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Ecological momentary assessment of maladaptive eating in children and adolescents with overweight or obesity

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Abstract

Objectives—Contextual factors related to maladaptive eating behavior in youth with overweight/obesity are poorly understood. This pilot study sought to elucidate immediate internal and external cues related to perceptions of overeating and loss of control (LOC) over eating in a heterogeneous sample of children and adolescents with overweight/obesity assessed in their natural environments.

Methods—Community-based youth [*N*=40; 55% female (*n*=22)], aged 8–14y (*M* age=11.2±1.9y), with overweight/obesity (*M* z-BMI=2.07±0.49) reported on all eating episodes and their physiological, environmental, affective, and interpersonal antecedents and correlates via ecological momentary assessment over a 2-week period. Generalized estimating equations were used to assess the relationship between contextual variables and degree of overeating and LOC.

Results—Eating occasions involving greater food hedonics (i.e., perceived palatability of food being consumed) were associated with greater LOC severity (within-subjects effect: *B*=.01, *p*=.015), although youth with *lower* overall levels of food hedonics reported *higher* LOC severity ratings on average (between-subjects effect: *B*=−.04, *p*=.005). Youth reporting higher overall cravings reported higher average ratings of LOC severity (between-subjects effect: *B*=.20, *p*=.001). Finally, youth reporting greater overall influence of others on eating behavior evidenced greater average levels of overeating severity (between-subjects effect: *B*=.17, *p*<.001).

Discussion—Eating-related factors appear to be most strongly associated with LOC severity, while environmental factors were most associated with overeating severity. Interventions targeting

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maladaptive eating in youth with overweight/obesity may benefit from helping youth incorporate palatable foods and satisfy cravings in a planned and controlled manner, and enhancing awareness of social-contextual effects on eating.

Keywords

Ecological momentary assessment; loss of control; overeating; binge eating; obesity; child; adolescent

Overweight and obesity affect over 30% of children and adolescents in the United States (Ogden, Carroll, Kit, & Flegal, 2014; Ogden et al., 2016) and are associated with severe physical and psychosocial comorbidities, decrements in quality of life, and increased healthcare expenditures (Finkelstein, Graham, & Malhotra, 2014; Hoelscher, Kirk, Ritchie, & Cunningham-Sabo, 2013). Maladaptive eating behaviors involving excess energy intake are a major factor in the onset, maintenance, and/or exacerbation of overweight/obesity (French, Epstein, Jeffery, Blundell, & Wardle, 2012). In particular, binge eating, which involves the consumption of an objectively large amount of food (overeating) accompanied by a sense of loss of control while eating (LOC; American Psychiatric Association, 2013) presents in over 20% of children and adolescents with overweight/obesity (He, Cai, & Fan, 2016). In addition, overeating (independent of LOC) and LOC (independent of overeating) each are uniquely associated with serious health complications, including excess weight gain and the onset of full-syndrome eating disorders (Goldschmidt, 2017). However, little is known about momentary factors that are associated with these eating behaviors in youth, thus limiting development of interventions that can be delivered in real time when risk for maladaptive eating is highest.

While LOC and overeating are related constructs, they can and do occur independently of one another (Goldschmidt et al., 2014). Research suggests that LOC is a psychopathology construct, as reflected in cross-sectional and prospective associations with markers of distress and impairment, while overeating may be better conceptualized as a marker of excess weight gain (Goldschmidt, 2017). Indeed, research supports affect-related factors as antecedents to LOC eating (Haedt-Matt & Keel, 2011), while overeating appears to be driven by environmental (e.g., sight and smell of palatable food, presence of distracting stimuli, physical location; de Castro, King, Duarte-Gardea, Gonzalez-Ayala, & Kooshian, 2012; Mekhmoukh, Chapelot, & Bellisle, 2012; Thomas, Doshi, Crosby, & Lowe, 2011) and physiological triggers (e.g., hunger; Nijs, Muris, Euser, & Franken, 2010). However, comprehensive, naturalistic studies of intra- and extra-personal factors involved in these different forms of maladaptive eating are lacking, particularly in children and adolescents.

