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Momentary stress-induced food craving: An ecological momentary assessment study comparing perceived interpersonal and non-interpersonal stressors

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Abstract

Daily-life stressors and food cravings are dynamic and vary within and across persons. Some evidence suggests interpersonal stressors increase appetite. However, little is known about the association of food craving with different types of stressors at the momentary level in the general population. We aimed to explore the momentary relationships between daily-life stressful events and food craving in a non-clinical community sample, and to compare the associations with food craving when the most stressful event was perceived as interpersonal versus non-interpersonal. We used ecological momentary assessment (EMA) to collect reports on the most stressful event, perceived stressor type, stressor appraisal, and food craving from 123 adults three times a day scheduled at fixed intervals over 10 days. Mixed effects random intercepts and slopes models examined the within- and between-person associations. Experiencing a stressor was significantly positively associated with within-person food craving at the same measurement. No differences in momentary food craving were found when the most stressful event was perceived as interpersonal or non-interpersonal (within-person level). However, frequently reporting the most stressful event as interpersonal (vs. non-interpersonal) was positively associated with food craving across the study (between-person level), particularly when the stressor was appraised as more unpleasant. Daily-life stressors were associated with momentary food craving. Individuals who generally perceived interpersonal stressors as their most stressful event tended to experience food cravings. Future research could further investigate the role of interpersonal stressors as a factor for overeating in daily life and the potential benefits of stress management in interventions.

KEYWORDS
ecological momentary assessment, food craving, interpersonal stress, stress, stress appraisal, stress type

1 | INTRODUCTION

Stress is part of our everyday life but is associated with negative effects on well-being, including physical and psychological health and behaviours (O'Connor et al., 2021; Tomiyama, 2019). It has been shown that stress may result in changes in eating patterns (e.g., restraining eating, binging, food craving), and unhealthy foods preference that may lead to eating disorders and overeating (Chao et al., 2015; Gibson, 2012; Groesz et al., 2012; Lemmens et al., 2011; Tryon et al., 2013). Stress-induced eating has been proposed as a means to meet other needs beyond nutritional requirements such as emotion regulation or to cope with a stressor (Greeno & Wing, 1994; Schepers & Markus, 2015). However, while some people increase their eating under stress, others eat less (Gibson, 2012), highlighting the need to further understand the within-person factors that may lead to individual differences in eating behaviours in response to stress.

Food craving is a strong desire to eat specific foods or types of food (Weingarten & Elston, 1990), commonly associated with food intake and consumption of highly palatable foods (Chao et al., 2015; Hill, 2007). Food craving has been also found to be related to higher levels of stress across longitudinal, laboratory, and ecological momentary assessment studies (Chao et al., 2015; Lemmens et al., 2011; Reichenberger et al., 2021; Tryon et al., 2013). A cross-sectional study found that craving partially mediated the relationship between stress and weight status (Chao et al., 2015). Studies have also found that individuals with overweight may be more likely to have food cravings and eat under stress than those with normal weight (Chao et al., 2015; Lemmens et al., 2011). Individual situational factors, such as experiencing daily-life stressors or the perceived type of stressor, can play a role in food craving and eating behaviours (Leow et al., 2021; O'Connor et al., 2008; Reichenberger et al., 2021).

During stressful experiences or periods, people might have difficulties distinguishing between hunger and distress resulting in overeating (Bruch, 1961; Kaplan & Kaplan, 1957), and may want to eat as a way to escape or avoid distress (Heatherton & Baumeister, 1991), or to seek emotional relief (Fowler et al., 2022; Klatzkin et al., 2022). Additionally, not all events will result in a similar stressful response and health impact (Cohen et al., 2016). The way people subjectively appraise a situation might also determine their responses to stress (Lazarus & Folkman, 1984). Different appraisal levels might have differential effects on the reaction to a stressor (Ader et al., 2022; Scott et al., 2013). Situations appraised as more stressful could elicit emotional states that trigger physical and behavioural reactions, with potential long-term implications for health (Cohen et al., 2016; Crosswell & Lockwood, 2020). Both the occurrence of an event and the event-related stress appraisal have been found to be related to overeating behaviours (Goldschmidt et al., 2014; Srivastava et al., 2021; Wolff et al., 2000). Consequently, when facing a stressful event, people might experience higher food craving, especially if the event is appraised as highly unpleasant.

The reactions to stressors also can differ based on contextual and intraindividual elements (Lazarus & Folkman, 1984). In particular, interpersonal stressors, which can be characterised as difficult, dangerous or threatening situations that include social interaction or relationships with other persons, such as relationship conflict with the partner or social isolation (Cohen et al., 2019; Owens et al., 2019; Sheets & Craighead, 2014), play a significant role in poor health and emotional distress (Arcelus et al., 2013; Cohen et al., 2019; Epel et al., 2018; Owens et al., 2019). Meaningful and reciprocal interpersonal interactions are an important need in everyday life and well-being (Baumeister & Leary, 1995; Pietromonaco & Collins, 2017). Their absence can negatively impact the social self and social esteem (Dickerson et al., 2009) as well as behaviours and physical and mental health, including eating-related behaviours (Jaremka et al., 2014; Owens et al., 2019; Pietromonaco & Collins, 2017). Previous research linked interpersonal stress to dysregulated eating and appetite, eating disorders, and negative coping strategies like overeating (Albano et al., 2019; MacIntyre et al., 2021; O'Connor et al., 2008; Ranzenhofer et al., 2014; Raspopow et al., 2013).

