between Mood and Eating Among Girls Reporting Loss of Control

To examine the relation between mood and loss of control eating behavior, differences in eating behavior subsequent to a sad versus neutral mood induction were examined in girls reporting loss of control eating in the three months prior to assessment. It was hypothesized that, among girls reporting loss of control eating problems at the baseline assessment, food intake would be greater in the sad mood condition relative to the neutral mood condition. Contrary to hypotheses, there were no observed differences in kilocalorie consumption or amount of food consumed in grams by LOC+ girls at the test meals subsequent to a sad versus neutral mood induction. Furthermore, LOC+ girls were no more likely to have self-reported a sense of loss of control during the sad condition test meal, relative to the neutral condition test meal. These results may indicate that the mood induction procedures did not effectively mimic triggers for loss of control eating encountered in the natural environment, or, alternatively, that emotional eating in children with loss of control is not manifest in the consumption of (relatively) large amounts of food.

There are a number of plausible explanations as to why the mood inductions did not differentially impact kilocalorie intake or food intake in grams among LOC+ girls as hypothesized. First, although the manipulation check indicated that the sad film resulted in significantly greater levels of negative affect than the neutral film, it is possible that the affect manipulation did not induce a sufficient *intensity* of negative affect to impact eating behavior. Theories of emotion and behavior suggest that the intensity of a given emotion is positively associated with the likelihood of engaging in a compensatory behavior (e.g., running away from a predator in response to intense fear; Brehm, 1999), and acute sadness appears to be a more passive emotion which typically does not induce immediate action, as compared to more active emotions such as anger. Extending this theory to binge eating behaviors, recent ecological momentary assessment data suggest

that, among adult women with BN, binge eating is most likely to occur on days characterized by persistently high, or steadily increasing, negative affect (Crosby et al., 2009). In addition, other studies in binge eating samples have demonstrated that the likelihood of binge eating is positively associated with the level of negative affect experienced (Engelberg, Steiger, Gauvin, & Wonderlich, 2007; Smyth et al., 2007). In the current study, LOC+ girls generally reported feeling "sort of sad" following the negative mood induction (Face Scale *M* = 4.5, *SD* = 2.0). Thus, participants may not have been sad *enough* to engage in compensatory loss of control eating. Further research is warranted regarding the intensity of negative affect required to elicit loss of control eating among children.

Alternatively, the mood manipulation used in the current study may not have elicited the *type* of negative affect necessary to influence eating behavior. Some researchers have suggested that ego-related distress, or distress that threatens one's sense of self-worth, is necessary for eliciting disinhibited eating (Heatherton, Herman, & Polivy, 1992). According to the authors:

> Threats to… self-image motivate people to escape from self-awareness, which is especially aversive when they encounter negative information about the self. To escape from this state… binge eaters tend to avoid broadly meaningful thought and instead narrow their attention to the immediate stimulus situation. This cognitive shift redirects attention away from unpleasant thoughts about the self and toward food cues in the environment; it also has the effect of disengaging restraints and inhibitions that are normally supported by meaningful thought... The result… is disinhibited eating (p. 801).

Laboratory studies of disordered eating samples have yielded inconsistent support for this theory. Although some studies find that binge eating or overeating is more likely following an ego-related stressor relative to other types of stressors (Lattimore, 2001; Lattimore & Caswell, 2004; Lattimore & Maxwell, 2004; Oliver, Wardle, & Gibson, 2000), other studies have found non-ego-related distress to elicit aberrant eating as well (Agras & Telch, 1998; Chua et al., 2004; Cools, Schotte, & McNally, 1992; Schotte, Cools, &

McNally, 1990; Telch & Agras, 1996a). One specific source of ego-related stress that may be related to aberrant eating is that derived from negative social interactions. Several laboratory studies suggest that social rejection is related to failures in self-regulation (DeWall, Baumeister, & Vohs, 2008; Twenge, Catanese, & Baumeister, 2002), including self-regulation of food intake (Baumeister, DeWall, Ciarocco, & Twenge, 2005; Tanofsky-Kraff, Wilfley, & Spurrell, 2000). Furthermore, interpersonal problems have been found to be the most common precipitant to binge eating among adults (Stein et al., 2006), and teasing experiences predict loss of control eating among children and adolescents (Eddy et al., 2007). These findings may explain the positive effects of interpersonal psychotherapy on loss of control and binge eating symptoms in adults and children (Tanofsky-Kraff, Yanovski et al., 2008; Wilfley et al., 2002), as interpersonal psychotherapy seeks to alleviate affective distress and subsequent aberrant eating by modifying negative interpersonal interactions (Wilfley, Frank, Welch, Spurrell, & Rounsaville, 1998).

Relevant to the current study, it is possible that negative affect induced by viewing a sad event depicted in a film did not effectively replicate the distress elicited by ego-related or socially-based threats encountered in one's natural environment. Moreover, children may have found it difficult to personally relate to a distressing event experienced by a character in a film. As such, future studies should examine the impact of ego-related or interpersonal stressors on eating behavior among youth with loss of control eating problems, although caution should be used in implementing these procedures with young children, given ethical considerations. Relatedly, future studies should explore the types of events (interpersonal or otherwise) that are related to the occurrence of loss of control eating among children to inform future research and intervention development.

Additional factors that were not closely examined in the current study may interact with negative mood to elicit binge or loss of control eating in children. For example, both naturalistic and laboratory studies have demonstrated interactional effects of dietary restraint and negative affect on binge eating and overeating in adults (e.g., Cools et al., 1992; Schotte et al., 1990; Sheppard-Sawyer, McNally, & Fischer, 2000; Stice, Akutagawa, Gaggar, & Agras, 2000). Some (Decaluwe & Braet, 2005; Field et al., 2003; Tanofsky-Kraff et al., 2004) but not all (Claus et al., 2006; Decaluwe & Braet, 2003; Decaluwe et al., 2003; Glasofer et al., 2006) cross-sectional studies in children support an association between dieting and loss of control eating, hence dieting behaviors and/or cognitions may be involved in emotionally driven loss of control eating among children as well. In the current study, LOC+ and LOC- girls did not significantly differ on restraint and, in general, very low rates of dietary restraint were reported by both groups (LOC+ Restraint *M* = 1.43, *SD* = 0.91; LOC- Restraint *M* = 0.95, *SD* = 1.05). These low rates of restraint, combined with the small sample size, precluded meaningful examination of the interactional effects of dietary restraint and mood state on eating behavior. However, future studies should examine whether the effects of negative mood on eating behavior are contingent upon measures of dietary restraint as practiced in daily life or by experimentally induced dietary restraint (i.e., prior to laboratory assessment). Other factors that should be explored for interactions with negative mood include behavioral impulsivity (Braet et al., 2008) and reward sensitivity (Stice, Spoor, Bohon, & Small, 2008).

Finally, it is possible that the effects of mood state on subsequent loss of control eating in children may occur over a more distal time period than was captured within the experimental protocol. Indeed, the current study found that mood state *before* the sad mood induction was a stronger predictor of self-reported loss of control during the subsequent test meal, than was mood state *after* the mood induction. These results are

consistent with findings from Hilbert and colleagues (2009). In that study, children experienced more negative mood during days on which loss of control eating occurred, as compared with days on which loss of control eating did not occur. However, negative mood did not directly precede loss of control episodes. Within this framework, a negatively valenced event may trigger negative mood in children, which, instead of immediately triggering loss of control eating, intensifies over the course of the day, is managed ineffectively, and ultimately triggers loss of control eating when no longer tolerable.