Ecological momentary assessment (EMA) is an experience sampling technique in which events and associated behaviors, emotions, and cognitions are assessed in near real time in the natural environment (Stone & Shiffman, 1994). Because EMA minimizes reliance on retrospective recall, provides enhanced ecological validity, and allows for repeated measurement of constructs over time (Shiffman, Stone, & Hufford, 2008), this methodology has been used extensively to study momentary antecedents and consequences of binge eating and related behaviors in adults with eating- and weight-related problems (Engel et al., 2016).

Indeed, our recent EMA research in a heterogeneous sample of adults with obesity found that eating episodes involving LOC (with or without overeating) were associated with elevated pre- and post-episode negative affect, increased post-episode cravings, and eating alone, while overeating episodes without LOC were associated with reduced levels of pre- and post-episode hunger (Goldschmidt et al., 2014). These findings suggest that while LOC eating and overeating may represent overlapping constructs, they have unique correlates independent of one another.

In contrast to the adult literature, EMA research on maladaptive eating in pediatric samples has been scant, and has primarily utilized samples presenting with LOC eating. This is problematic because findings from the adult literature suggest that many adults with obesity report binge eating behaviors during EMA protocols despite denying such behaviors during face-to-face interviews (Greeno, Wing, & Shiffman, 2000; Le Grange, Gorin, Catley, & Stone, 2001). Thus, data gleaned from samples that are selected based on the presence of eating pathology may not accurately inform our understanding of contextual factors associated with maladaptive eating behaviors across the spectrum of youth with overweight/obesity. In two EMA studies of youth, interpersonal problems (Ranzenhofer et al., 2014) and eating-, shape-, and weight-related cognitions (Hilbert, Rief, Tuschen-Caffier, de Zwaan, & Czaja, 2009) have been identified as precipitants to LOC eating in youth, but contrary to the adult literature (Haedt-Matt & Keel, 2011), there has been limited support for a link between momentary negative mood and LOC eating in this population. Qualitative data in children and adolescents suggest that additional contextual factors, such as being alone, eating secretively, and eating while watching television, may also be involved in the momentary experience of LOC with or without overeating (Tanofsky-Kraff et al., 2007).

Given the dearth of research assessing momentary LOC and overeating in youth, the purpose of the current study was to assess the presence and correlates of LOC and overeating measured in naturalistic settings via EMA among a heterogeneous sample of children and adolescents with overweight/obesity. Based on the previous literature, we hypothesized that LOC would be associated with affective, interpersonal, and attitudinal correlates, while overeating would be associated with environmental and physiological factors.

Material and Methods

Participants and Procedures

Participants were recruited from two academic institutions in Chicago, IL (The University of Chicago Medicine and Illinois Institute of Technology) via community flyers, direct pediatrician referrals, and phone logs from previous studies (which also recruited via community flyers and referrals) where the families had consented to be re-contacted (Goldschmidt et al., 2018). Participants were excluded if they had medical conditions known to influence weight or appetite (e.g., type 2 diabetes) or were taking medications known to influence weight or appetite, in order to ensure that the sample was representative of the general population of youth with overweight/obesity; met criteria for an eating disorder other than binge eating disorder (BED); were unable to read and understand English fluently; or were receiving concurrent treatment for overweight/obesity. Parents of interested individuals completed a phone screen to assess basic study entry criteria, and eligible

participants were invited to attend a baseline study visit, along with a parent or guardian. In total, 92 youth were screened via phone, 44 of whom presented to the research sites for a baseline evaluation, and 40 of whom provided adequate EMA data (e.g., completed at least 1 week of EMA recording) to be included in the current analyses. After providing written informed assent/consent, participants had their height and weight measured and completed interviews and questionnaires assessing their eating patterns and psychosocial functioning. Participants and their caregivers were then trained to complete the EMA recordings.