The interpersonal model of binge eating posits that people may turn to overeat in response to the distress caused by interpersonal stressors (Ansell et al., 2012; Fairburn et al., 2003; Goldschmidt et al., 2014; Ranzenhofer et al., 2014). Additionally, individuals with overweight or disordered eating might be particularly susceptible to social interactions and negative feedback from others, and pay more attention to social threats, possibly intensifying the impact of social stressors and triggering behaviours like overeating and social withdrawal (Albano et al., 2019; Cardi et al., 2013; Fairburn et al., 2003; Monteleone et al., 2018). Interpersonal stressors can also negatively affect self-esteem, increasing the desire to achieve idealised body weight or shape and thus the likelihood of adopting disordered eating (Fairburn et al., 2003). Studies on the relationship between stress and appetite may shed some light on the relationship between stress and food craving. Some studies found a positive association between appetite and interpersonal stress, but not non-interpersonal stress (Jaremka et al., 2014, 2015). Whereas other studies found that, non-interpersonal stressors, like work-related stress, were also positively associated with greater eating (O'Connor et al., 2008). Therefore, how interpersonal and non-interpersonal stressors differentially associate with food craving is still unclear.

This knowledge gap may be in part because stressful events and food cravings are dynamic and vary within and across persons (Leow et al., 2021; O'Connor et al., 2008; Ranzenhofer et al., 2014; Reichenberger et al., 2019, 2021; Zenk et al., 2014) yet most research has not examined their association at the momentary level, which fails to capture these individual fluctuations or the dynamics of everyday life, and may be prone to recall bias. In recent years, researchers have increasingly applied ecological momentary assessment (EMA) approaches to examine the relationship between stress and eating behaviours, using repeated reports on experiences and behaviours several times a day across days in participants' daily life and natural environment which enhance ecological validity and accuracy of the results (Engel et al., 2016).

Studies using EMA among non-clinical adult populations have found more unhealthy eating and snacking on days with more daily hassles (Moss et al., 2021; Zenk et al., 2014), and when experiencing interpersonal and work-related stress (O'Connor et al., 2008). Snacking was related with reduced negative affect after stressful

daily events (Wouters et al., 2018). There have been relatively few EMA studies examining stress-food craving relationship. These studies seem to indicate that stress is positively associated with momentary food craving (Leow et al., 2021; Reichenberger et al., 2021), especially among people with a higher tendency for stress-induced eating (Reichenberger et al., 2021). Another EMA study identified an important role of coping with stress in the adherence to eating goals (Pannicke et al., 2021). These studies mainly focused on the intensity of feeling stress. In sum, research indicates that momentary stress is related to overeating-related patterns and sensations like food craving. To our knowledge, no study has examined the relationship between the occurrence of a stressor, the event-related stress appraisal and food craving while considering the variation between and within individuals. Furthermore, no study has investigated this link in terms of interpersonal versus non-interpersonal stressors in the general population.

Based on the same dataset as the current study, we previously used a dynamic network approach to examine relations between food craving, restrained eating, hunger and seven negative emotions, and found that feelings of stress were the only negative emotion that triggered food craving (Dicker-Oren et al., 2022). In our previous study we did not examine the role of experiencing a stressful event nor event-related stress appraisal and did not consider the perceived type of the stressor. The aim of the current study was to further explore the relationship between stressful events and food craving. In particular, whether the momentary experience of a stressful event, the event-related stress appraisal and perceived stressor type (interpersonal or non-interpersonal) were associated with food craving in a non-clinical community sample. The results could help to better understand the complex momentary associations between stressful events aspects and food cravings, while considering individual and across person's variations in how people experience stressors and how it relates to food cravings over time. We had four hypotheses. (1) Experiencing a daily-life stressful event would be related to higher momentary food craving. (2) Greater unpleasant event-related stress would be associated with higher momentary food craving. (3) The type of event perceived as most stressful (interpersonal or non-interpersonal) would be differentially associated with food craving. Specifically, perceiving the most stressful event as an interpersonal stressor would be associated with more food craving. (4) Stressor type would moderate the associations between the stressor appraisal and food craving, with a stronger relationship for the most stressful event perceived as being interpersonal compared to non-interpersonal.

2 | METHODS

2.1 | Participants, design and procedure

The sample (n = 123) in the current study was based on a general population convenience sample living in Israel, recruited via social media advertisements and posts, and snowballing method. All participants contacted the researcher via phone, email, or Facebook, to receive more information about the study. A short screening questionnaire was conducted via telephone to determine eligibility: (a) persons older than 18 years old, (b) women not pregnant or breastfeeding, (c) individuals without current severe psychiatric illness, (d) no eating disorders diagnosis (past or present), (e) BMI (kg/m^2) above 18.5 (underweight), and (f) individuals who have not undergone bariatric surgery over the last year. Those that were eligible and willing to participate provided electronic informed consent via the Qualtrics platform (www.qualtrics.com).