It is important to understand the cognitive and emotional processes taking place during the interlude between the onset of negative mood and the initiation of loss of control eating. Preliminary data suggest that children with loss of control eating problems endorse significantly greater use of maladaptive coping strategies in response to negative mood than age-, sex- and weight-matched controls (Czaja et al., 2009). Frequently reported strategies include “giving up” and “perseveration”; this combination of avoidance and rumination may result in a delayed reaction to the original event that precipitated the negative mood. More generally, alexithymia, which involves an inability to identify, articulate, and cope with emotions (Sifneos, 1996), has been proposed as a central feature of loss of control eating in children (Tanofsky-Kraff, Goossens et al., 2007), given children’s self-reports of numbing and dissociation during loss of control eating episodes. Further research is warranted to explore interoceptive awareness and coping in children with loss of control eating to inform intervention development. Moreover, in future laboratory studies, it may be necessary to lengthen the time between a mood induction and administration of test meals; alternatively, it may be difficult to study mood and eating behavior using laboratory methodology. More detailed experience sampling methods, such as behavioral chain analysis, may be required for capturing the relation between mood and loss of control eating.

Aside from limitations of the experimental protocol, it is possible that emotional eating in children with loss of control eating problems is primarily characterized by the subjective experience of loss of control while eating, rather than consumption of large amounts of food. In general, although LOC+ girls as a whole ate more kilocalories than overweight controls after a neutral mood induction, there were no differences in kilocalorie intake on the basis of loss of control eating status across the two mood conditions (i.e., lack of significant main effect for loss of control status). Other laboratory data have also provided evidence that differences in objectively measured energy intake are apparent only when categorizing children on the basis of *objective binge eating* (Mirch et al., 2006). In contrast, when children are categorized on the basis of loss of control eating, *with or without objective overeating*, differences in energy intake fail to emerge (Tanofsky-Kraff, McDuffie et al., 2009). As the majority (65.2%, *n* = 15) of the LOC+ sample in the current study consisted of girls reporting only subjective binge eating (i.e., consumption of relatively small amounts of food accompanied by loss of control while eating), the lack of difference between LOC+ participants' sad and neutral energy intake may reflect their tendency to eat smaller amounts of food during loss of control eating episodes in general. Nevertheless, negative mood predicted self-reported loss of control during the sad condition test meal in the current study, suggesting that emotionally driven loss of control eating is a phenomenon that is relevant to children, even though effects may not be quantifiable in terms of the amount of food consumed. Furthermore, given that loss of control is associated with psychopathology and a tendency to gain excess weight over time, even when accompanied by consumption of smaller amounts of food (Ackard et al., 2003; Goldschmidt, Jones et al., 2008; Tanofsky-Kraff, Yanovski et al., 2009), results suggest that affect-related loss of control eating is a viable point of early intervention for children with such problems.

Although the mood inductions did not differentially impact kilocalorie consumption or amount eaten in grams, within-group comparisons revealed that LOC+ girls consumed a greater percentage of energy from fat in the sad condition relative to the neutral condition. The absence of a significant interactional effect for loss of control status and mood condition regarding percentage energy intake from fat may be due to reduced power, given that the aforementioned within-group comparisons yielded a modest effect size (Cohen's *d* = .18). Negative affect has been associated with increased fat intake in humans (Cartwright et al., 2003; Habhab, Sheldon, & Loeb, 2009), especially among emotional eaters (Nguyen-Michel, Unger, & Spruijt-Metz, 2007; Oliver et al., 2000; Wallis & Hetherington, 2009). In turn, higher fat intake has been associated with reduced cognitive alertness and attention (Dye, Lluch, & Blundell, 2000; Gibson, 2006), perhaps reflecting an enhanced state of relaxation. These latter findings are consistent with the escape theory of binge eating (Heatherton & Baumeister, 1991), which proposes that binge eating is a method of avoiding self-awareness during times of emotional distress. Taken together, these findings suggest that, in the current study, LOC+ girls' greater energy intake from fat during the sad mood condition may reflect a tendency to seek comfort from high-fat foods during times of increased negative affect.

Although a greater energy intake from fat did not translate to increased kilocalorie consumption in the sad mood condition, this pattern of eating, if representative of eating in the natural environment, may help explain the increased rates of obesity and excess weight gain observed in children with loss of control eating problems (Tanofsky-Kraff et al., 2006; Tanofsky-Kraff, Yanovski et al., 2009). That is, energy intake from fat may not be reflected in greater kilocalorie consumption during a single eating episode but may lead to a positive energy balance over a longer duration of time, given that fat contains more kilocalories per gram (9 kilocalories per gram) than either carbohydrates or protein (each 4 kilocalories per gram). Furthermore, excess

intake of dietary fat has been associated with weight gain and obesity (Moussavi, Gavino, & Receveur, 2008), in part because it is more likely to be converted to body fat than to be utilized for energy expenditure as compared to carbohydrate and protein (Bessesen, Bull, & Cornier, 2008; Westerterp, 2009). Thus, recurrent bouts of emotional eating that are characterized by elevated fat intake may promote the development and maintenance of obesity in children.

Group Differences in Emotional Eating Behavior

It was hypothesized that there would be an interactional effect of loss of control eating status and mood condition on eating behavior, such that LOC+ girls would consume *more* food in the sad versus neutral mood conditions, whereas LOC- girls would consume *similar amounts* of food in the sad versus neutral mood conditions. This hypothesis was based on affect regulation theories of binge eating in adults, which posit that binge eating is a maladaptive method for coping with negative affect (Heatherton & Baumeister, 1991; Kenardy et al., 1996). Although a trend towards an interactional effect of loss of control status and mood condition on food intake was observed, this effect was attributed to LOC- girls eating *more* in the sad versus neutral condition, and LOC+ eating *similar amounts of food* regardless of mood condition. This trend was only observed for food intake as measured in grams, not kilocalories, and was even more pronounced when comparing girls reporting objective binge eating to overweight controls. Given this latter finding, it is unlikely that the observed trend is due to artifact.

The literature has been mixed regarding emotional eating among overweight children, with some studies finding no association between weight status and self-reported emotional eating behavior (Caccialanza et al., 2004; Nguyen-Rodriguez, Chou, Unger, & Spruijt-Metz, 2008; Snoek, van Strien, Janssens, & Engels, 2007; Tanofsky-Kraff, Theim et al., 2007) and others finding that overweight children are more likely to

self-report emotional eating than their normal weight peers (Braet et al., 2008; Braet & Van Strien, 1997; Sleddens, Kremers, & Thijs, 2008; Webber, Hill, Saxton, Van Jaarsveld, & Wardle, 2009). The current study is the first to demonstrate that emotional eating is prevalent among overweight girls using objective laboratory data. Although the nature of the interaction contradicts initial predictions based on the previous literature in children (Tanofsky-Kraff, Goossens et al., 2007; Tanofsky-Kraff, Theim et al., 2007) and adults (Agras & Telch, 1998; Chua et al., 2004; Stein et al., 2006; Telch & Agras, 1996a), results suggest that overweight controls may have attempted to soothe or distract themselves from momentary negative mood by eating greater quantities of food, whereas youth with loss of control eating problems appear to have ignored emotional cues and instead "numbed out" in the presence of palatable foods (Tanofsky-Kraff, Goossens et al., 2007), regardless of mood condition. Furthermore, results may indicate that, whereas for overweight girls with loss of control eating problems emotional eating is expressed in the subjective experience of loss of control (see p. 107), for overweight controls emotional eating is expressed in consumption of increased quantities of food.

