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Post-Treatment Daily Dynamics of Negative Affect, Stress, and Eating Behavior in Youth with Obesity: The Role of Resting Heart Rate Variability

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Abstract

Background. Adolescents are at heightened risk for weight regain following inpatient obesity treatment, yet little is known about the momentary emotional processes that may undermine sustained treatment success. Therefore, current study examined within-person associations between negative affect, stress intensity, and maladaptive eating behaviors during the early post-treatment period, and investigated resting heart rate variability (HRV) as a predictor of maladaptive eating and of individual differences in affect–eating associations. **Methods.** Seventy adolescents aged 13-19 years (M = 15.7, SD = 1.76; 63% girls) who completed inpatient obesity treatment participated in an ecological momentary assessment (EMA) during the first two months after discharge. Participants reported negative affect, stress intensity, and eating behaviors five times per day for two 7-day periods. Resting HRV was assessed prior to EMA, at treatment completion. The main study hypotheses and analyses were preregistered (see https://osf.io/67pxb). **Results.** Dynamic structural equation modeling showed that higher stress intensity predicted increased emotional eating at the subsequent assessment. The association between negative affect and later emotional eating was less certain. Emotional and reactive eating both predicted higher subsequent negative affect. Neither negative affect nor stress intensity predicted reactive eating. Resting HRV did not predict average levels of maladaptive eating or individual differences in within-person associations. **Conclusions.** Emotional eating appears to be triggered by daily stressors and may contribute to subsequent increases in negative affect, whereas reactive eating primarily predicts later distress. These findings underscore the importance of targeting daily emotion and stress regulation processes and providing close support during the early post-discharge period.

Introduction

Obesity in Youth: Treatment and High Relapse Rates

Obesity is a significant global health problem, affecting millions of individuals across all age groups [1]. In both adults and children, having obesity is associated with a range of adverse physical and psychological consequences, including cardiovascular diseases, type 2 diabetes, depression, and an overall reduced quality of life [2,3]. Among youth, obesity presents the additional challenge of a heightened risk of persisting into adulthood, further exacerbating long-term health risks [4,5]. For youth, especially those with severe obesity, interventions involving semi-residential care, such as summer camps or boarding schools, have been shown to be more effective than outpatient ambulatory interventions in achieving weight loss and reducing body fat percentage [6,7,8,9]. However, the initial benefits often diminish at follow-up, with weight returning to pre-treatment levels within two years [10]. This high relapse rate highlights the urgent need to understand the mechanisms contributing to post-treatment weight regain, particularly in the first months following discharge, when youth return to less structured and more triggering environments.

Maladaptive Eating as a Key Mechanism of Weight Regain

Not surprisingly, the main contributor to weight regain after discharge is maladaptive eating behavior [11,12,13], including emotional eating (i.e., eating in response to emotions), external eating (i.e., eating triggered by food-related cues), and loss of control (LOC) eating (i.e., being unable to control one's eating). These behaviors are highly common among individuals with obesity and are frequently triggered by negative affective states and daily stressors [14]. After discharge, youth may face heightened emotional and environmental challenges as they transition from the structured, supportive context of inpatient care back to everyday life, where they may be exposed to elevated stress levels. During this period, previously learned healthy behaviors may be undermined and give way to pre-treatment coping mechanisms, including maladaptive eating. Importantly, maladaptive eating behaviors may not only be a response to emotional distress but can also exacerbate it, thereby creating a reinforcing negative cycle [15,16,17,18]. Specifically, negative affect may prompt maladaptive eating,

which in turn may lead to further emotional discomfort, perpetuating the pattern. These processes may occur particularly among adolescents. Indeed, compared to children and adults, adolescents are generally more sensitive to stress and tend to experience elevated levels of negative affect [19,20]. Moreover, these developmental vulnerabilities may be further exacerbated among adolescents with obesity, who are exposed to more frequent and intense stressors (e.g., weight stigma, discrimination) and higher levels of negative affect than their average-weight peers [21,22].