All data were collected using the Qualtrics online survey software. After providing consent and enrolling in the study, participants completed a baseline questionnaire. The next day they started the EMA surveys, three times a day at fixed intervals predetermined times personalised to each participant, between 7.00 AM and 11.00 PM (morning, afternoon, and evening) for 10 days via smartphones or computers. Each prompt was scheduled with a 6 hour gap throughout the day and was open for completion for 2 hours (latency mean = 39.69 min, SD = 35.30). At the beginning of the study, participants could choose one of the three possible panel options to receive the prompts: (i) 7 AM, 1 and 7 PM; (ii) 8 AM, 2 and 8 PM; or (iii) 9 AM, 3 PM and 9 PM. These times were chosen to provide flexibility to the participants and increase participant compliance, while maintaining a six-hour gap between prompts, ensuring time of the day (morning, afternoon and evening), and avoiding overlapping prompts. Similarly to previous studies on eating patterns or stress (e.g. Debeuf et al., 2018; Mason et al., 2019; van der Stouwe et al., 2019), we chose a three-time point assessment to diminish participant attrition and burden, potentially leading to more missing surveys, or to a higher likelihood of encountering no or minor stressor events. Items referred to stressor experiences and food craving and took an average of 365.3 s to complete (SD = 615.21).

Participants were emailed links to the EMA surveys and were notified via WhatsApp message reminders. To improve compliance, we sent a WhatsApp message after three missed surveys and contacted them by phone after four missed surveys. To further encourage compliance, participants with a response rate higher than 80% of the EMA questionnaires were entered in a raffle for 12 vouchers of 100 NIS ($30) each and we also offered an optional personalised report depicting their reports of stressful events and food craving during the study (119 out of 123 participants asked for the report). The design and procedure of the study were approved by the Faculty of Health and Social Welfare Ethics Committee at the University of Haifa (IRB approval: 220/21).

In total, 131 participants enroled in the study. We excluded data from five participants with less than 50% response (≤15 surveys) due to dropout from the study resulting in insufficient data for our analyses, from two participants who reported not experiencing any of the variables during the whole study indicating no variance across the study, and from one participant with very short and likely unfeasible completion times (an average of 40 s in 23 of 29 completed surveys) which were the lowest completion times observed across all participants and raised concerns about the reliability of the

TABLE 1 Descriptive characteristics of the study sample (n = 123).

Variable	N	Mean	%	SD
Gender				
Men	17		13.82	
Women	106		86.18	
Age		41.60		13.56
Marital status				
Married/living with a partner	75		60.98	
Not married	48		39.02	
Education				
High school (with/without diploma)	21		17.08	
Professional training	15		12.20	
Higher education	87		70.72	
Mean years of education		15.16		4.22
Employment[a]				
Full time	63		51.22	
Part-time	27		21.95	
Temporary jobs	5		4.07	
Student	19		15.45	
Unemployed or pensioner	14		11.38	
Other	18		14.64	
Financial status				
Far below average	35		28.46	
Somewhat below average	30		24.39	
About average	27		21.95	
Somewhat above average	21		17.07	
Far above average	10		8.13	
Body mass index (BMI)				
Normal weight (18.5–24.9)	66		53.66	
Overweight (25–29.9)	31		25.20	
Obese (≥30)	26		21.14	
BMI mean		25.63		5.42

[a]Participants could select more than one answer.

responses. The final sample included 123 participants (93.9%) with a range of 24–30 completed surveys per person. Detailed sample characteristics are presented in Table 1.

2.2 | Measures

2.2.1 | Baseline questionnaire

Demographic background: this survey assessed gender, year of birth, education level (high school with/without diploma, professional training, higher education), total years of education, relationship status (married or living with a partner/not married or not living with a partner), employment status (full-time, part-time, temporary job, student, unemployed or pensioner, other), financial status (far below average, somewhat below average, about average, somewhat above average, far above average). Weight and height were asked to calculate body mass index (BMI; weight/height^2). The questionnaire was conducted in Hebrew.

