State emotion modulation and loss-of-control eating in individuals with obesity: A preliminary ecological momentary assessment study

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Abstract

There is ample evidence linking broad trait emotion regulation deficits and negative affect with loss-of-control (LOC)-eating among individuals with obesity and binge eating, however, few studies have examined emotion regulation at the state-level. Within and across day fluctuations in the ability to modulate emotion (or regulate emotional and behavioral responses), one facet of *state* emotion regulation, may be a more robust momentary predictor of LOC-eating than momentary

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negative affect and *trait* emotion regulation ability. As such, the current study tested if daily emotion modulation, and daily variability in emotion modulation differed on days with and without LOC-eating episodes, and if momentary emotion modulation was associated with subsequent LOC-eating episodes. For two weeks individuals (*N*=14) with obesity and binge eating completed surveys as part of an ecological momentary assessment study. Participants reported on current ability to modulate emotion, LOC-eating, and current negative affect. On LOC-eating days compared to non-LOC-eating days, ability to modulate emotion was poorer (ß =0.10, *p*<.001) and average variability in ability to modulation emotions was greater (ß=0.56, *p*=.008), even when controlling for negative affect. Greater momentary difficulty modulating emotion was associated with a 40% increase in subsequent risk for LOC-eating (ß=0.34, *p*=.071, OR=1.40). Findings from this pilot study suggest that individuals with LOC-eating report poorer ability to modulate emotion and greater variability in ability to modulate emotion on LOC-eating days, even when controlling for negative affect. Future research should replicate findings and further elucidate the relationships between state emotion regulation, negative affect, and LOC-eating.

Keywords

Loss of control eating; Ecological Momentary Assessment; State Emotion Regulation; Emotion Modulation; Obesity

1. Introduction

Loss-of-control (LOC)-eating (i.e., feeling that one cannot stop eating once started) is a core feature of binge eating and is associated with the development and maintenance of physical (e.g., greater BMI) and psychosocial (e.g., greater distress and poorer quality of life) consequences, regardless of the amount consumed during LOC-eating episodes (Palavras, Hay, Lujic, & Claudino, 2015). Among individuals with obesity and binge-eating, state negative affect and trait emotion regulation capabilities appear to contribute to risk for LOC-eating. For example, a naturalistic study among individuals with obesity and binge-eating report momentary increases in negative affect preceding LOC-eating episodes, but little reduction in negative affect following LOC-eating (Goldschmidt et al., 2012). Further, individuals with binge eating often have deficits in trait emotion regulation including lack of access to healthy emotion regulation strategies (Kittel, Brauhardt, & Hilbert, 2015; Leehr et al., 2015). Overall, this pattern suggests LOC-eating is one behavior through which individuals with obesity and binge eating attempt to regulate distress.

One limitation to previous studies testing the link between emotion regulation and LOC-eating is the use of retrospective self-report measures to assess one's general or trait emotion regulation capabilities. Trait measures assume one's ability to regulate emotions is stable over time. Even among individuals who are generally good at regulating emotion, ability to modulate emotion (i.e., ability to regulate emotional responses and engage in healthy behaviors) which is a key facet of *state* emotion regulation (Lavender, Tull, DiLillo, Messman-Moore, & Gratz, 2017), may fluctuate. In the laboratory, individuals experience greater difficulty modulating emotion following a negative mood induction and/or stressful task, even when accounting for trait emotion regulation (Lavender et al., 2017). This

suggests that momentary changes in ability to modulate emotion, such as in response to daily stressors, are important, but these changes are not captured by trait measures.

Preliminary studies conducted in the natural environment, suggest state emotion regulation ability fluctuates throughout the day and modulates between- (Smith et al., 2020) and within-day (Keating, Mills, & Rawana, 2019) risk for binge-eating episodes and decreases following LOC-eating episodes (Stevenson, Wilborn, Kramer, & Dvorak, 2019). Among individuals with binge eating, despite a generally poor ability to modulate one's affect, a momentary ability to reduce stress in a healthy way (e.g., calling a friend, going for a walk) may protect against binge eating in response to stressful events. Greater within-day fluctuations in the ability to regulate emotion may also be associated with greater risk for LOC-eating. For example, those who experience more frequent and/or severe decreases in ability to regulate emotion during the day may be at greater risk for feeling out of control while eating compared to those who experience fewer/lesser daily decreases in ability to regulate emotion.

Thus, the current study used ecological momentary assessment (EMA; intensive repeated measurement of behavior in its natural context) to assess ability to modulate emotion multiple times a day and determine if state ability to modulate emotion impacts momentary risk for LOC-eating episodes in adults with obesity and binge eating. The following hypotheses were tested: on days LOC-eating episodes occur, compared to days without LOC-eating episodes individuals would 1) experience lower average ability to modulate emotion and 2) experience greater average variability in ability to modulate emotion. We also hypothesized that momentary decreases in ability to modulate emotion would be associated with subsequent LOC-eating episodes.