Despite the central role of eating behavior in relapse, relatively little is known about the dynamic daily-life processes that drive these behaviors in adolescents following treatment. Existing studies linking emotional, external, and LOC eating to difficulties in weight maintenance and greater weight regain have focused exclusively on adults [11,12,23,24,25,13] and have solely relied on retrospective measures to assess eating patterns over the past several months. This approach is prone to recall bias and fails to capture how real-life stressors and emotions may influence eating behavior in the moment, during individual's daily lives [26]. Ecological Momentary Assessment (EMA) provides a valuable alternative by enabling real-time tracking of affective states and eating behaviors, thereby allowing the examination of how stressors and affective experiences in daily life contribute to momentary fluctuations in eating behavior. EMA is especially valuable in the period immediately following treatment, when relapse risk is the highest. The few existing EMA studies on the effects of daily stressors and momentary negative affect on eating behavior in youth with overweight or obesity have not focused on the post-discharge period and have yielded mixed results [27]. A recent study revealed that when adolescents reported higher levels of anxiety (relative to their own average), they also reported higher levels of emotional eating, but not of LOC eating [28]. Other work found no significant within-person associations between momentary negative affect and subsequent LOC eating or overeating [29]. These mixed findings suggest the presence of moderating factors that influence the relationship between affective states, daily stress and eating behavior [27].

The Role of Heart Rate Variability

Self-regulatory abilities (e.g., emotion regulation, executive functioning) have been proposed as one such potential moderator that may explain why some individuals endorse maladaptive eating behaviors (when exposed to stress) while others do not [30,31,32]. However, prior research has rarely examined self-regulatory processes at the physiological level, despite their possible relevance, particularly among individuals with obesity. Theories (e.g., neurovisceral integration model [33], polyvagal theory [34]), and empirical evidence propose that heart rate variability (HRV)—reflecting parasympathetic nervous system activity—is associated with an individuals' ability to regulate emotional and behavioral responses [35]. Higher resting HRV is associated with better self-regulation, adaptability, and resilience. Conversely, lower HRV has been linked to emotional and behavioral dysregulation [36,37]. Importantly, children and adolescents with obesity exhibit autonomic dysfunction, characterized by lower resting levels of HRV, compared to their average-weight peers [38]. Individual differences in resting HRV may therefore provide unique insights into identifying youth who are more susceptible to engaging in maladaptive eating behaviors when exposed to stressors or negative affect.

HRV may influence eating behavior in at least two ways: a) directly, by reflecting an individual's ability to regulate urges and inhibit impulsive behaviors and b) indirectly, by buffering the impact of daily stress and negative affect on eating behavior. Additionally, given the bidirectional nature of the affect–eating relationship, HRV may also moderate the impact of maladaptive eating on subsequent negative emotions. That is, adolescents with lower resting HRV may not only be more likely to eat in response to distress, but also more emotionally affected by having done so. Despite the theoretical relevance, only a few studies have investigated the role of HRV in eating behavior in individuals with obesity. Among adults with obesity, lower HRV has been associated with greater severity of overeating and LOC eating [39]. Similar patterns have been observed in adolescents with overweight, although findings remain inconsistent [40,41]. Further research is needed to clarify the role of HRV in eating behaviors among adolescents with obesity.

Study Rationale and Objectives

Despite the well-documented problem of weight regain, relatively little is known about the dynamic daily-life processes driving eating behavior in adolescents following inpatient obesity treatment. This study aimed to address this gap by using EMA to examine the real-time associations between stress, negative affect, and eating behaviors in adolescent daily lives during the first two months after treatment. Additionally, drawing on theory and research linking HRV to self-regulatory processes, we examined resting HRV as a physiological marker that may influence maladaptive eating both directly and by moderating the within-person associations between negative affect or stress intensity and eating behaviors.