Participants were instructed to complete EMA recordings after any type of eating behavior (event-contingent); before bedtime (interval-contingent); and at 3–5 semi-random times throughout the day (signal-contingent; Wheeler & Reis, 1991). Signaled prompts occurred every 2–3 hours between 8:00am to 9:00pm on the weekends, and between 7:00–8:00am, 3:00–4:00pm, and 6:00–7:00pm on weekdays so as not to interfere with participants' school schedules. During all recordings, participants were instructed to report on current affect, stressors, interpersonal events, weight- and shape-related concerns, and characteristics of any recent eating episode that had not been previously recorded. This combination of signal-, event-, and interval- contingent recordings has been successfully implemented in previous EMA studies of overweight youth (Hilbert et al., 2009; Ranzenhofer et al., 2014).

A one-day practice period during which adherence was ≥70% of ratings qualified children to initiate the 14-day EMA study period; these data were not used in statistical analyses to reduce concerns about the effect of immediate reactivity to self-monitoring. Participants were contacted by phone by a member of the study team after the first day of EMA recording, and every 2–3 days thereafter, to receive feedback regarding their compliance rates and address any questions or concerns regarding assessment procedures.

Upon completion of the daily assessment phase, participants returned to the research institution at which they were initially assessed to return loaner smartphones (if applicable); complete a brief, final assessment; and receive their final study incentive payments. Participants received $50 for the intake assessment; $50 for completion of the 2-week protocol; and up to $50 for daily assessments prorated according to degree of response to random signals ($1 for each response to a total of 50 semi-random signals over the course of the 2-week protocol). Study procedures were approved by The University of Chicago and Illinois Institute of Technology Institutional Review Boards.

Measures

Baseline Measures—Height and weight were measured in light indoor clothing by a trained research assistant via stadiometer and calibrated digital scale, respectively. Children's standardized body mass index (kg/m^2; z-BMI) was calculated using CDC growth charts and accompanying procedures (Kuczmarski et al., 2000). Demographic data were reported by children and parents, and included children's age, gender, race/ethnicity (White, Black/African-American, Hispanic/Latino, Asian, Native Hawaiian or Other Pacific Islander, American Indian or Alaska Native, or multi-racial/other), current medications, and medical problems.

Diagnostic items from the Child Eating Disorder Examination 12.0 (Child EDE; Bryant-Waugh, Cooper, Taylor, & Lask, 1996) were used to assess current and lifetime LOC eating and rule out other eating disorders. The Child EDE is a semi-structured, interviewer-based instrument based on the well-validated adult EDE, with modifications including the use of simpler language appropriate for a younger audience. The Child EDE has adequate reliability and validity (Bryant-Waugh et al., 1996; Decaluwe & Braet, 2004; Watkins, Frampton, Lask, & Bryant-Waugh, 2005).

EMA Measures—At eating episode recordings, participants reported on the type of eating episode they experienced (meal, snack, or binge) as well as several contextual, inter-, and intra-personal features of the episode. Ratings for overeating ("To what extent do you feel that you overate?") and LOC ("While you were eating, did you feel a sense of loss of control?"; "While you were eating, did you feel that you could not stop eating once you had started?"; "While you were eating, did you feel like you could not resist eating?"; "While you were eating, did you feel like a car without brakes, you just kept eating and eating?") were made on a 1- to 5-point Likert-type scale (1="no, not at all," and 5="yes, extremely"). The four items assessing LOC were summed to form a total score (range=4–20) based on their high internal consistency (α=.91). Physiological features included current cravings ("Please rate how much you agree with the following statement: I am craving food") and hunger levels ("Please rate how much you agree with the following statement: I am hungry"), both of which were rated on a 1- to 5-point Likert-type scale (1="disagree strongly," and 5="agree strongly"), as well as food hedonics ("On a scale of 1 (terrible) to 10 (the best thing you have ever tasted) how good did the food you ate taste?"). Environmental variables included the location of the eating episode (home, car, school, cafeteria, restaurant, outside, friend's house, other); presence of dining companions ("Did you eat alone/with other people?"); eating while engaged with electronics (watching television, playing videogames, or using the computer, all rated as yes/no); and the extent to which their eating was influenced by others ("Please rate how much you agree with the following statement: I am eating because others are eating"), the latter of which was rated on a 1- to 5-point Likert-type scale (1="disagree strongly," and 5="agree strongly"). In order to avoid confounding electronics use with interpersonal processes, participants were not asked about using electronics to engage with peers (e.g., text messaging, social media usage).