It is notable that the increased food intake among LOC- girls in the sad mood condition did not translate to increased kilocalorie consumption at the test meal. Nevertheless, increased food intake in response to negative emotions may result in greater overall calorie consumption and consequent weight gain over time; indeed, excess intake of only 10 calories per day translates to a weight gain of one pound over a year. This is especially relevant in light of the increased emotional demands encountered throughout childhood and adolescence (Ge et al., 1994; Larson & Ham, 1993). Furthermore, aside from associations with weight gain, emotional eating is related to increased eating-related and general psychopathology (Masheb & Grilo, 2006; Pinaquy, Chabrol, Simon, Louvet, & Barbe, 2003; Waller & Osman, 1998), including anxiety and depression. Thus, results highlight the need for early identification of this

behavior among overweight girls, to assist with prevention and early intervention of psychosocial and weight-related problems.

Effects of Eating on Mood State

An exploratory aim of this study was to examine the relevance of affect regulation theories (Heatherton & Baumeister, 1991; Kenardy et al., 1996) to loss of control eating in children. Although all children were expected to experience an increase in negative affect (i.e., more negative mood) after the sad versus neutral mood induction, it was hypothesized that LOC+ girls would experience a decrease in negative affect (i.e., more positive mood) after eating, whereas LOC- girls would maintain their negative mood after eating. This pattern would demonstrate that girls with loss of control eating problems engage in aberrant eating as a means of coping with or alleviating negative affect.

The current study found some support for the affect regulation model, although patterns of mood change in the sad versus neutral mood conditions were the same for LOC+ and LOC- participants. That is, all participants reported mood improvements after eating in the sad mood condition, regardless of loss of control status. Because the experiment did not include a control condition in which participants did not have access to food subsequent to viewing the films, it is impossible to discern whether alleviation of negative mood was related to eating or to the passage of time. Alternatively, given the general mood-enhancing properties of food in humans (Gibson, 2006), both groups may have experienced an increase in positive mood subsequent to eating for reasons unrelated to purposeful coping or affect regulation.

Strengths and Limitations

Strengths of the current study include the community-based, ethnically diverse sample, and the use of well-validated measures for the assessment of loss of control

eating. As noted previously, girls reporting loss of control eating at the baseline assessment visit also reported higher levels of eating-related and general psychopathology than overweight controls, highlighting the use of a well-defined and generalizable sample. Furthermore, most components of the experimental protocol, including the mood induction procedures (Gross & Levenson, 1995; Rottenberg et al., 2007) and the laboratory test meal (Mirch et al., 2006; Tanofsky-Kraff, McDuffie et al., 2009), had been validated in previous studies. Relatedly, the current study was the first, to the author's knowledge, to examine the relation between mood and eating behavior in children using objective laboratory methodology. Although loss of control during the test meals was ascertained via retrospective self-report, the brief time lapse between the eating episode and assessment of loss of control while eating reduces concerns about biases that are typically encountered in studies relying on recall over a longer time delay.

Notable limitations include the relatively small sample, which was limited to overweight girls. Given the lack of gender disparities in loss of control and binge eating among children (Morgan et al., 2002; Tanofsky-Kraff et al., 2005), findings warrant replication in boys as well. Furthermore, as normal weight children report loss of control eating behaviors as well, future studies should include youth across the weight spectrum to enhance generalizability. Participants were recruited in part by offering behavioral weight loss treatment, and although most participants did not attend the behavioral weight loss sessions, the sample may not have been truly community-based in nature.

The laboratory-based study design, although useful for minimizing confounds inherent to retrospective self-report assessment of eating behavior, nevertheless relies on an artificial setting which may not elicit the type of eating behavior that occurs in the natural environment. Indeed, children often report engaging in loss of control eating while at home, while with friends or family, or while pursuing another activity (e.g., watching television; Tanofsky-Kraff, Goossens et al., 2007). In the current study,

participants were required to eat alone in a conference room; thus, the unfamiliar setting could have inhibited tendencies to truly lose control for some youth. Future studies may also benefit from use of a laboratory designated specifically for feeding studies, and employing the use of design features to enhance comfort in research participants (e.g., child-friendly décor). Relatedly, concerns about the investigator measuring food intake after the test meals could have caused some girls to restrain their eating. In future studies, it would be useful to query participants about any restriction exercised during the test meal to control for these possible confounds.

Finally, children's sense of loss of control while eating was determined by subjective self-report. Although loss of control was assessed by a rigorously trained investigator using a set of standardized, well-validated probes (Bryant-Waugh et al., 1996; Glasofer et al., 2006; Tanofsky-Kraff, Goossens et al., 2007; Tanofsky-Kraff et al., 2004; Watkins et al., 2005), it is possible that children's self-report of loss of control while eating, both at the baseline assessment and during the test meals, reflects an underlying propensity to endorse distress across multiple domains of functioning (De Pauw et al., in press). Indeed, the presence of a latent construct prompting a tendency to pathologize oneself may be responsible for the increased psychosocial problems among LOC+ children in the current study, although the use of multiple informants reporting on psychosocial functioning (i.e., child, parent) minimizes this concern somewhat. Nevertheless, future research should examine alternative methods for determining the presence of loss of control to avoid reliance on self-report. For example, employing expert judges to observe eating episodes and establishing clinical markers of loss of control (e.g., rate of eating) may assist investigators in this regard.

Clinical Implications

The current study has implications for both DSM-V and for intervention development. As noted previously, research suggests that loss of control, with or without consumption of unambiguously large amounts of food, is associated with psychosocial impairment in children (Goldschmidt, Jones et al., 2008; Tanofsky-Kraff et al., 2004) and may not manifest in the consumption of objectively large amounts of food (Tanofsky-Kraff, McDuffie et al., 2009). For this reason, several investigators have proposed that the current DSM-IV definition of binge eating (i.e., consumption of unambiguously large amounts of food accompanied by a sense of loss of control over eating) is not appropriate for children (Marcus & Kalarchian, 2003; Tanofsky-Kraff, Marcus, Yanovski, & Yanovski, 2008). Instead, these investigators have suggested that binge eating in children be defined primarily by the experience of loss of control in the upcoming DSM-V. Furthermore, these investigators propose that "eating in response to negative affect" be included as a central feature associated with loss of control eating in their amended DSM-V criteria for children (Marcus & Kalarchian, 2003; Tanofsky-Kraff, Marcus et al., 2008).

The current study provides some support for the aforementioned modification of the binge eating criterion in the upcoming DSM-V, by demonstrating that loss of control while eating in preadolescent children is preceded by the experience of negative emotions and may not invariably be accompanied by consumption of large amounts of food. However, further research is warranted to understand whether loss of control in and of itself is sufficient for an eating disorder diagnosis. It is possible that the combination of large amounts of food and loss of control (i.e., objective binge eating) confers the greatest risk of physical and psychiatric impairment, but that the presence of loss of control in the absence of large amounts of food (i.e., subjective binge eating) indicates a subset of youth at high risk for more severe eating- and weight-related problems.