2.2.2 | EMA questionnaires

Most stressful events: Participants were asked to think about the most stressful event "since you have woken up" in the morning survey or 'over the last 6 h' in the afternoon and evening surveys and to select if it was an interpersonal stressful event (e.g., was embarrassed; argued with spouse or another person; felt ignored; had problem with kids), or a non-interpersonal stressful event (e.g., problems completing work; car trouble; minor accident; bad weather) (coded 1 = interpersonal stressful event, 2 = non-interpersonal stressful event). The stressful event examples provided were based on previous EMA studies (Goldschmidt et al., 2014; Smyth et al., 2007, 2009) and the Daily Stress Inventory (DSI; Brantley et al., 1987). If they did not experience any stressful event they could choose 'I did not experience a stressful event' (coded 0 = did not experience a stressful event), meaning that no stressor occurred. The reference to one most significant event, in this case the most stressful event, is a common approach in EMA stress-related research (e.g., Heron et al., 2022; Jacobs et al., 2011; McIntyre et al., 2019; Myin-Germeys et al., 2001; Scott et al., 2017; van der Stouwe et al., 2019), including eating related behaviours (Wouters et al., 2018). Focussing on the most stressful event rather than listing all stressful events can reduce participant burden in completing surveys and minimise biases in retrospective recall, as people tend to remember distinct events more readily than aggregate responses and checklists (Bolger et al., 2003; Crosswell & Lockwood, 2020; Genet & Siemer, 2012; Heron et al., 2022), with some people overestimating or underestimating the number of stressors experiences (Cohen et al., 2019; Crosswell & Lockwood, 2020; Shiffman et al., 2008). If participants reported they experienced a stressful event, they were asked about the pleasantness of the event (−3 = very unpleasant to 3 = very pleasant) to measure the appraisal of the most stressful event (then recoded so higher scores indicates more unpleasant events). This item has been often employed to represent event-related stress appraisal in EMA studies (Ader et al., 2022; Lataster et al., 2013; Myin-Germeys et al., 2001; Rintala et al., 2023; Wouters et al., 2018). The items were in Hebrew, and we used a translation and back-translation and amendments procedure.

Food Craving: was assessed by the Food Cravings Questionnaire-State (Cepeda-Benito et al., 2000; FCQ-S). It consists of 15 items representing five state-dependent cravings dimensions to measure current cravings for foods: intense desire to eat, anticipation of positive reinforcement that may result from eating, anticipation of

relief from negative states and feelings as a result of eating, obsessive preoccupation with food, or lack of control regarding eating, and physiological states that may trigger food cravings. Participants were asked to refer 'since you have woken up' in the morning survey or 'over the last 6 h' in the afternoon and evening surveys. Responses were rated on a five-point Likert scale scored 1–5 ranging from strongly disagree to strongly agree. We calculated a total score (ranged 15–75). The higher the score, the stronger the sensation of craving. The FCQ-S has shown good reliability and validity (Cepeda-Benito et al., 2000; Lombardo et al., 2016; Moreno et al., 2008). We used a Hebrew version, which was translated using the translation, back translation and amendments procedure. This measure showed very good within-person (α = 0.88, CI = 0.87–0.89) and between-person reliability (α = 0.96, CI = 0.95–0.97).

2.3 | Data analyses

We used the Kleiman Lab website (https://kleimanlab.org/resources/power-curves/) to conduct post-hoc power analysis to ensure that we had sufficient power to conduct the planned analyses. Based on n = 123, the observed response rate of 96%, and an intra-class correlation of 0.5, we have 90% power to detect a medium effect size, which we considered to be sufficient.

Data analysis was conducted in R version 4.0.3. We calculated the aggregated mean-centred (within-person mean) to examine the associations of demographic background with the time-varying EMA variables. To test the hypotheses, the hierarchical structure of repeated EMA measurements (level 1) nested within individuals (level 2) was taken into account. We used mixed effects models with random intercepts and slopes fit by restricted maximum likelihood estimation through the nlme package version 3.1–152. The models referred to the variables measured within the same time window (concurrent momentary associations). Initially, potential demographic background variables (age, gender, BMI, financial status, relationship, and education) were assessed as independent variables but were not significantly related to food craving and were excluded from the final models. Time and autocorrelation were included in all models, with time measured using the prompt number as a covariate to control for potential time trends and reactivity (Bolger & Laurenceau, 2013). Auto-correlated residuals were used to account for the effects of the outcome with itself. An empty model (with no independent variables) was used to estimate intra-class correlations (ICC) of food craving.

All models included both within-person and between-person versions of the momentary independent variables. This helps to disentangle the between-person and within-person associations of the variables. Between-person of the momentary independent variable was calculated by person-level means (the mean of a particular variable for each subject). We created a within-person variable by within-person mean centring (each individual's score was centred around their own average of the variable, indicating the extent to which momentary independent variable differed from the individual's own average level).

The first model included the occurrence of a stressful event (dichotomised into 0 = "did not experience a stressful event", 1="experienced a stressful event") as the independent variable and food craving (total FCQ-S score) as the dependent variable, to examine whether experiencing a stressful event is associated with food craving in the same time window. Based on previous stress-related studies (e.g. Schilling et al., 2022; Schneiders et al., 2006; Uink et al., 2018), we utilised a dummy stressor experience variable to focus on the change in food craving after experiencing a stressor compared to when no stressor occurred. Next, we modelled the momentary relationship between event-related stress appraisal and food craving. To also consider observations in which participants reported they did not experience a stressful event, we coded observations with no stressors as a level 0 in accordance with previous studies, (e.g. Genet & Siemer, 2012; Scott et al., 2013) (i.e. 0 = no stressor, 1 = neutral, 2 = somewhat unpleasant, 3 = unpleasant, 4 = very unpleasant). Since we aimed to focus on negative stressful events and considering the very low number of stressful events reported as positive by our participants (57 observations out of more than 3500), stressors reported as pleasant were also considered as no stressor to avoid potential biases (e.g. Jacobs et al., 2011; Rauschenberg et al., 2021; van der Stouwe et al., 2019). A third model compared the associations of the most stressful event as being an interpersonal versus non-interpersonal stressor with momentary food craving (total FCQ-S score) in the same time window, with perceived most stressful event type as independent variable. The fourth model included the interaction term between the type of the perceived most stressful event appraisal levels of the stressor.