The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) was used to assess current negative mood state. The PANAS is a brief, reliable, and valid measure (Laurent et al., 1999) that has been used in several EMA studies (Engel et al., 2013; Smyth et al., 2007), including studies involving children (Hilbert et al., 2009; Ranzenhofer et al., 2014). Each negative affect item (e.g., afraid, upset) was rated on a 5-point scale ("1"="Not at all"; "5"="Extremely") and summed to form a composite negative affect scale (range=0–50). In addition to negative affect, participants reported on the occurrence of stressful events ["Since your last rating, please indicate which of the following has been stressful for you (choose all that apply): family concerns; personal relationships; school-related problems; other; I have not experienced any stressful events"], which were selected based on Kearney and colleagues (Kearney, Drabman, & Beasley, 1993). The number of endorsements of stressful events across categories at each signal was summed to create a

total stress score at each recording. Body shape/weight concerns were measured using five items adapted from the Child EDE that assessed feelings of fatness, dissatisfaction with shape and weight, and discomfort with shape and weight via a 7-point Likert-type scale ranging from "Not at all" to "Very much." Items were summed into a single scale (range=5–35) based on their high internal consistency (α=.94). The Social Adjustment Scale-Self Report (SAS-SR; Weissman & Bothwell, 1976) was used to assess the interpersonal context of eating behavior. Five items assessing experiences of loneliness, social rejection, poor quality friendships, and recent arguments, all of which were rated on a 5-point scale ranging from "Not at all" to "A lot," were combined into a single scale (range=5–25) based on their high internal consistency (α=.74).

Statistical Analysis

Eating episode data were limited to recordings which occurred within 1 hour of the eating episode taking place, representing 471 out of 700 total eating episode recordings (67.3%), to reduce concerns about retrospective recall. A two-step approach was applied to determine the most parsimonious predictive models for LOC and overeating severity. First, separate generalized estimating equation (GEE) models assessed the relationship between each continuous (i.e., cravings, hunger, food hedonics, influence of others, negative affect, number of stressful events, shape/weight concerns, and interpersonal stress), nominal (i.e., location), or dichotomous (i.e., presence of dining companions, engaged with electronics) independent variable and the two dependent variables (i.e., degree of overeating and LOC) at the univariate level. All independent variables were drawn from the same EMA recording as the reported eating episode, with the exception of *cravings* and *hunger*, which were time-lagged from the previous EMA recording (since eating episode recordings were completed after the eating episode had occurred). Second, independent variables that were significant (p<.05) at the univariate level were retained and entered into two separate final models for LOC and overeating severity.

Each GEE used a gamma link function to account for non-normal distributions of the outcome variables and an AR(1) matrix structure to account for autoregressive effects. GEEs included both between-subjects (i.e., grand-mean centered) and within-subjects effects (i.e., centered within each person) of continuous independent variables. Age, gender, and BMI were considered as covariates, but these variables were not significant univariate predictors of LOC or overeating severity, and therefore were removed from the analyses.

Power analyses and sample size estimation for the current study were based upon multi-level Monte Carlo simulations with Mplus software (Muthén & Muthén, 1998–2013) assuming a medium effect size of .50 between normal eating episodes and overeating/LOC eating episodes, 14 days of EMA recordings with 4 responses per day, an EMA compliance rate of 85%, an intraclass correlation coefficient of .40, and a two-tailed alpha of .05. A total sample size of 40 participants provides a statistical power of .81.