Despite the relatively high prevalence of loss of control eating in children and adolescents (Decaluwe & Braet, 2003; Decaluwe et al., 2003; Glasofer et al., 2006; Goossens et al., 2007; Johnson et al., 1999; Morgan et al., 2002; Tanofsky-Kraff et al., 2004) and demonstrated associations with weight gain (Tanofsky-Kraff et al., 2006; Tanofsky-Kraff, Yanovski et al., 2009), obesity onset (Field et al., 2003; Stice et al., 2002), and psychopathology (Decaluwe et al., 2003; Goldschmidt, Jones et al., 2008; Goossens et al., 2007; Morgan et al., 2002; Tanofsky-Kraff et al., 2004), very few interventions have specifically targeted loss of control eating in pediatric populations. The current findings provide important directions for prevention and treatment development. Given that negative mood was associated with increased likelihood of reporting loss of control while eating, interventions focused on improving affect regulation may reduce the occurrence of loss of control eating and slow the trajectory of weight gain observed in children reporting loss of control eating episodes. These recommendations are consistent with previous findings supporting a link between negative mood and pediatric loss of control eating (Hilbert et al., 2009; Tanofsky-Kraff, Goossens et al., 2007), and studies demonstrating impairments in affect regulation among children and adolescents with loss of control eating problems (Czaja et al., 2009; Sierra Baigrie & Lemos Giraldez, 2008).

Cognitive behavioral therapy and interpersonal psychotherapy, both of which are considered gold standards in the treatment of adult BED (Wilfley, 2002), have each been implicated in the treatment of pediatric loss of control eating (Goldschmidt & Wilfley, 2009; Tanofsky-Kraff, Wilfley et al., 2007). Although the primary foci of cognitive behavioral therapy and interpersonal psychotherapy differ considerably, both therapies seek to modify negative affect as a mode of reducing binge eating. Both cognitive behavioral therapy and interpersonal psychotherapy have shown initial promise in the reducing the frequency of loss of control eating episodes among children and

adolescents (M. Jones et al., 2008; Tanofsky-Kraff, Yanovski et al., 2008). The current study's findings that negative mood predicted self-reported loss of control while eating may help explain these positive results, as reducing negative affect may in turn decrease reliance on food for comfort or alleviation of distress. However, further research is necessary to elucidate whether the mechanism of action of these treatments is through decreasing negative affect-related loss of control eating among children.

Given its focus on affect regulation, dialectical behavior therapy may also be useful in the treatment of loss of control eating in children. Although dialectical behavior therapy has not been examined in children with loss of control eating problems, several studies have demonstrated its effectiveness in reducing binge eating among adults with BED (Chen, Matthews, Allen, Kuo, & Linehan, 2008; Telch, Agras, & Linehan, 2001) and in the treatment of other psychological problems in younger populations (Goldstein, Axelson, Birmaher, & Brent, 2007; Katz, Cox, Gunasekara, & Miller, 2004; Nelson-Gray et al., 2006; Stippel, Krischer, & Lehmkuhl, 2008). Given that children with loss of control eating problems appear to have difficulties with affect regulation (Czaja et al., 2009; Sierra Baigrie & Lemos Giraldez, 2008), improving coping skills through such strategies as mindfulness practice and distress tolerance may prove useful for reducing loss of control eating behaviors and improving psychosocial distress related to such eating problems (Safer, Telch, & Agras, 2001).

Summary and Future Directions

Pediatric obesity has reached epidemic proportions in the past several decades (Ogden et al., 2006), and research is urgently needed to identify children at high risk for the medical and psychosocial problems associated with chronic obesity. Loss of control and binge eating behaviors are prevalent among overweight youth (Decaluwe & Braet, 2003; Decaluwe et al., 2003; Goossens et al., 2007; Morgan et al., 2002; Tanofsky-Kraff

et al., 2004) and are associated with excess energy intake (Hilbert et al., 2009; Mirch et al., 2006) and weight gain over time (Tanofsky-Kraff et al., 2006; Tanofsky-Kraff, Yanovski et al., 2009). That said, little is known about the nature of loss of control eating episodes among children. This was the first study to examine one potential antecedent to loss of control eating episodes in children, negative affect, using a prospective, experimental feeding laboratory design.

Overall, study findings provide preliminary support for the hypothesized relation between mood and aberrant eating behavior among overweight girls with loss of control eating problems. Although the experimental mood inductions failed to result in differential food intake among LOC+ girls, mood state on the day of testing predicted an increased likelihood of these girls reporting loss of control during the multi-item buffet meal. Furthermore, girls with loss of control eating problems consumed a greater percentage of energy from fat when subjected to a sad versus neutral mood induction, which could translate to future weight gain over time. These results suggest that emotional eating in children with loss of control eating problems may be reflected in the *quality* rather than the *quantity* of eating episodes. Findings could also help explain the elevated rates of anxiety and depressive symptoms among youth with loss of control eating problems (Decaluwe et al., 2003; Hilbert & Czaja, 2009; Morgan et al., 2002; Tanofsky-Kraff et al., 2004) and findings that negative affect prospectively predicts the onset of loss of control eating behaviors (Stice & Agras, 1998; Stice et al., 1998; Stice et al., 2002). Children experiencing more negative affect overall, combined with other vulnerabilities for disordered eating (e.g., shape and weight concerns, weight-related problems, poor affect management; Czaja et al., 2009; Eddy et al., 2007; Sierra Baigrie & Lemos Giraldez, 2008), may be more prone to eat in response to acute negative affect in the absence of other coping skills.

The current study found evidence that, in addition to predicting self-reported loss of control while eating among girls with loss of control eating problems, negative affect was related to increased food intake in grams in overweight control participants relative to those reporting loss of control eating problems. Recurrent eating in response to non-physiological cues (i.e., external eating) is likely to lead to weight gain over time (Hays & Roberts, 2008; Levitsky, 2005). Furthermore, eating driven by a need for comfort or distress relief is unlikely to resolve precipitants to negative affect in any meaningful or sustainable way. Therefore, development of intervention components targeting affect-related eating in overweight children, both with and without loss of control eating problems, should be a priority to curb weight gain and to assist with healthy regulation of eating and emotions in childhood.

Future studies should continue to explore negative mood as a trigger to loss of control eating in children using more ecologically valid methodology. Moreover, examination of other negative mood states, such as stress and anxiety, is warranted to better understand how different emotions may influence the quality and/or quantity of eating episodes. The laboratory may be a useful setting for future studies, although it is unknown whether experimental mood inductions can elicit the type and intensity of emotional distress related to loss of control and binge eating in children. Finally, future research should help elucidate the precise nature of events that precipitate binge eating in children. This could help inform intervention development, as well as provide directions for future empirical studies of loss of control eating in and outside of the laboratory.

In summary, emotional eating appears to be a phenomenon that is relevant to the overweight child population as a whole, but more particularly, to the subset of children reporting loss of control eating problems. Results of the current study are consistent with the previous literature documenting associations between loss of control

eating and negative affective states, and provide further support for affect regulation theories of binge eating (although it is unclear at this time whether eating or other factors lead to alleviation of distress). Further exploration of the phenomenology of loss of control and emotional eating in overweight children is needed to further science in general and to inform the development of effective prevention and treatment interventions for aberrant eating and obesity in childhood.