Lastly, since previous evidence suggested a relationship between gender, age, BMI and food craving (Abdella et al., 2019; Tryon et al., 2013), we also re-ran the models including these variables as sensitivity checks. Post-hoc sensitivity analyses were conducted controlling for time of the day (as a continuous variable) and time of the week (weekdays = 0 vs. weekends = 1). It is possible that stressors perceived as pleasant could potentially distort the results (van der Stouwe et al., 2019) due to their more adaptive and positive reactions (Kupriyanov & Zhdanov, 2014). However, in sensitivity analyses we examined the categorisation including pleasant levels as a separate sub-category from no stressors in stressor appraisal level.

3 | RESULTS

On average, participants completed 28.76 EMA surveys (95.9%, SD = 1.62), indicating excellent compliance. Overall, participants provided 3537 completed surveys over 10 days (one observation was removed due to missing data). Of these, 1051 observations included a stressful event (29.7% of the EMA surveys), for which 438 (41.7%) of the reported most stressful events were interpersonal stressful event and 613 (58.3%) were non-interpersonal stressful event. Participants reported an average of 8.54 stressful events (SD = 5.49), with an average of 4.42 reports of an interpersonal stressor (SD = 3.23) and 5.73 reports of a non-interpersonal stressor

(*SD* = 4.11) as being the most stressful events across the study. The mean stressor appraisal was 0.68 (*SD* = 0.48) when including observations with no stressors, and 2.41 (*SD* = 0.55) in the assessments with stressful events only (either interpersonal or nor interpersonal). The mean stressor appraisal of stressors perceived as interpersonal was 2.52 (SD = 1.07) and as non-interpersonal was 2.12 (SD = 0.97). Perceived interpersonal stressors were appraised as more unpleasant than non-interpersonal ($B = -0.40$, $SE = 0.10$, $p < 0.001$). Women reported significantly higher aggregated mean most stressful events perceived as interpersonal (men: $\overline{X} = 2.71$; women: $\overline{X} = 4.71$; $t = -3.39$, $p < 0.01$), and there were no other differences between men and women. There were no other statistically significant relationships between background variables and mean aggregated food craving or aggregated mean number of stressful events and stressful events type. The mean level of food craving was 26.88 (*SD* = 7.46) (see Table S1 for the correlation table as the independent variable). The intra-class correlation for food craving was 0.55 (indicating 55% between-person variance and 45% within-person variance).

3.1 | Experiencing a stressful event association with food craving

The first model included the occurrence a stressful event (did not experience a stressful event/experienced a stressful event) and time as independent variables, food craving as the dependent variable within the same time window and autocorrelated residuals with random intercepts and slopes. There was a significant positive association between experiencing a stressful event and food craving at the within-person level ($B = 1.42$, $SE = 0.34$, $p < 0.001$) and a marginal significance at the between-person level ($B = 6.84$, $SE = 3.39$, $p = 0.046$). That is, when individuals reported they experienced a stressful event their individual likelihood of food cravings was higher than when they did not experience a stressful event. Across the course of the study, participants who reported an average higher proportion of stressful events they reported, on average, high food craving. When examining a model with stressor appraisal as an independent variable, we found a significant association only in the within-person level. Participants with more unpleasant stressor appraisal reported momentary higher food cravings compared to their own individual mean ($B = 0.57$, $SE = 0.14$, $p < 0.001$). In both models, time had a significant negative association with food craving; as the study period continued, food craving gradually decreased. The models showed significant autocorrelation indicating that the outcome correlated with itself across measurements. The results of these models are presented in Table 2.

3.2 | The association between stressful events type and food craving

We also conducted mixed effect models to examine the momentary associations of the perceived type of the most stressful event (interpersonal and non-interpersonal) and food craving, and the interaction between perceived type and appraisal of the most stressful event (see Table 3). To examine the relationship between the perceived type of the most stressful event and food craving, we included in the analyses 115 participants (93.50%) who reported at least one stressful event during the study period (eight participants did not report any stressful event across the study and thus they did not have any interpersonal or non-interpersonal event). We fitted a model with stressful events type (interpersonal and non-interpersonal) and time as independent variables of food craving within the same time window; and autocorrelated residuals with random intercepts and slopes. There was an association between the most stressful event type and food craving only at the between-person level, which indicated that the overall tendency to have the most stressful event perceived as interpersonal versus non-interpersonal stressors were, on average, differentially associated with food craving through the 10-day study period ($B = -5.54$, $SE = 2.40$, $p = 0.023$). There was no significant association at the within-person level ($B = 0.39$, $SE = 0.57$, $p = 0.490$). Time had a significant negative association with food craving; and there was a significant autocorrelation, indicating that the outcome correlated with itself.