We focused a priori on two main maladaptive eating behaviors, emotional eating and reactive (e.g., external-, LOC-) eating, because these are typically associated with overeating and weight regain. Restrained eating, representing a more deliberate attempt to regulate food intake, was included for exploratory purposes only, given that in the context of obesity treatment, restrained eating may serve as a beneficial weight management strategy [42], predicting better long-term weight maintenance [11,43,44,45].

The main study hypotheses were preregistered (see https://osf.io/67pxb). Specifically, we hypothesized that, at the within-person level, (1) higher stress intensity and negative affect would predict increased maladaptive eating behaviors (emotional and reactive eating) and (2) maladaptive eating would, in turn, predict subsequent increases in negative affect, indicating a reciprocal and reinforcing cycle between affect and eating. In addition, higher levels of resting HRV at discharge were hypothesized to (3) be associated with lower maladaptive eating and (4) buffer the effects of stress intensity and negative affect on maladaptive eating, as well as the effects of maladaptive eating on negative affect.

Method

Participants

Participants were 70 adolescents aged 13-19 years (M = 15.7, SD = 1.76; 63% girls) who recently completed a residential multidisciplinary obesity treatment (MOT) program in Belgium (Duration: M =

9 months, SD = 2.8 months). Prior to treatment, participants had a mean adjusted body mass index[1] (%BMI) of 198 (SD = 30.7). On average, they lost 22 kilograms (SD = 9.7) during treatment, resulting in a mean post-treatment %BMI of 153.8 (SD = 23.1). Following treatment, the majority of participants remained in the overweight (N = 16) or obesity range (N = 50), and only four participants achieved a weight below the overweight cutoff at post-treatment. This study is part of a larger project approved by the Medical Ethics Committee of Ghent University Hospital (ONZ-2022-0038). Prior to the start of data-collection, participants gave their assent and one of their parents provided active written informed consent.

Procedure

In the final days of treatment, participants' electrocardiogram (ECG) was assessed in a quiet room at the treatment center to derive a resting measure of HRV (see measure section for additional details). During this baseline visit, participants downloaded m-Path and were familiarized with the types of questions (multiple choice, slider, open question) they would encounter. A total of 64 participants (91% of study sample) completed the baseline HRV assessment. For six participants, this in-person assessment was not possible due to practical constraints prior to discharge. These participants instead received instructions for the EMA protocol via an online meeting. After discharge, EMA was conducted over two non-consecutive 7-day periods within the first two months following discharge from the MOT. Participants used their personal smartphones to complete surveys via the m-Path app (www.m-Path.io). Each day, participants were asked to complete five time-based assessments, each prompted by a notification: one in the morning (30-60 minutes after waking), three throughout the day (noon, afternoon, evening), and one before bedtime. Timing was tailored to individual wake/sleep schedules and school hours, with adjustments for weekdays and weekends. Reminders were sent if multiple assessments in a row were missed. Participants received a €20 voucher for their participation.

[1] BMI adjusted for age and sex resulting in the percentage of overweight. An adjusted BMI score ≥ 120% is seen as overweight, an adjusted BMI score ≥ 140% as obesity.

Each survey collected data on momentary affect, recent stressors and eating behaviors, with an estimated completion time of two minutes. The evening assessment included additional questions (e.g., about main meals, snacking), which are outside the focus of the present study. Participants who completed fewer than 10 surveys were excluded a priori from the main analyses (N=1; see https://osf.io/67pxb). This threshold was adopted to maximize data availability and ensure a minimum of within-person assessments while reducing bias associated with including only highly compliant participants [46].