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Appendix A

Washington University Human Studies Committee Approval Document

Washington University in St. Louis

Human Research Protection Office

Barnes-Jewish Hospital
St. Louis Children's Hospital
Washington University

March 26, 2007

Denise Wilfley, PhD
Psychiatry (General)
Box 8134

RE: 07-0280
A Laboratory-Based Study of Mood and Eating Behavior in Overweight Children

Dear Dr. Wilfley:

The above-stated protocol was reviewed and approved by the Human Research Protection Office (HRPO). Following please find specifics of the approval:

Approval Date:	3/26/2007
Date released for accrual:	3/26/2007
Expiration Date:	3/25/2008
Research Risk Level:	Minimal
Type of Review:	New (Expedited 4,7)
Reviewing Committee:	07 N E/E
HIPAA Compliance:	Compliant with Authorization

A subcommittee of WU HRPO members have been designated by the HRPO Chair to review all submissions that meet the criteria for "Expedited" review. All actions and recommendations of the subcommittees are reported to a full board committee in accordance with regulatory requirements for "Expedited" review.

The WU HRPO complies with the regulations outlined in 45 CFR 46, 45 CFR 164, 21 CFR 50, 21 CFR 56. The OHRP Federal Wide Assurance numbers for WUSM, BJH, and SLCH are FWA00002284, FWA00002281, and FWA00002282 (respectively).

If further information is necessary, please contact the HRPO office at (314) 633-7400.

Sincerely,

Philip Ludbrook, M.D.
Associate Dean and Chair

CC: Juliana Pernik

Danforth Office: 1 Brookings Drive, Campus Box 1054, St. Louis, MO, 63130 Phone: (314) 935-6950, FAX: (314) 935-5862
Medical Center Office: 660 South Euclid Ave., Campus Box 8089, St. Louis, MO 63110 Phone: (314) 633-7400, FAX: (314) 367-3041

Appendix B

Child Informed Assent Document

Washington University in St. Louis

Assent Form

Human Research Protection Office

ASSENT FOR PARTICIPATION IN A RESEARCH STUDY

Participant_____ HRPO Approval Number_____

Principal Investigator **Wilfley Denise Ph.D.** PI's Phone Number **(314)286-2079**

Title of Project: A laboratory-based study of mood and eating behavior in overweight children

---

We are going to talk to you about what is means to be in a research study and what it will be like to be in this study. You can say no if you do not want to be in this study. No one (including us, or your parents) can make you be in the study if you don't want to be in it. If you agree to be in the study now, but change your mind about it later, you can stop being in the study and no one will be mad at you.

1. What is Research?

   Research is a way to learn information about something. Research is a way to study plants, animals, and people. Scientists and doctors study different subjects the same way you study English or math as a subject in school.

   There are many reasons people choose to be in a research study. Sometimes people get treatment or medicine while they are in a study. This does not always happen. Sometimes people know someone who is sick and want to help find a cure for those who are sick.

   You and your parents/guardians should understand why you would want to say yes to being a research participant. Before you decide to be in this study, we must explain everything about it to you and your parents. Your parents must also have to say that it is okay for you to be in the study. Take the time you need to decide if you want to be in this study. Ask us any questions you have. You can ask questions at any time.

2. Why are we doing this research?

   Andrea Goldschmidt and Denise Wilfley are doing a research study to learn more about the way kids eat. Some day this study may help them figure out more about why some kids have problems with their eating.

We are asking children who are 6 to 12 years old, female, and overweight to be in this research study.

In our research we want to learn: how different types of moods or feelings might cause some children to eat differently.

3. What will happen during the study?
If you agree to be in this study, we will ask you to come to a clinic for about one to two hours to answer some questions about your eating, how you feel about your body, and other things about your feelings in general. At the end of that visit, if you still want to be in the study, we will invite you to come back to the clinic two more times, about a week later, for another one to two hours each time. We will also give you some breakfast to eat the morning of your second and third visit. When you come back for those visits, we will measure your height and weight, and ask you to answer a few more questions about your eating. Then we will show you a 5-minute movie, and take you to a room where there will be a bunch of different types of food. You will be asked to eat however much you want of those foods, but you don't have to eat any foods you don't like or want. The total amount of time we are asking you to be in our study is three to six hours, or one to two hours for each of the two visits.

4. What are the bad things that could happen to me from being in this study?
Sometimes things happen to people in research studies that may hurt them or make them feel bad. These are called risks. You might feel embarrassed while answering questions about your eating, body shape/weight, and your feelings, or feel weird or embarrassed when getting your weight and height measured. You might also feel upset after watching the movies, or after you are finished eating. You don't have to answer any questions you don't want to, or eat any food you don't want to.

5. What are the good things that could happen to me from being in this study?
Sometimes things happen to people in research studies that make them feel good or benefit them in some way. A benefit is something good or helpful. Researchers usually hope that their research will benefit somebody. You probably won't personally gain anything by being in this study. By being in this study, you may help scientists learn more about the types of problems kids have with their eating.

6. Do I have other choices?
You can choose not to be in this study.

7. Will I be paid to be in this study?
You will be given a $25 gift card each time you come to the clinic. You can also be in a group later on with other kids to learn how to lose weight in a healthy way if you want.

8. What if I have questions?

If you have any questions or worries about the research, you can call Dr. Wilfley at 314-286-2079. You may also ask questions talk about any worries to Dr. Philip Ludbrook, the Associate Dean and Chairman of the University's Human Research Protection Office, at (3l4) 633-7400 or (800) 438-0445.

I assent (that means I agree) to participate in this study called: A laboratory-based study of mood and eating behavior in overweight children.

_____ _____

Signature of minor participant Doctor's signature

This form is valid only if the Human Research Protection Office's current stamp of approval is shown below.

Appendix C

Parent Informed Consent Document

Washington University in St. Louis

Model Form #2 HIPAA 1/06
Human Research
Protection Office

INFORMED CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Participant _____ HRPO Approval Number _____

Principal Investigator **Wilfley Denise Ph.D.** PI's Phone Number **(314)286-2079**
Last First Credentials

Title of Project: **A laboratory-based study of mood and eating behavior in overweight children**

You are invited to take part in a research study by Dr. Wilfley and/or colleagues.

Please ask for an explanation of any words you do not understand.

You may want to talk about the study with your family or friends before you decide to be in it.

1. **Why is this study being done?**
   The overall purpose of this research is to examine how mood impacts children's eating behavior.

2. **What am I being asked to do?**
   Your child's participation will involve having her height and weight measured, completing several questionnaires related to eating, weight and shape, and psychological factors, as well as an interview about her eating habits and feelings about her shape and weight. You will also have your height and weight measured, and be asked to complete a questionnaire about your eating, weight and shape. Your child will then watch a brief clip from a movie approved for child audiences, and will then be asked to take part in a test meal, in which she will be presented with a range of foods and asked to let herself go and eat as much as she wants.

   How long will I be in the study?
   You will be in the study for approximately 4-6 hours total (1-2 hours across three separate sessions) over an approximately one month period.

3. What are the Costs?

Participation in this study is free of charge. You and your child will receive a total of $75 for your time ($25 for each visit) as well as the opportunity to receive free behavioral weight loss treatment. The weight loss treatment will consist of counseling only, and will not involve drug, surgical, or pre-packaged meal programs.