Next, we included an interaction term between the type and the appraisal of the most stressful event as an independent variable. There was no within-person interaction ($B = 0.29$, $SE = 0.77$, $p = 0.706$), but a between-person interaction between stressor appraisal and the type of the most stressful event ($B = -10.05$, $SE = 3.74$, $p = 0.008$). The relationship between the stressor appraisal and food craving was more pronounced for those who more often reported the most stressful event as interpersonal. The greater the proportion of most stressful events perceived as interpersonal, the average levels of unpleasant stressor appraisal were positively associated with food craving, while for overall greater proportion of most stressful events perceived as non-interpersonal, higher levels of unpleasant stressor appraisal were related to less food craving across the study (see Figure S1).

3.3 | Follow-up analyses

For sensitivity analyses, we reran the main models including gender, age and BMI as well as time of the day and weekends versus weekdays as covariates. When including gender, age and BMI as covariates the between-person level association of experiencing a stressor with food craving became not significant, while the other associations remained significant. Time of the day had a significant positive association with food craving in all models, with higher levels of food craving in later hours. Time of the week (weekdays vs. weekends) was negatively significantly related to food craving only in the models including a stressful event and stressor appraisal, but not in the models regarding the most stressful event type. Including time of the day and week did not change the significance of the main results. Additionally, we repeated the main models including pleasant

TABLE 2 Random intercepts and slopes autoregressive model for the association of stressful events experience and stressor appraisal with food craving.

	Coef.	SE	95% CI	*t*-value	*p*
Stressful event (yes/no)					
Fixed effects					
Intercept	**24.82**	**1.21**	**22.45–27.19**	**20.54**	**<0.001**
Time	**−0.07**	**0.02**	**−0.12 to −0.03**	**−3.16**	**0.002**
Stressful event—between	**6.84**	**3.39**	**0.14–13.55**	**2.02**	**0.046**
Stressful event—within	**1.42**	**0.34**	**0.75–2.09**	**4.17**	**<0.001**
Random effects					
Intercept SD	7.23				
Slope (time) SD	0.21				
Slope (stressful event) SD	2.30				
Residual	6.29				
Autocorrelation	0.73				
Stressor Appraisal					
Fixed effects					
Intercept	**25.17**	**1.14**	**22.92–27.41**	**21.98**	**<0.001**
Time	**−0.07**	**0.02**	**−0.12 to −0.03**	**−3.17**	**0.002**
Appraisal—between	2.49	1.37	−0.22 to 5.20	1.82	0.071
Appraisal—within	**0.57**	**0.14**	**0.29–0.84**	**4.06**	**<0.001**
Random effects					
Intercept SD	7.25				
Slope (time) SD	0.21				
Slope (appraisal) SD	0.97				
Residual	6.28				
Autocorrelation	0.74				

Note: Within: within-person-mean centered variable. Between: between person-level means of the variable. The significant variables are highlighted in bold.

Abbreviations: CI, confidence interval; Coef., coefficient; SE, standard error.

events to examine whether including stressors appraised as pleasant levels as a separate category from no stressors affected the results and found this did not substantively change the results. See Supplementary Material for details on the models (Tables S2–S12).

4 | DISCUSSION

We examined the associations of experiencing daily-life stressors and food cravings in a community sample and explored whether most stressful events perceived as interpersonal or non-interpersonal had differential associations with food cravings. Our findings supported the first hypothesis, indicating that experiencing a stressful event was significantly associated with higher levels of food cravings. The second hypothesis was supported at the within-person level, as higher levels of unpleasant appraisal were linked to momentary more food cravings relative to the participant's typical levels of food craving. The third hypothesis regarding the perceived type of the most stressful event was partially supported; there were no within-individual differences in the association between interpersonal and non-interpersonal stressors and food cravings. However, individuals who tended to perceive their most stressful event as interpersonal had higher overall levels of food cravings across the study. Finally, the perceived type of the most stressful event moderated the relationship between stressor appraisal and food cravings only at the between-person level.

Our finding that there were within-person associations between daily-life stressors and food cravings supports previous findings (Leow et al., 2021; Reichenberger et al., 2021) indicating a key role of stress in food craving. However, in the current study, the association between experiencing a stressful event and food craving was only marginally significant at the between-person level and was not significant after including age, BMI and gender as covariates for sensitivity analyses. This difference between the within- and between-

TABLE 3 Random intercepts and slopes autoregressive model for the association of the type of the perceived most stressful event and food craving and its interaction with stressor appraisal.