Measures

HRV

Resting HRV was assessed via a portable eMotion Faros 90° device (Mega Electronics Ltd, Finland), a non-invasive ECG monitoring system. ECG measurements were collected using two disposable FS-50 electrodes placed under the right clavicle and on the left lower ribs (Lead II placement). During the measurement, participants watched a six-minute neutral clip from a nature documentary while seated and were instructed to remain still and silent. ECG data was available for 64 participants, and was preprocessed and analyzed using Anslab 2.6. The ECG signal, sampled at 1000 Hz, was visually inspected for artifacts, ectopic beats, and signal loss. One participant was excluded due to excessive noise, resulting in 63 participants with valid data. Only the middle five minutes of the six-minute recording were used for HRV analysis to ensure data stability and minimize start/end effects. Interbeat intervals (IBIs) were extracted using R-wave detection with a semi-automated algorithm. HRV was quantified using the Root Mean Square of Successive Differences (RMSSD), a commonly used time-domain measure to index HRV [47].

EMA measures

Negative Affect. Momentary negative affect was assessed with five items tapping into different negative emotions (i.e., sad, angry, afraid, bored, and stressed), which are commonly used in prior EMA studies. Each emotion was rated on a 7-point Likert scale (1 = "Not at all" to 7 = "Very much"), reflecting

how participants felt "at that moment". A composite negative affect score was calculated by averaging across the items at each signal (ω_{within} = .60 and $\omega_{between}$ =.85).

Stress Intensity. Participants first indicated which events they had experienced as stressful since the previous assessment by selecting all applicable sources from a predefined list (e.g., family, friends/classmates, school-related issues such as tests or assignments, or “other”). If a unique stressor was specified under “other,” it was added as a response option in subsequent assessments. Participants were then asked to rate the perceived intensity of the most stressful event they had experienced during that interval on a 7-point Likert scale (1 = “Not stressful at all” to 7 = “Very stressful”). Focusing on the most stressful event is a commonly used approach in EMA research, as it reduces participant burden and enhances recall accuracy compared to reporting on multiple events simultaneously [48,49].

Eating behavior. Participants’ eating motivations and behaviors were assessed using items adapted from the Dutch Eating Behavior Questionnaire [50] and the Child Eating Disorder Examination-Questionnaire [51]. Items tapped into three maladaptive eating behaviors: emotional eating, reactive eating, and restrained eating behavior [53]. Each item was rated on a 7-point Likert scale (1 = "Strongly disagree" to 7 = "Strongly agree"). In each EMA survey, participants first indicated whether they had eaten since the last survey. If they answered “yes”, items regarding emotional and reactive eating were shown. Emotional eating was measured with a single item: “Since the last assessment, I ate because I wanted to feel better (less sad/nervous, etc.)”. Reactive eating consisted of external eating, hedonic hunger, overeating, and LOC eating, and was assessed with four items “Since the last assessment, I ate because I saw or smelled food.”, “Since the last assessment, I ate because I desired to eat.” “Do you feel like you have overeaten?”, and “Did you feel a loss of control while eating?”. A total reactive eating score was computed by averaging across these items at each occasion (ω_{within} = .61 and $\omega_{between}$ = .82). If participants indicated they had not eaten since the last assessment, they were asked three items to assess restrained eating behavior: “I deliberately eat smaller portions to control my weight”, “I avoid certain foods because they make me gain weight”, and “I will probably eat less than I actually want”. A

total restrained eating score was computed by averaging across these items at each occasion (ω_{within} = .70 and $\omega_{between}$ = .92).

Data-analysis

All study analyses were preregistered (see https://osf.io/67pxb) and conducted accordingly unless explicitly stated otherwise. Data were analyzed using Dynamic Structural Equation Modeling (DSEM) in Mplus version 9.0 to examine the temporal dynamics between stress intensity, negative affect, and eating behaviors. DSEM is welly suited for intensive longitudinal data, allowing for simultaneous estimation of within-person fluctuations and between-person differences. Momentary variables (negative affect, stress intensity, eating behavior) were latent person-mean centered (default in Mplus DSEM), which has several advantages compared to traditional person-mean centering [54]. Autoregressive Lag-1 models were estimated to account for temporal dependencies within each variable.