4. What are the Risks?

You or your child may feel embarrassed when having your/her height and weight measured, or when answering questions about your/her eating habits and feelings about your/her shape and weight. You have the right to refuse to answer any question for any reason. Your child may also feel distressed after watching the film clips or taking part in the test meal. You may experience all or some of the risks listed above. There may also be unknown risks. The PI will answer any questions you have about these risks.

What happens if I am injured because I took part in this study?

Washington University investigators and their staffs will try to reduce, control, and treat any complications from this research. If you feel you are injured because of the study, please contact the Investigator and/or the Human Research Protection Office Chairperson from Item 8. Decisions about payment for medical treatment for injuries relating to your participation in research will be made by Washington University.

5. Are there Benefits to taking part in the study?

There are no known benefits to participating in this research. However, by taking part in this study you and your child may help contribute to knowledge that may one day be used to prevent or treat eating and weight problems.

6. What other Options are there?

Taking part in this research study is voluntary. You may choose not to take part in this research study or you may withdraw your consent at any time. Your choice will not at any time affect the commitment of your health care providers to administer care. There will be no penalty or loss of benefits to which you are otherwise entitled.

7. What about Confidentiality?

Protected Health Information (PHI) is health information that identifies you. PHI is protected by federal law under HIPAA (the Health Insurance Portability and Accountability Act). To take part in this research, you must give the research team permission to use and disclose (share) your PHI for the study explained in this consent form.

The research team will follow state and federal laws and may share your information with:

- Government representatives, to complete federal or state responsibilities.
- Hospital or University representatives, to complete Hospital or University responsibilities.

- Your primary care physician if a medical condition that needs urgent attention is discovered.

Once your health information is shared with someone outside of the research team, it may no longer be protected by HIPAA.

The research team will only use and share your information as talked about in this form. When possible, the research team will make sure information cannot be linked to you (de-identified). Once information is de-identified, it may be used and shared for other purposes not discussed in this consent form. If you have questions or concerns about your privacy and the use of your PHI, please contact Joan Podleski, the University's Privacy Officer, at 866-747-4975.

If you decide not to sign this form, it will not affect

- your treatment or the care given by your health provider.
- your insurance payment or enrollment in any health plans.
- any benefits to which you are entitled.

However, it will not be possible for you to take part in the study.

If you sign this form:

- You authorize the use of your PHI for this research.
- Your signature and this form will not expire as long as you wish to participate.
- You may later change your mind and not let the research team use or share your information (you may revoke your authorization).
- To revoke your authorization, complete the withdrawal letter, found at http://hrpo.wustl.edu, or you may request that the Investigator send you a copy of the letter.

If you revoke your authorization:

- The research team may only use and share information already collected for the study.
- Your information may still be used and shared if necessary for safety reasons.
- You will not be allowed to continue to participate in the study.

Please specify any contact restrictions you want to request for this study only. (Example – no calls at home, no messages left for you, no –emails, etc.)

_____

_____

The Research Subject Advocate of the General Clinical Research Center may review your medical record.

8. Who do I call if I have Questions or Problems?

If you have any questions, concerns or complaints about the study, or feel that you are injured because of the study call Denise Wilfley at (314) 286-2113. If you wish to talk to someone else, or have questions or concerns about your rights as a research subject, call Dr. Philip Ludbrook, Chairman of the University's Human Research Protection Office, at (3l4) 633-7400 or (800) 438-0445.

For questions about the General Clinical Research Center, please call Michelle Jenkerson, Subject Advocate at (314) 362-5626.

9. The Principal Investigator (PI) may withdraw you from the study without your consent if considered appropriate. For safety, it may be in your best interest to allow follow-up outside the study. The PI will share any new information that could change how you feel about continuing in the study.

10. Being in a research study does not take the place of routine physical exams or visits to your own doctor and should not be relied on to diagnose or treat medical problems.

I have read this consent form and have been given the chance to ask questions. I will also be given a signed copy of this consent form for my records. I give my permission to participate in the research described above, titled: A laboratory-based study of mood and eating behavior in overweight children.

Participant's Signature or Legally Authorized Representative	Date	Signature of person providing Consent	Date

The HRPO does not require participants to re-sign the consent form unless a change is made; the investigator, however, may choose to have participants sign annually (If designee, see guideline Consent Guidance).

Relationship to Participant

Thank you for your important contribution to research studies that are trying to improve medical care.

This form is valid only if the Human Research Protection Office's current stamp of approval is shown below.

Appendix D

Amount and Energy Content of Meal Items by Food Group Presented at the Buffet Test Meals

Item	Amount	Kilocalories
Dairy		
American cheese	240 g	792.0
2% milk	850 g	425.0
Desserts and snacks		
Oreo cookies	12 cookies	611.8
Vanilla wafer cookies	12 cookies	204.1
Tortilla chips	120 g	592.6
Pretzels	150 g	582.0
Jellybeans	120 g	450.0
M&M's candy	120 g	601.3
Meats		
Ham	180 g	192.6
Turkey	180 g	151.2
Chicken nuggets	200 g	668.0
Vegetables		
Tomatoes	200 g	36.0
Lettuce	50 g	7.0
Baby carrots	200 g	70.0
Fruit		
Medium bananas	3 medium	456.4
Grapes	250 g	172.5
Oranges	3 medium	285.0
Bread		
White bread	12 slices	851.8
Condiments		
Peanut butter	120 g	712.5
Grape jelly	120 g	300.0
Mayonnaise	90 g	642.9
Mustard	90 g	60.3
Light ranch dressing	90 g	230.4
Barbeque sauce	90 g	135.0
Mild salsa	250 g	113.6
Drinks		
Bottled water	850 g	0.0
Apple juice	850 g	399.5
Lemonade	850 g	354.2
Total		10097.7

Appendix E

Verbal Instructions to Children for Experimental Mood Inductions

The sad film instructions were as follows: “This movie is about a boy and his dad, who is a boxer. The dad has just won a boxing match when he calls for his son. Please make sure you watch the film closely since I will be asking you questions about it afterwards.”

The neutral film instructions were as follows: “Please make sure you watch the film closely since I will be asking you questions about it afterwards.”

Appendix F

Emotional Eating Scale for Children and Adolescents

Participant ID: _____
Date: _____

EES

We all react to different feelings in different ways. Some types of feelings make us want to eat. Please let us know how much the following feelings make you want to eat by checking the appropriate box.

EXAMPLE

WHEN I FEEL THIS WAY	I have no desire to eat	I have a small desire to eat	I have a moderate desire to eat	I have a strong desire to eat	I have a very strong desire to eat	*On average, how many days a week do you eat because you feel this way? (0-7)*
Starving					**X**	**3**
WHEN I FEEL THIS WAY	I have no desire to eat	I have a small desire to eat	I have a moderate desire to eat	I have a strong desire to eat	I have a very strong desire to eat	*On average, how many days a week do you eat because you feel this way? (0-7)*
Resentful						
Discouraged						
Shaky						
Worn Out						
Not doing enough						
Excited						
Disobedient						
Down						
Stressed out						
Sad						
Uneasy						
Irritated						
Jealous						
Worried						

WHEN I FEEL THIS WAY	I have no desire to eat	I have a small desire to eat	I have a moderate desire to eat	I have a strong desire to eat	I have a very strong desire to eat	*On average, how many days a week do you eat because you feel this way? (0-7)*
Frustrated						
Lonely						
Furious						
On edge						
Confused						
Nervous						
Angry						
Guilty						
Bored						
Helpless						
Upset						
Happy						

Thank you!