	Coef.	SE	95% CI	*t*-value	*p*
Stressor type (interpersonal vs non-interpersonal)					
Fixed effects					
Intercept	**31.52**	**1.55**	**28.49–34.56**	**20.39**	**<0.001**
Time	**−0.08**	**0.03**	**−0.14 to −0.02**	**−2.44**	**0.015**
Stressor type—between	**−5.54**	**2.40**	**−10.29 to −0.79**	**−2.31**	**0.023**
Stressor type—within	0.27	0.57	−0.85 to 1.39	0.48	0.633
Random effects					
Intercept SD	7.02				
Slope (time) SD	0.18				
Slope (stressor type) SD	2.00				
Residual	6.71				
Autocorrelation	0.74				
Stressor type-appraisal interaction					
Fixed effects					
Intercept	**24.96**	**6.23**	**12.74–37.18**	**4.01**	**<0.001**
Time	**−0.07**	**0.03**	**−0.13 to −0.01**	**−2.32**	**0.020**
Stressor type—between	16.26	9.22	−2.01 to 34.54	1.76	0.081
Stressor type—within	0.43	0.59	−0.73 to 1.58	0.72	0.469
Appraisal—between	3.04	2.41	−1.73 to 7.82	1.26	0.209
Appraisal—within	0.33	0.34	−0.34 to 1.00	0.96	0.337
Stressor type × appraisal—between	**−10.05**	**3.74**	**−17.46 to −2.63**	**−2.69**	**0.008**
Stressor type × appraisal—within	0.29	0.77	−1.22 to 1.79	0.38	0.706
Random effects					
Intercept SD	6.67				
Slope (time) SD	0.14				
Slope (stressor type) SD	1.56				
Slope (appraisal) SD	1.06				
Residual	6.75				
Autocorrelation	0.75				

Note: Within: within-person-mean centered variables. Between: between person-level means of the variables. The significant variables are highlighted in bold.

Abbreviations: CI, confidence interval; Coef., coefficient; SE, standard error.

person associations suggests that momentary stress experiences may be more relevant for explaining fluctuations in food cravings than general levels of daily stress experiences. When an individual experiences a stressor, and if the most stressful event is rated as unpleasant, this is associated with stronger food cravings than they typically experience. This association is only marginally translated to the between-person level; people who tend to experience stressors more often over the study period, or to report more unpleasant levels, had slightly higher levels of food cravings, but this became non-significant after accounting for age, BMI and gender in sensitivity checks. It could be that the experience of a stressor triggers an immediate increase in distress and consequently an immediate willingness to eat in order to diminish such distress (Fowler et al., 2022; Klatzkin et al., 2022), and so the cravings are quickly resolved. Further research could explore whether negative emotions mediate the within-person relationship between a stressor experience and food craving. Taken together, these findings support a dynamic individual-difference model approach which emphasises situational time-varying factors in addition to stable traits to explain stress-induced eating (Ruf et al., 2022).

Whether the most stressful event was perceived as interpersonal or non-interpersonal was not related to changes in participants' own level of food craving in the short-term. This is consistent with previous research showing that both momentary interpersonal and non-interpersonal stress (work-related stress) were associated with snacking (O'Connor et al., 2008). However, there was a significant association at the between-person level, suggesting that over time, individuals with a greater tendency to report the most stressful event to be interpersonal versus non-interpersonal were more likely to experience food cravings. The type of the stressor also moderated the association between overall stressor appraisal and food craving. When individuals tend to perceive the most stressful event as interpersonal, overall worst stressor appraisal was related to higher average levels of food craving, whereas it was related to lower food craving when individuals tended to perceive it as non-interpersonal.

Interpersonal stressors may have a greater impact on individuals, eliciting higher distress, greater challenges for coping, and stronger emotional impact on self-regulation and self-worth (Epel et al., 2018; Goldschmidt et al., 2014; O'Neill et al., 2004; Sheets & Craighead, 2014). The significant association of perceived stressor type at the between-person level, but not at the within-person level, suggests that specific traits or coping mechanisms associated with perceiving interpersonal events as stressful could be involved. For instance, traits such as sensitivity to social rejection or feedback, fear of negative evaluation, social distrust, social anhedonia, or neuroticism have been associated with a greater perception of interpersonal events as stressors and disordered eating (Albano et al., 2019; Arcelus et al., 2013; Cardi et al., 2013; Harrison et al., 2014; O'Neill et al., 2004). Persistent interpersonal stressors can also diminish self-esteem and contribute to the distress individuals experience (Fairburn et al., 2003). These individuals may want to eat as a way of coping with the distress caused by interpersonal stressors, leading to stronger food cravings. Furthermore, various aspects of the interpersonal stressor such as the specific type of interpersonal stress might be related to stress responses like disordered eating (Cain et al., 2010). Exploring whether personality traits or the type of the relationship (e.g., relative, friend, stranger) interact in the complex relationship between interpersonal stress and food craving warrants future investigation.

There may be psychobiological factors that can help to explain these findings. Stress is known to trigger changes in the hypothalamic-pituitary-adrenal (HPA) axis and reward system, affecting hormones, behaviour, and cognition, including impaired self-regulation and appetite regulation (Adam & Epel, 2007; Tomiyama, 2019). This psychobiological dysregulation could drive stronger food cravings. Interpersonal threats may be particularly relevant due to the evolutionary advantages of social belonging and group collaboration like obtaining food (Baumeister & Leary, 1995; Dickerson et al., 2009; Pietromonaco & Collins, 2017). For example, interpersonal stressors, but not non-interpersonal stressors, enhance the levels of ghrelin (an appetite-increasing hormone) and decrease leptin (an appetite-suppressing hormone) (Jaremka et al., 2014).