Results

Descriptive characteristics

Participants were 40 children and adolescents (55.0% female; *n*=22) with overweight/obesity (BMI≥85th percentile for age and sex according to Centers for Disease Control and Prevention [CDC] normative data; Kuczmarski et al., 2000; *M* z-BMI=2.07±0.49), aged 8–14y (*M* age=11.2±1.9y), who self-identified as African-American (62.5%; *n*=25), Hispanic (17.5%; *n*=7), non-Hispanic Caucasian (15.0%; *n*=6), or Asian (2.5%; *n*=1), which reflects the demographics of the study site (not reported, *n*=1).

A total of 10 youth (24.4%) reported engaging in LOC eating during the last 3 months via the Child EDE; of these, 1 participant (10%) reported objectively large binges and 9 (90%) reported subjectively large binges. Participants with and without LOC eating did not differ in mean EMA ratings of LOC [$t(38)= -0.42$; $p=.811$; *M* rating for youth with LOC=4.73±1.38; *M* rating for youth without LOC=4.73±1.41; full sample ICC=.62] or overeating [$t(39)= -0.44$, $p=.753$; *M* rating for youth with LOC=1.28±0.39; *M* rating for youth without LOC=1.22±0.39; full sample ICC=.36]. Two participants (5%) reported having engaged in objectively large eating episodes without LOC during the last 3 months via the Child EDE. This small sample size precluded statistical comparisons on EMA ratings of LOC and overeating severity.

Participants completed, on average, 13.83 (*SD*=1.74) days of EMA recordings, including 1,119 (67.6%) signal-contingent recordings, 151 (9.1%) event-contingent recordings, and 387 (23.3%) bedtime recordings. The average participant completed 2.03 (*SD*=0.86) signal-contingent recordings per day (range=0.64–3.43), 0.50 (*SD*=0. 69) event-contingent recordings per day (range=0.06–3.00), and 0.70 (*SD*=0.24) bedtime recordings per day (range=0.15–1.00), for an average of 3.01 (*SD*=1.37) total recordings per day (range=0.86–7.43). Of the 471 eating episodes recorded within 1-hour of the episode taking place, 266 (56.5%) episodes were reported during signal-contingent recordings, 124 (26.3%) were reported during event-contingent recordings, and 81 (17.2%) were reported during bedtime recordings.

Univariate correlates of overeating and LOC severity

Table 1 displays univariate model results. For the dependent variable of LOC severity, there were significant between-person effects for interpersonal stress and cravings, such that participants who evidenced higher overall levels of interpersonal stress and cravings throughout the 14-day protocol also reported greater overall levels of LOC severity. In addition, there was a significant within-person effect for food hedonics, such that higher momentary ratings of food palatability were related to higher concurrent ratings of LOC eating severity. Thus, interpersonal stress, cravings, and food hedonics were retained as independent variables in the final model for LOC.

For the dependent variable of overeating severity, body dissatisfaction, interpersonal stress, cravings, influence of others, and presence of others were significant between-person correlates, such that higher levels interpersonal stress, cravings, and influence of others, and more frequent reports of eating with others (versus alone) throughout the 14-day protocol

each was associated with higher overall ratings of overeating severity; therefore these variables were retained as independent variables in the final model for overeating severity.

Multivariate correlates of overeating and LOC severity

Table 2 displays results for the final models including all significant univariate within- and between-person correlates of LOC and overeating severity. For the dependent variable of LOC severity, there were main effects for food hedonics (between- and within-person), as well as a between-person effect for cravings. That is, during eating episodes in which participants reported higher momentary food hedonics they reported greater concurrent LOC eating severity (B=.01, p=.015), though the between-person effect indicated that those who reported *lower* overall levels of food hedonics throughout the 14-day protocol reported *higher* LOC severity ratings, on average (B=−.04, p=.005). Conversely, those who reported higher overall cravings during the 14-day protocol reported higher average ratings of LOC severity (B=.20, p=.001).