Appendix G

Food Scale Questionnaire

Participant ID: _____
Date: _____

FOOD PREFERENCES QUESTIONNAIRE

Items:	Do Not Like				Like Very Much
1. Chocolate bar	1	2	3	4	5
2. Frozen yogurt	1	2	3	4	5
3. Brownies	1	2	3	4	5
4. Cracker Jacks	1	2	3	4	5
5. Doughnut	1	2	3	4	5
6. Danish	1	2	3	4	5
7. Ice Cream	1	2	3	4	5
8. Cookies	1	2	3	4	5
9. Apple Pie	1	2	3	4	5
10. Cake	1	2	3	4	5
11. Potato Chip	1	2	3	4	5
12. Chicken Wings	1	2	3	4	5
13. Bacon	1	2	3	4	5
14. Doritos	1	2	3	4	5
15. Hamburger	1	2	3	4	5
16. Corn Chips	1	2	3	4	5
17. Cheese Balls	1	2	3	4	5
18. Tortilla Chips	1	2	3	4	5
19. Bologna	1	2	3	4	5
20. Chicken Fingers	1	2	3	4	5

Items:	Do Not Like				Like Very Much
21. Soda	1	2	3	4	5
22. Peanut Butter	1	2	3	4	5
23. Chocolate Syrup	1	2	3	4	5
24. Grapes	1	2	3	4	5
25. Gum Drop	1	2	3	4	5
26. Turkey	1	2	3	4	5
27. Hard Candy	1	2	3	4	5
28. Mayonnaise	1	2	3	4	5
29. Lollipop	1	2	3	4	5
30. Chicken Nuggets	1	2	3	4	5
31. Grape jelly	1	2	3	4	5
32. Bananas	1	2	3	4	5
33. Italian Lemon Ice	1	2	3	4	5
34. Salsa	1	2	3	4	5
35. Carmel Candies	1	2	3	4	5
36. Tomatoes	1	2	3	4	5
37. Vanilla Wafer Cookies	1	2	3	4	5
38. Apple Juice	1	2	3	4	5
39. Jelly Beans	1	2	3	4	5
40. Kool-Aid	1	2	3	4	5
41. Mustard	1	2	3	4	5
42. Pretzels	1	2	3	4	5
43. Bagel	1	2	3	4	5
44. M&Ms Candies	1	2	3	4	5

45. Baby Carrots	1	2	3	4	5
46. English Muffin	1	2	3	4	5
47. White Rice	1	2	3	4	5
48. Ranch Dressing	1	2	3	4	5
49. Corn	1	2	3	4	5
50. Oranges	1	2	3	4	5
51. Barbecue Sauce	1	2	3	4	5
52. Baked Potato	1	2	3	4	5
53. Oreo Cookies	1	2	3	4	5
54. Peas	1	2	3	4	5
55. Peppers	1	2	3	4	5
56. Ham	1	2	3	4	5
57. White Bread	1	2	3	4	5
58. Milk	1	2	3	4	5
59. American Cheese	1	2	3	4	5
60. Graham Crackers	1	2	3	4	5
61. Oyster Crackers	1	2	3	4	5
62. Lemonade	1	2	3	4	5
63. Lettuce	1	2	3	4	5
64. Water	1	2	3	4	5

Appendix H

Eating Scales

Participant ID: _____
Date: _____
Timepoint: Pre-film Post-film Post-meal

EATING SCALES

Directions: Circle the number between 1 and 5 that best shows how you are feeling <u>right now</u>.

Example:
Jane just ate lunch, so she is not hungry at all. She circles a 1 on the scale below.

(1)	2	3	4	5
Not hungry at all				Extremely hungry

1. How hungry do **you** feel right now?

1	2	3	4	5
Not hungry at all				Extremely hungry

2. How **full** do you feel right now?

1	2	3	4	5
Not full at all				Extremely full

3. How much do you **want to eat** right now?

1	2	3	4	5
Don't want to eat at all				Really want to eat

4. How **nauseous** do you feel right now?

1	2	3	4	5
Not nauseous at all				Extremely nauseous

5. How **out of control** do you feel right now?

1	2	3	4	5
Not at all out of control				Extremely out of control

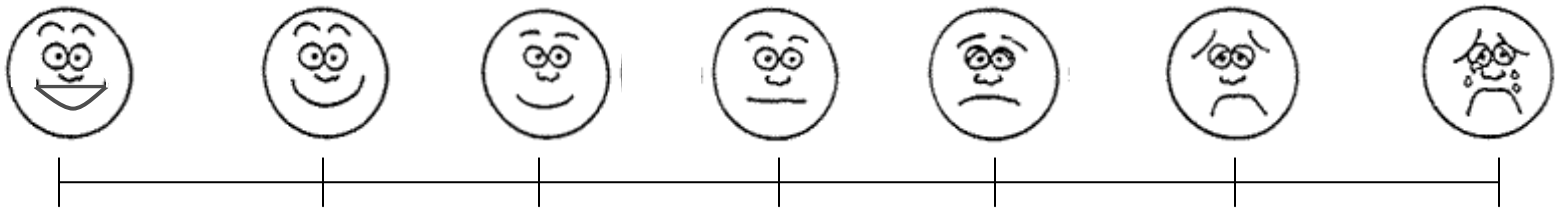
Appendix I

The Face Scale

Participant ID: _____
Date: _____
Timepoint: Pre-film Post-film Post-meal

The Face Scale

Directions: Circle the place on the line that best shows how you are feeling <u>right now</u>.



Really, really happy Pretty happy Sort of happy Just OK Sort of sad Pretty sad Really, really sad

Appendix J

Mood Scales

Participant ID: _____
Date: _____
Timepoint: Pre-film Post-film Post-meal

FEELINGS SCALE

Directions: Circle the number between 1 and 5 that best shows how you are feeling <u>right now</u>.

Example:
Jane just got in trouble at school, so she is pretty angry. She circles a 4 on the scale below.

1	2	3	(4)	5
Not angry at all				Extremely angry

1. How angry do **you** feel right now?

1	2	3	4	5
Not angry at all				Extremely angry

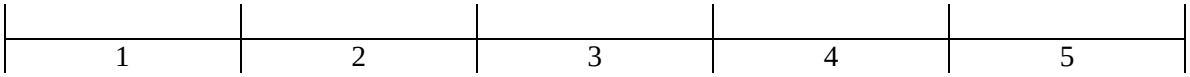
2. How **sad** do you feel right now?