2. Methods

2.1 Participants and Procedures

Adults with a body mass index in the obese range (BMI; 30 kg/m^2 or above) who reported binge-eating episodes (subjectively or objectively large) in the past three months were recruited to a trial testing guided self-help cognitive-behavioral therapy for binge eating. Participants were excluded if they were currently engaging in compensatory behaviors, in treatment for weight loss, pregnant, using a stimulant medication, had a comorbid diagnosis that would impact their ability to comply with study procedures (eg. psychotic disorder, substance dependence), or had a history of bariatric surgery. Participants were recruited from the Philadelphia area via flyers and online postings.

During a baseline visit, participants height and weight were measured to determine participant's BMI (kg/m^2), provided informed consent and were administered the Eating Disorder Examination (Cooper & Fairburn, 1987) to assess LOC-eating. If the participant had a smartphone, they were given the option to complete a two week EMA protocol prior to initiating treatment. The EMA protocol contained both event contingent (i.e. they were asked to complete a survey anytime they had an eating episode) and semi-random (i.e. they received six prompts to complete a survey at semi-random times throughout the day)

surveys. Study procedures were approved by the IRB at Drexel University and participants received additional compensation for participating in the EMA study.

2.2 EMA Measures

All EMA items were rated on a dimensional 1 (not at all) to 5 (completely or extremely) scale and are included in the Supplementary Materials. The modulate subscale of the State Difficulties Regulating Emotions Scale (S-DERS) (Lavender et al., 2017) assess one's perceived ability to control emotion and behavior, and thus was used to assess momentary emotion modulation. Higher scores represent greater difficulty modulating emotion. Internal reliability was excellent (Cronbach's alpha = .94). For each eating episode, participants were asked five questions assessing the degree to which they experienced a sense of loss of control while eating including "to what extent did you feel 1) a sense of loss of control, 2) that you could not stop eating once you started". Eating episodes were considered a LOC-eating episode if participants rated a three or higher (out of 5) on any of the LOC-eating items (Berg et al., 2015). Current negative affect score was created by averaging a subset of items from the Positive And Negative Affect Schedule (PANAS) (Watson, Clark, & Tellegen, 1988). Internal reliability was excellent (Cronbach's alpha = .91).

2.3 Statistical Analyses

More detailed analytic methods are included in the Supplementary Materials. All analyses used a general linear mixed model (GLMM) with a Gamma distribution and logit function. Day-type was determined as a non-LOC-eating day or a LOC-eating day (i.e., one or more LOC-eating episodes were reported). Ability to modulate emotion and negative affect were aggregated within-person and within-day to obtain daily averages. To compare emotion modulation between LOC-eating and non-LOC-eating days (hypothesis 1), day-type was used to predicted daily average emotion modulation while controlling for daily average negative affect. Daily variability, or variance in emotion modulation and negative affect, was quantified by the mean of the squared successive differences (MSSD). To compare average variability in emotion modulation between LOC-eating and non-LOC-eating days (hypothesis 2), day-type was used to predict daily MSSD scores, while controlling for daily MSSD of negative affect. To examine if momentary levels of emotion modulation were associated with subsequent LOC-eating episodes (hypothesis 3), momentary emotion modulation and negative affect ratings were lagged within-persons and within-day and used to compute within-person (e.g., difference between an individual's current modulation rating and their average modulation rating) and between-person (e.g., difference between an individual's average modulation rating and the entire sample's average modulation rating) measures of emotion modulation. Within and between subject emotion modulation variables were mean centered and used to predict LOC-eating at the subsequent eating episode. Presence of LOC-eating at a previous survey and momentary negative affect were included as covariates. Given the small sample size and preliminary nature of the current study effect sizes were computed.

3. Results

Eighteen participants enrolled in and completed the EMA protocol. Due to error with the EMA surveys four participants did not receive the LOC-eating questions, and therefore were excluded from analyses (final N=14). The final sample was 64% female (n=9), 71% white (n=10), had an average age of 39 years (SD=11) and an average BMI of 37.22 (SD=5.82). On average, participants reported 21 (SD=15.38) subjectively or objectively large binge-eating episodes in the past month. EMA descriptive results are included in the Supplementary Materials.

As shown in Table 1, on LOC-eating days compared to non-LOC-eating days, participants reported greater average difficulty and greater variability in difficulty modulating emotion, even when controlling for negative affect. Table 2 contains estimated marginal means and standard errors for day-type models. Increases in momentary difficulty modulating emotion were positively and marginally associated with risk for a LOC-eating episode when controlling for momentary negative affect.

4. Discussion

The current study utilized EMA to conducted a preliminary examination of the daily and momentary relationships between state ability to modulate emotion and LOC-eating in individuals with obesity and binge eating. Consistent with hypotheses, on LOC-eating days, compared non-LOC-eating days, average ability to modulate emotion was poorer and average fluctuations in ability to modulate emotion were greater. Momentary difficulties with emotion modulation increased risk for subsequent LOC-eating by 40%, even when controlling for momentary levels of negative affect.