For the dependent variable of overeating severity, the only effect that emerged as significant was for influence of others at the between-person level, in that those who reported greater overall influence of others throughout the protocol evidenced greater average levels of overeating severity (B=.17, p<.001).

Discussion

The purpose of the current study was to assess momentary, naturalistic correlates of maladaptive eating behaviors in children and adolescents with overweight/obesity. We found that eating-related factors (i.e., food hedonics and cravings) were most strongly associated with LOC severity, while one environmental factor (contextual influence of others eating) was associated with overeating severity. While several other interpersonal and cognitive/attitudinal factors were associated with LOC and overeating severity at the univariate level, these factors did not emerge as significant correlates of maladaptive eating-related features once other correlates were considered simultaneously. Negative affect was neither a univariate nor multivariate predictor of LOC or overeating severity, which contradicts much of the adult literature (Haedt-Matt & Keel, 2011) but is consistent with the pediatric literature (Hilbert et al., 2009; Ranzenhofer et al., 2014) and may suggest that negative mood state emerges as a predictor of maladaptive eating later in development. Taken together, interventions to reduce the experience of LOC eating in youth with overweight/obesity may benefit from helping youth incorporate palatable foods and satisfy cravings in a planned and controlled manner, while efforts to reduce overeating may benefit from enhancing awareness of social-contextual effects on promoting excess food/energy intake.

While the between- and within-person effects of food hedonics on LOC eating severity (i.e., lower overall food hedonics predicted higher average LOC severity across the 14-day EMA protocol, while momentary food palatability ratings predicted higher concurrent LOC severity, respectively) may seem somewhat contradictory, these findings may be understood in the context of previous research on anticipatory and consummatory responses to food in individuals with obesity (Stice, Spoor, Ng, & Zald, 2009). This prior research suggests that individuals with overweight/obesity may be hyposensitive to food reward, which

paradoxically promotes increased ingestive behavior to compensate for a sluggish reward system and facilitate the experience of pleasure related to eating (Stice, Spoor, Bohon, & Small, 2008; Stice, Spoor, Bohon, Veldhuizen, & Small, 2008). While the momentary experience of enjoying the taste of food may promote experiences of dysregulation around eating, youth who tend to experience higher levels of LOC severity overall may do so to compensate for a relative deficit in food reward response. These youth may also be more prone to cravings, reflecting underlying tendencies towards greater anticipation of food reward despite blunted response to actual consumption of food.

The between-person effect of influence of others on overeating severity is consistent with the well-documented social facilitation effect on eating behavior, which suggests that on average, humans eat more when they are in groups (Elliston, Ferguson, Schüz, & Schüz, 2017; Herman, 2015), particularly when dining companions are also eating larger amounts of food (Higgs & Thomas, 2016). While research on this effect has primarily been conducted in adults, children may be especially vulnerable to influences of others' eating behavior on their own eating behavior since they tend to engage in shared meals more often due to cohabitation status. Of note, we did not assess eating during daytime weekday hours to minimize disruptions to the school day, thus inhibiting an opportunity to potentially understand the influence of others on eating behavior in cafeteria settings where children frequently consume their midday meals. Thus, future research is warranted to understand social facilitation effects of eating in children and adolescents, particularly in the context of eating with peers.

Results of the current study could inform development of interventions to reduce maladaptive eating behaviors in children and adolescents, including those delivered in real time when youth are at highest risk for engaging in these behaviors. In particular, our findings support the use of mindfulness-based practice and/or appetite-awareness training to regulate food intake in youth with eating- and/or weight-related problems. These interventions tend to focus on recognition and response to physiological cues related to eating (e.g., perceptions of the taste of food, experience of hunger/satiety signals) and as such, could help children better attend to internal rather than external cues related to eating, including anticipatory (e.g., cravings) and consummatory (e.g., food palatability) responses. Indeed, such interventions have demonstrated preliminary effectiveness in the treatment of pediatric obesity and maladaptive eating behaviors (Bloom, Sharpe, Mullan, & Zucker, 2013; Boutelle et al., 2011), and future studies should assess whether they can be successfully adapted for delivery via ecological momentary intervention/just-in-time adaptive interventions.