At each trigger (time t), participants reported on their eating behavior and stress intensity that occurred between the previous (time t-1) and current assessment (time t), while momentary affect was rated at the moment of each assessment (time t). Therefore, eating behavior at time t (i.e., occurring between time t–1 and t) was assumed to temporally precede affect at time t. Accordingly, negative affect at time t was regressed on eating behavior at t under this temporal assumption, consistent with previous EMA studies [49,55].

Four main DSEM models were specified, combining negative affect or stress intensity with either emotional or reactive eating, and each model was estimated in three consecutive steps. First, cross-lagged paths examined whether fluctuations in stress intensity (time t-1) and negative affect (time t-1) predicted subsequent eating behaviors (time t), and whether eating behavior (time t) predicted later affect (time t), thereby testing bidirectional (reinforcing) relationships (Models 1a-d). Second, resting HRV was added as a time-invariant predictor of eating behaviors, to test its direct (main) effect on overall eating tendencies (Model 2a-d). Third, resting HRV was included as a time-invariant moderator of the cross-lagged effects to examine whether it attenuated the within-person associations

between negative affect or stress intensity and eating behavior (Model 3a-d). In step 2 and 3 (hypotheses 3-4), age, sex, and %BMI at the end of the treatment were included as covariates predicting eating behavior. Because participants completed the emotional or reactive eating items only if they had eaten since the previous trigger, these models were estimated using only occasions on which participants had eaten (see Table 1 for number of assessments). Conversely, exploratory models examining restrained eating included only occasions on which participants reported not having eaten since the last assessment.

All models were estimated using Bayesian estimation with Markov Chain Monte Carlo (MCMC) methods and non-informative priors. A minimum of 20,000 iterations was used, with model convergence evaluated via the potential scale reduction factor (PSR < 1.012) and inspection of trace plots. In DSEM, missing data were handled using a Kalman filter approach [54], which allows the inclusion of all observations in the analyses. The TINTERVAL command, set at three hours, was used to account for unequal spacing between observations. Because the EMA protocol included two non-consecutive weeks, we specified a gap of 24-hours between week 1 and week 2, to avoid modeling too many missing observations between the two weeks. This adjustment allowed the two EMA weeks to be modeled as a single, approximately continuous 14-day time series with consistent temporal spacing for DSEM estimation [55]. Statistical significance of parameters was inferred based on the 95% credibility intervals (CI) of unstandardized estimates (i.e., a parameter was considered significant when the 95% CI did not include zero).

Results

Descriptive Statistics

Table 1 presents the descriptive statistics and intraclass correlations (ICCs) for all study variables. Based on ICCs, negative affect, stress intensity, emotional eating, and reactive eating showed substantial within-person variability (range = 43%-67%), justifying the examination of momentary within-person dynamics. In contrast, the high ICC for restrained eating (.86) suggests that most of the variance was at the between-person level, reflecting an enduring individual trait rather than a

fluctuating state. Regarding EMA compliance, participants responded to an average of 48 out of 70 prompts (range = 11–70), corresponding to a mean compliance rate of 69%. Compliance was not significantly associated with age, sex, %BMI, or RMSSD (all ps > .05).

Model convergence and estimation

Two models slightly exceeded the preregistered PSR cutoff used to evaluate convergence (PSR ≤ 1.012). However, the PSR was below the commonly accepted convergence criterion (PSR < 1.10) [56], and inspection of trace plots did not indicate non-convergence. Therefore, these models were also retained for inference. Only the two models including negative affect, emotional eating, and RMSSD exceeded acceptable levels (PSR > 1.10) and did not converge even when increasing the number of interations. Therefore these models were excluded from interpretation. Full parameter estimates for all retained models are reported in Tables 2-4.