1	2	3	4	5
Not sad at all				Extremely sad

3. How **happy** do you feel right now?

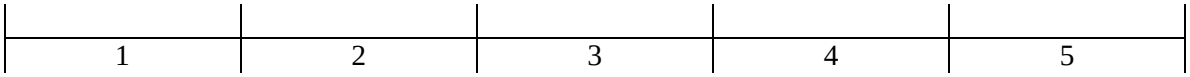
1	2	3	4	5
Not happy at all				Extremely happy

4. How **frightened** do you feel right now?



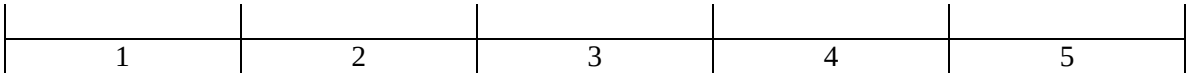
Not frightened at all — Extremely frightened

5. How **depressed** do you feel right now?



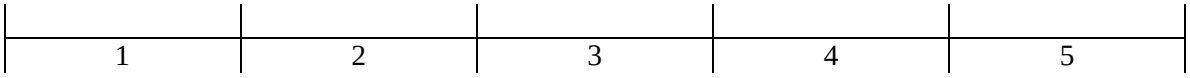
Not depressed at all — Extremely depressed

6. How **lonely** do you feel right now?



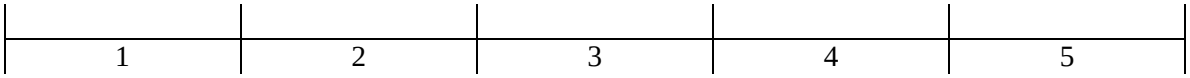
Not lonely at all — Extremely lonely

7. How **bored** do you feel right now?



Not bored at all — Extremely bored

8. How **anxious** do you feel right now?



Not anxious at all — Extremely anxious

Appendix K

Feelings Questionnaire

Participant ID: _____
Date: _____

Exit Questionnaire

1.Do you remember the movie you watched today? _____

2.What was the name of the boy/animal in the film? _____

3.What happened in the film? _____

4.How did you feel after watching that film a little while ago?
_____

5.What foods did you eat today? (Probe with specific foods)

Item	Yes	No
White bread		
Ham		
Turkey		
American cheese		
Chicken nuggets		
Peanut butter		
Grape jelly		
Tomatoes		
Lettuce		
Medium bananas		
Grapes		
Oranges		
Oreo cookies		
Vanilla wafer cookies		
Mayonnaise		
Mustard		
Light ranch dressing		
Barbeque sauce		
Mild salsa		
Baby carrots		
Tortilla chips		
Pretzels		
Jellybeans		
M&M's candy		
2% milk		
Apple juice		
Lemonade		

6.Did you feel out of control? (Probe with LOC explanations if necessary)

_____

7.Are those the foods you would usually eat (LOC -)/when you are feeling out of control (LOC +)?

_____

8.Are those the foods you would usually eat when you feel (insert answer to Question #1)?

_____

9.How much did you eat today? Too much/just okay/not enough?

10. Is that how much food you would usually eat (LOC -)/when you are feeling out of control (LOC +)? If no, was it more or less?

_____

11. Is that how much food you would usually eat when you are feeling (insert answer to Question #1)?

_____

12. How much did you eat of the _____? Too much/just okay/not enough?

Item	**Amount**		
	Too much	Just okay	Not Enough
White bread			
Ham			
Turkey			
American cheese			
Chicken nuggets			
Peanut butter			
Grape jelly			
Tomatoes			
Lettuce			
Medium bananas			
Grapes			
Oranges			
Oreo cookies			
Vanilla wafer cookies			
Mayonnaise			
Mustard			
Light ranch dressing			
Barbeque sauce			
Mild salsa			
Baby carrots			
Tortilla chips			
Pretzels			
Jellybeans			
M&M's candy			

2% milk			
Apple juice			
Lemonade			

**********READ AFFECT STORIES HERE **********

Interviewer: Tell the child the following stories to talk about emotions to ask the next set of questions

Happy

What do you do when you feel happy?
What is something that makes you happy?
Can you show how your face would look if you were happy?

There is a little girl I know who felt happy one day. She shared some of her toys with one of her friends. Do you know how she felt? She smiled and made her feel good--she felt happy.
That is what it feels like to be happy.

Sad

What do you do when you feel sad?
What is something that makes you sad?
Can you show me how your face would look if you were sad?

There was a little girl I know who felt sad one day. She fell down and hurt her knee when she was outside playing. And then somebody grabbed on of the toys that she was playing with. Do you know how she felt? Her smile went away and she wanted to cry--she was sad. That is what it feels like to feel sad.

Just O-kay

What do you do when you feel just o-kay?
What is something that you do that makes you feel just o-kay?
Can you show me how you would look if you felt just o-kay?

There was a little girl I know who felt just okay. Her mom asked her how she felt about wearing her green or her yellow coat? Do you know how she felt? She pushed her lips together and shrugged her shoulders. She wasn't really happy, but she wasn't really sad--she felt just o-kay. That is what it feels like to feel just o-kay.

Guilt

What do you do when you feel guilty about something?

What is something that makes you feel guilty?
Can tell me what you would look like if you felt guilty?

There was a little girl I know who felt guilty one day. She was playing with a toy that she knew she was not supposed to play with--and she broke it. Do you know how she felt? She frowned and sort of felt bad about it. She wanted to make things better so she told her mom about it and tried to fix the toy. That is what it feels like to be guilty.

Shame

What is shame?
What is something that makes you feel ashamed?
Can you tell me what you do when you feel ashamed?

There was a little girl I know who felt guilty one day. She was playing with a toy that she knew she was not supposed to play with--and she broke it. Do you know how she felt? She frowned and sort of felt bad about it. She put the broken toy down and walked out of the room. Her mom asked her what happened and the girl felt bad about it and looked down at the ground. She didn't want to look at her mom--she was ashamed. That is what it feels like to be ashamed.

13. How did you feel about what you ate today? Shame Guilt Just OK Happy Sad

14. Is that how you usually feel when you eat like this? If no, how do you usually feel when you eat like this?

_____

15. How did you feel about eating _____(Probe with specific foods)?

Circle as many feelings for each food that the child reports.

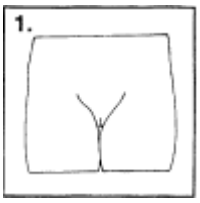
Item	**Response**				
	Shame	Guilt	Just OK	Happy	Sad
White bread					
Ham					
Turkey					
American cheese					
Chicken nuggets					
Peanut butter					
Grape jelly					
Tomatoes					
Lettuce					
Medium bananas					
Grapes					
Oranges					
Oreo cookies					
Vanilla wafer cookies					
Mayonnaise					
Mustard					

Light ranch dressing					
Barbeque sauce					
Mild salsa					
Baby carrots					
Tortilla chips					
Pretzels					
Jellybeans					
M&M’s candy					
2% milk					
Apple juice					
Lemonade					

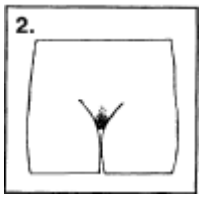
Figured Drawings

Participant ID: _____
Date: _____

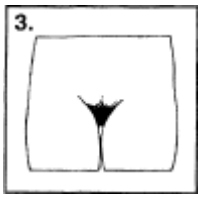
Please put a check in the box that looks most like you now…



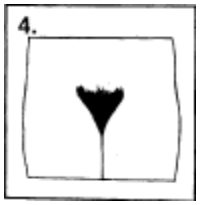
No hairs



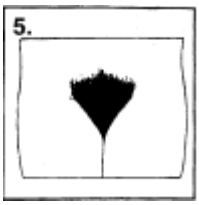
Very little hair



Quite a lot of hair



The hair has not spread over the thighs



The hair has spread over the thighs