The current study was marked by several strengths, including the heterogeneous sample of community-based children and adolescents with overweight/obesity; the use of EMA to characterize eating episodes in real time in the natural environment; and the assessment of a range of internal and external cues hypothesized to drive eating behavior in youth. Limitations include the relatively small sample size, which was restricted to youth aged 8–14 thereby precluding generalizability to older adolescents; the lack of a non-overweight control group; the reliance on self-report to assess constructs of interest (e.g., LOC, overeating), which were not verified by independent clinical assessors; and the examination

of primarily concurrent, rather than antecedent, predictor variables, which limits ability to infer causation and to understand highly dynamic processes (e.g., negative affect). An additional limitation was participants' modest compliance in responding to EMA prompts and providing event-contingent ratings, which could have reduced power to detect significant model effects given that sample size estimations assumed a compliance rate of 85%. One possible explanation for these lower-than-expected compliance rates could be the amount of data requested during EMA recordings (i.e., 34–49 items, depending on the type of recording), which may have been perceived as overly burdensome to participants. Further research is needed to understand if there is systematic bias in the types of eating episodes that are reported versus omitted in momentary studies of eating behavior, and to determine methods for improving response rates to signal-contingent recordings (e.g., providing immediate incentives such as credit towards online applications, rather than prorated incentives provided at the completion of the study). Indeed, future studies may benefit from employing more frequent daily assessments, while reducing the overall duration of the sampling period and the number of EMA items, in order to both address participant burden and understand the influence of rapidly changing constructs, such as affective state, on eating behavior (Kockler, Santangelo, & Ebner-Priemer, 2018).

In summary, the current study provides novel information about contextual factors that contribute to the momentary experience of LOC and overeating in children and adolescents with overweight/obesity. Results suggest that internal factors are stronger correlates of the experience of LOC, while external factors may be more likely to contribute to perceptions of overeating. Future research should replicate and extend these findings in larger samples, and assess the effectiveness of momentary interventions focused on reducing triggers for LOC and overeating in the natural environment.