Generally, lower ability to modulate emotion and greater fluctuations in emotion modulation were observed on LOC-eating days, which could be influenced by several factors. For example, between-day factors, such as sleep quality (Palmer & Alfano, 2017) and within-day factors, such as the occurrence of stressful events (Keating et al., 2019), may impact one's ability to regulate emotions. Importantly, compared to negative affect, poorer and more variable daily emotion regulation had a larger impact on LOC-eating. As such, it may be that emotion regulation ability, rather than negative affect itself, is a stronger driver of LOC-eating. Therefore, identifying between- and within-day factors that impact state emotion modulation may elucidate targets for future LOC-eating interventions.

Although not statistically significant, momentary emotion modulation prospectively increased odds of LOC-eating at the next eating episode by 40%. This finding is consistent with a small study of university students (Goetz, Johnson, Naugle, & Borges, 2020), but contrasts with another recent study (Stevenson et al., 2019). Seemingly inconsistent findings may be attributable to sample (e.g., binge eating vs mixed eating disorder) and analytic differences (e.g., examining associations among various LOC-eating episodes vs trajectories of change pre- and post-the first LOC-eating episode that day. Therefore, studies with larger and more diverse samples (eg., wider BMI ranges, other eating disorder diagnoses, racial/ ethnic minority groups) are needed to clarify differences.

The state emotion modulation facet of the S-DERS has demonstrated adequate internal consistency in the present study and in previous EMA studies (Goetz et al., 2020; Stevenson et al., 2019) suggesting it has utility for assessing state emotion modulation ability in the natural envionrment. However, items of the S-DERS appear to measure the degree to which one is overwhelmed by emotion, not use of actual emotion modulation skills. Therefore, momentary emotion modulation, as measured in the current study, may be a proxy for self-efficacy in regulating emotions, rather than actual access to skills. Some participants may have used healthy coping strategies to prevent LOC-eating episodes despite feeling overwhelming by emotions, thereby weakening the momentary associations between perceived emotion modulation ability and LOC-eating. This is consistent with a study that found use of emotion regulation skills, but not reported intentions to use a skill mitigated risk for binge eating (Svaldi, Werle, Naumann, Eichler, & Berking, 2019). Examinations of the timing of self-reported strategy use, perceived ability to modulate emotions, and changes in emotion may clarify the relationship between actual and perceived ability to regulate emotion.

This preliminary study's limitations include a small sample size. Future studies with larger samples sizes should aim to replicate our findings. LOC-eating episodes were classified without considering the amount of food consumed; thus, future research should determine if state emotion regulation ability differentially impacts risk for episodes of objective binge-eating, subjective binge-eating, and LOC-eating. To our knowledge, the psychometric properties of the full S-DERS have not been tested in EMA studies, thus, studies should determine if its factor structure replicates in natural settings.

4.1 Conclusions

Findings from this preliminary study suggest examining relationships between state emotion regulation and LOC-eating warrant future study. The link between individual's perceived ability to modulate affect and their actual ability to reduce affect through the use of adaptive strategies need to be examined. A better understanding of these relationships among specific eating disorder populations could inform precise intervention targets.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Funding Sources:

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Highlights

- On LOC-eating days, ability to modulate emotion was poorer and more variable

- Risk for LOC-eating increased 40% following a decrease in emotion modulation

- State emotion modulation impacts LOC-eating when adjusting for negative affect

Table 1.

Summary of Generalized Linear Mixed Models

	ß	*SE*	*p*	95% CI	ES
Daily Emotion Modulation					
Intercept	−0.50	0.19	.007	−0.86, −0.13	
Negative Affect	0.48	0.02	<.001	0.44, 0.52	
Day-type	0.10	0.02	<.001	0.05, 0.14	0.48[a]
Daily Emotion Modulation MSSD					
Intercept	−1.60	1.13	.157	−3.82, 0.62	
Negative Affect	0.59	0.11	<.001	0.37, 0.81	
Day-type	0.56	0.21	.008	0.15, 0.98	0.17[a]
Momentary Emotion Modulation					
Intercept	0.38	1.70	.823	−2.97, 3.73	
Prior LOC-eating episode	0.62	0.21	.003	0.22, 1.03	
Momentary Negative Affect	−0.41	0.20	.045	−0.81, −0.01	0.66[b]
Average Modulation	−0.82	0.65	.211	−2.10, 0.47	0.44[b]
Momentary Modulation Difficulties	0.34	0.19	.071	−0.03, 0.71	1.40[b]

Note. ES = effect size; MSSD = Mean Successive Square Difference;

[a]Cohen's d;

[b]OR = odds ratio.

Table 2.

Estimated Marginal Means from Day Type models

Dependent Variable	Overall	Non-LOC-eating Days[a]	LOC-eating Days[b]
Emotion Modulation Daily Average *M (SE)*	1.44 (0.26)	1.37 (0.25)	1.51 (0.27)
Emotion Modulation Daily MSSD *M (SE)*	0.32 (0.36)	0.25 (0.28)	0.43 (0.48)

Note. MSSD= Mean Successive Square Difference;

[a]Two participants reported LOC-eating episodes everyday during the EMA period so n=12;

[b]One participant did not report any LOC-eating episodes during the EMA period so n=13; Greater average emotion modulation represents poorer ability to modulate emotion.