Model 1: Within-person associations between negative affect, stress and eating behavior

All parameters estimates from DSEM models 1a-d are reported in Table 2. Across all models, significant autoregressive effects were observed for emotional eating, reactive eating stress intensity and negative affect, suggesting temporal stability, such that higher levels at one assessment predicted higher levels at the subsequent assessment. In the models on emotional eating, stress intensity significantly predicted increases in emotional eating at the subsequent time point. Also negative affect showed a positive association with later emotional eating; however, the 95% CI of the unstandardized estimate narrowly included zero ([-.009, .292]), indicating uncertainty regarding the precision and magnitude of this effect. Regarding reactive eating, event-related stress and negative affect were not significant predictors. Both emotional eating and reactive eating did predict higher negative affect at the next assessment.

Model 2-3: Effects of baseline RMSSD on eating behavior and affect/stress dynamics

Results from the converged DSEM including baseline RMSSD are shown in Tables 3 and 4. The effect of baseline RMSSD as a time-invariant predictor of emotional and reactive eating was not

significant. In addition, baseline RMSSD did not predict the slopes of cross-lagged effects between negative affect or stress intensity and eating behavior. None of the covariates (i.e., age, sex, and %BMI) were significantly associated with emotional eating or reactive eating (all 95% CI included zero).

Exploratory Analyses: Restrained Eating

Given the high ICC for restrained eating (.86), indicating that most variance was between individuals, within-person variability was relatively limited. Nevertheless, in line with the preregistered analysis plan, dynamic within-person associations were examined using DSEM. The models including negative affect did not converge. Parameter estimates of the converged models can be found in Supplement Table S1. Significant autoregressive effects were observed for restrained eating, indicating that higher levels at one assessment predicted higher levels at the subsequent assessment ($\beta = .41$). Event-related stress showed a negative association with later restrained eating. However, the 95% credibility interval of the unstandardized estimate narrowly included zero ([-.082, .012]), indicating uncertainty regarding the precision and magnitude of this effect, despite the corresponding standardized interval not including zero. None of the covariates was associated with restrained eating (all 95% CI included zero).

Discussion

Adolescents who leave inpatient obesity treatment are at heightened risk for weight regain. However, little is known about the day-to-day emotional processes that may undermine sustained treatment success after discharge. The present study aimed to provide insight into how daily negative affect and stress intensity are dynamically linked to maladaptive eating behaviors during this early post-treatment phase. Additionally, HRV was examined as a potential influencing factor of maladaptive eating, both as a direct predictor and as a predictor of individual differences in within-person affect/stress–eating associations. Overall, the findings point to a pattern in which emotional eating follows increases in stressor intensity and is associated with subsequent increases in negative affect, whereas reactive eating primarily predicts later negative affect rather than being driven by affect or

stress. In contrast, baseline HRV did not explain individual differences in maladaptive eating or in the strength of affect–eating associations.

Consistent with hypothesis 1, stress intensity predicted increased emotional eating at the subsequent time point. This finding aligns with affect regulation models [57] of emotional eating, which propose that individuals may engage in eating as a strategy to cope with stress-related arousal. In the context of post-treatment adjustment, stressors encountered in daily life may therefore increase vulnerability to emotionally driven eating episodes. The association between negative affect and subsequent emotional eating was less definitive. Although the unstandardized 95% CI narrowly included zero, indicating a non-significant effect, most of the values within this CI were positive suggesting that increases in emotional eating following negative affect are plausible but the strength of this effect should be interpreted with caution. One possible explanation is that stress intensity represents a more concrete and situational trigger, whereas negative affect captures a broader and potentially more diffuse emotional state. Adolescents may respond more strongly to identifiable stressors than to general fluctuations in mood. In contrast, neither negative affect nor event-related stress predicted subsequent reactive eating, providing no support for the first hypothesis with respect to reactive eating. This suggests that reactive eating may be less directly driven by momentary emotional states and instead reflect more habitual, impulsive, or externally cued processes. This interpretation is in line with previous EMA research in youth that did not consistently find prospective effects of negative affect or stress on LOC eating [27,58].