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Table 1

Univariate predictors of LOC and overeating severity

		LOC eating						Overeating					
				95% confidence interval						95% confidence interval			
Univariate model	**Effect level**	***B***	***SE***	**Lower**	**Upper**	**Wald χ^2**	***p***	***B***	***SE***	**Lower**	**Upper**	**Wald χ^2**	***p***
Negative affect	Between	0.02	0.02	−0.02	0.06	0.76	0.383	0.04	0.03	−0.01	0.09	2.05	0.152
	Within	0.01	<0.01	<0.01	0.02	2.74	0.098	0.01	0.01	0.00	0.03	3.57	0.059
Stressful events	Between	0.13	0.11	−0.08	0.33	1.39	0.238	0.11	0.11	−0.11	0.32	0.98	0.323
	Within	0.02	0.05	−0.07	0.12	0.21	0.650	−0.11	0.11	−0.32	0.11	0.90	0.344
Body dissatisfaction	Between	0.01	0.01	<0.01	0.02	1.92	0.166	**0.01**	**0.01**	**<0.01**	**0.03**	**4.00**	**0.046**
	Within	0.01	0.01	−0.01	0.04	1.13	0.288	0.01	0.01	−0.01	0.03	1.59	0.208
Interpersonal stress	Between	**0.06**	**0.02**	**0.02**	**0.11**	**7.14**	**0.008**	**0.07**	**0.02**	**0.02**	**0.11**	**8.28**	**0.004**
	Within	0.01	0.01	−0.01	0.04	1.51	0.219	0.01	0.01	−0.01	0.03	0.83	0.361
Food hedonics	Between	−0.02	0.02	−0.07	0.02	1.20	0.273	<0.01	0.02	−0.05	0.05	0.00	0.971
	Within	**0.01**	**0.00**	**<0.01**	**0.01**	**9.08**	**0.003**	0.01	0.01	−0.01	0.03	1.99	0.158
Hunger	Between	0.15	0.12	−0.08	0.39	1.65	0.199	0.17	0.13	−0.08	0.41	1.78	0.183
(lagged)	Within	0.02	0.01	<0.01	0.05	2.88	0.089	0.01	0.02	−0.03	0.04	0.11	0.739
Cravings	Between	**0.25**	**0.06**	**0.13**	**0.37**	**17.66**	**<0.001**	**0.24**	**0.06**	**0.12**	**0.37**	**15.06**	**<0.001**
(lagged)	Within	−0.02	0.02	−0.05	0.02	0.62	0.429	0.01	0.03	−0.04	0.06	0.29	0.592
Influence of others	Between	0.17	0.11	−0.04	0.39	2.53	0.112	**0.23**	**0.08**	**0.06**	**0.39**	**7.12**	**0.008**
	Within	<0.01	0.03	−0.06	0.07	0.02	0.892	−0.04	0.04	−0.12	0.03	1.27	0.261
Presence of others[1]	Between	0.12	0.17	−0.21	0.45	0.49	0.484	**0.29**	**0.15**	**0.00**	**0.58**	**3.90**	**0.048**
	Within	0.02	0.03	−0.04	0.07	0.26	0.608	−0.01	0.07	−0.14	0.13	0.01	0.911
Engaged with electronics[2]	Between	<0.01	0.16	−0.31	0.31	<0.01	0.994	−0.10	0.16	−0.42	0.23	0.35	0.557
	Within	−0.05	0.03	−0.11	0.02	2.16	0.141	−0.03	0.04	−0.11	0.05	0.59	0.441
Location	---	---	---	---	---	7.83	0.348	---	---	---	---	4.86	0.678

Note. LOC=loss of control; NA=negative affect.

Bold font indicates significant (p<.05) effects.

[1]Reference category: eating alone.

[2]Reference category: not engaged with electronics.

Table 2

Final models predicting LOC and overeating severity

					95% confidence interval			
		Effect level	***B***	***SE***	**Lower**	**Upper**	**Wald χ^2**	***p***
LOC eating	Intercept	---	1.53	0.03	1.47	1.59	2462.08	<0.001
	Interpersonal stress	Between	0.02	0.02	−0.01	0.05	1.95	0.163
		Within	0.01	0.01	−0.01	0.03	0.45	0.503
	Food hedonics	Between	**−0.04**	**0.01**	**−0.06**	**−0.01**	**7.74**	**0.005**
		Within	**0.01**	**<0.01**	**<0.01**	**0.01**	**5.88**	**0.015**
	Cravings	Between	**0.20**	**0.06**	**0.08**	**0.32**	**10.85**	**0.001**
		Within	−0.01	0.02	−0.05	0.03	0.41	0.522
Overeating	Intercept	---	0.20	0.03	0.15	0.25	54.18	<0.001
	Body dissatisfaction	Between	0.01	<0.01	<0.01	0.02	2.85	0.091
		Within	0.01	0.01	−0.01	0.03	0.85	0.358
	Interpersonal stress	Between	0.02	0.02	−0.01	0.05	1.45	0.229
		Within	<0.01	0.01	−0.02	0.02	0.05	0.829
	Cravings	Between	0.10	0.06	−0.02	0.22	2.55	0.111
		Within	<0.01	0.02	−0.04	0.04	0.00	0.997
	Influence of others	Between	**0.17**	**0.05**	**0.08**	**0.26**	**12.65**	**<0.001**
		Within	−0.05	0.04	−0.13	0.02	2.16	0.142
	Presence of others	Between	0.08	0.11	−0.15	0.30	0.45	0.501
		Within	−0.02	0.06	−0.15	0.10	0.14	0.712

Note. LOC=loss of control.

Bold font indicates significant (p<.05) effect.

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