Supporting hypothesis 2, both emotional and reactive eating predicted higher negative affect indicating that rather than alleviating distress, maladaptive eating behaviors were followed by increases in negative affect. This pattern is consistent with previous research [58,59] and in line with a short-term negative reinforcement cycle. Adolescents may initially expect eating to reduce distress, yet experience guilt, loss of control, or self-criticism afterward, thereby maintaining or amplifying negative affect. Over time, such dynamics may contribute to the risk for weight regain and emotional vulnerability. In contrast to these dynamic patterns, exploratory analyses indicated that restrained

eating was predominantly stable between individuals (ICC = .86), suggesting a more trait-like pattern with limited within-person fluctuation.

Contrary to hypothesis 3, baseline HRV did not predict adolescents' average levels of emotional or reactive eating during the EMA period. Furthermore, hypothesis 4 was also not supported: resting HRV did not predict individual differences in the within-person associations between negative affect or event-related stress and maladaptive eating behavior. Several explanations are possible. First, HRV was assessed once, approximately two weeks prior to the start of EMA and while the participants were still in the treatment center. A single resting assessment may have not been sufficient to adequately capture individual differences in HRV that are relevant to emotionally salient real-world situations. Repeated or ambulatory HRV assessments in daily life may better reflect moment-to-moment fluctuations in parasympethatic regulation that influence emotional and eating responses [60]. Second, HRV may be more closely linked to immediate regulatory responses, such as the ability to downregulate stress or negative affect, rather than to specific behavioral outcomes such as eating. Third, the relatively small between-person sample size may have limited power to detect cross-level effects. Together, these findings suggest that resting HRV, as assessed in the present study, did not function as a protective factor against daily affect/stress-driven eating behavior during the post-treatment period.

Findings from this study have several important implications for clinical practice and post-treatment support. The observed affect- and stress-driven dynamics in emotional and reactive eating highlight the value of targeting daily emotion and stress regulation skills in adolescents following inpatient obesity treatment. Interventions may benefit from strengthening stress management strategies and promoting alternative coping mechanisms for managing negative affect and stressors in daily life. Given that maladaptive eating was followed by increases in negative affect, helping adolescents recognize and interrupt this cycle may be particularly important in preventing relapse and supporting sustained weight outcomes. Furthermore, these results underscore the importance of close follow-up and monitoring during the early post-discharge period, when youth appear most vulnerable to stress-related eating behaviors.

Strengths and Limitations

Several strengths enhance the contribution of the present study. First, the focus on the post-treatment transition period addresses a clinically critical yet understudied phase, during which adolescents are particularly vulnerable to weight regain. By examining daily processes shortly after discharge, the study provides insight into mechanisms that may undermine long-term treatment success. Second, the use of EMA allowed for the investigation of affect/stress–eating dynamics in real time, minimizing retrospective bias and increasing ecological validity [26]. Third, the integration of a physiological marker (HRV) alongside EMA data represents an important step toward a more multi-method understanding of maladaptive eating processes. Several limitations should also be acknowledged. First, the sample size was relatively small and may have limited statistical power to detect effects, especially in more complex models including HRV. Second, HRV was assessed only once and prior to the EMA period. Future studies should consider repeated or ambulatory HRV assessments to better capture parasympathetic activity in daily life. Third, maladaptive eating behaviors were assessed via self-report, which may still be influenced by reporting bias despite the use of EMA.

Conclusion

In the early post-treatment period, adolescents' daily affective and stress experiences were dynamically linked to maladaptive eating behavior. Emotional eating appeared to be both the result of stress-related events and a predictor of increases in negative affect, whereas reactive eating primarily predicted later negative affect. Resting HRV did not account for individual differences in these processes. Together, these findings highlight the importance of targeting daily emotion, stress, and impulse regulation processes to support sustained treatment outcomes in adolescents with obesity.

Author Contributions:

MG, CB and NM obtained project funding and co-developed the design with IV. MG and NM supervised the project. IV collected the data, implemented the statistical analyses and wrote the first draft. AT and VB facilitated the data collection. All authors provided feedback on the draft manuscript.

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