As stressful events and food craving were retrospectively assessed within the same time window, it was not possible to establish the direction of the relationship between experiencing a stressor and food craving. Higher levels of food craving could lead to increased feelings of distress (Fletcher et al., 2007; Meule & Kübler, 2012). Similarly, hunger has been linked to heightened tension and anger (Ackermans et al., 2022; MacCormack & Lindquist, 2019). Although hunger is not synonymous with food craving, they are related to each other (Reichenberger et al., 2018). Higher levels of food cravings could increase the vulnerability to stressors and in particular the sensitivity to social cues, perceiving interpersonal events as the most stressful interpersonal stressors. It is also possible that people eat the food they craved during stressful events leading to heightened distress if they give in to their cravings or experience greater distress when attempting to resist, potentially leading to a cycle of restrained and disordered eating, food craving, and further distress. Research is needed to investigate the reciprocal interplay among these factors. We also observed a time trend in all models, showing reduced food craving over the 10-day study period, possibly influenced by frequent assessments and increased self-awareness (Bolger & Laurenceau, 2013; Iida et al., 2012).

A number of limitations need to be considered. First, to avoid participant burden and recall biases, we did not assess other types of stress such as chronic and acute stress or frequency of multiple stressful events, and thus we could not determine stress pileup, which might influence food craving. Future studies could use a contingent-event approach to examine this more closely. Second, other traits not examined in this study, such as stress sensitivity or neuroticism, may be related to food craving following stress. Third, although we used the EMA approach which helps to reduce recall bias, measures were self-report. Since participants completed three measurements each day about 6 hours apart, there is still a possibility of some recall bias in their recall of momentary food craving levels (although much lower than traditional retrospective assessments), furthermore, the causality of the association could not be determined as we did not determine the temporality of these events and experiences. Future studies could have a more intensive assessment protocol including questions referring to the current moment, which may better capture transient experiences of food craving. Fourth, most of our sample were women, which limits the generalisation of the findings. Fifth, because there are no validated scales for momentary food craving and stressful events, we adapted validated scales as commonly applied in EMA studies (O'Connor et al., 2008; Reichenberger et al., 2021; Trull & Ebner-Priemer, 2020), to assess daily-life stressful events and food craving. Sixth, it is still difficult to determine whether the social aspect or the appraisal of the stressor is a more significant factor in food craving and further research disentangling these two factors is required. Given the potential low statistical power for such analyses in our current study, future studies with larger sample sizes and observations per each appraisal levels could specifically investigate how different unpleasantness levels and social aspects of stressors

relate to food craving. Finally, we assessed food craving but did not determine whether participants actually ate the craved food, or which specific foods they craved. Future studies could also examine actual food intake to examine whether or not individuals resist their food craving and the kind of food they crave when experiencing a stressful event.

Despite these limitations, our study adds to the existing literature on stress and eating behaviours, highlighting the importance of momentary stressful events and the need to differentiate between within-person and between-person levels; at the within-person level we found that individuals experienced more momentary food cravings at times when they reported experiencing stressful events, however at the between-person level individuals reporting stressful experiences more frequently on average had marginally higher levels of food craving in general. Furthermore, the study indicates the importance of understanding the impact of different perceived types of stressors. Disentangling between within-person and between-person variability highlights the complex relationship of stress-food craving. The most stressful event type did not seem to affect momentary food craving. While there was no difference between perceiving the most stressful event as interpersonal or non-interpersonal at the within-person level, in contrast at the between-person level, those who more frequently perceived interpersonal stressors as the most stressful event were more likely to report stronger food cravings over time, especially when these events were appraised as more unpleasant. Research could investigate the relationship between interpersonal stressors, and different types of social interactions involved in the stressful event, and food craving as a potential mechanism for overeating in daily life. Interventions in disordered eating and obesity may benefit from identifying potential stressful events that increase food craving and providing coping and stress management strategies and interpersonal approaches to deal with such events and cravings.

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CONFLICT OF INTEREST STATEMENT

No conflict of interest are declared by any of the authors.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

The design and procedure of the study were approved by the Faculty of Health and Social Welfare ethics committee at the University of Haifa (220/21). Informed consent was obtained from all participants.

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REFERENCES

Abdella, H. M., El Farssi, H. O., Broom, D. R., Hadden, D. A., & Dalton, C. F. (2019). Eating behaviours and food cravings; influence of age, sex, BMI and FTO genotype. *Nutrients*, *11*(2), 377. https://doi.org/10.3390/nu11020377

Ackermans, M. A., Jonker, N. C., Bennik, E. C., & de Jong, P. J. (2022). Hunger increases negative and decreases positive emotions in women with a healthy weight. *Appetite*, *168*, 105746. https://doi.org/10.1016/j.appet.2021.105746

Adam, T. C., & Epel, E. S. (2007). Stress, eating and the reward system. *Physiology and Behavior*, *91*(4), 449–458. https://doi.org/10.1016/j.physbeh.2007.04.011

Ader, L., Schick, A., Simons, C., Delespaul, P., Myin-Germeys, I., Vaessen, T., & Reininghaus, U. (2022). Positive affective recovery in daily life as a momentary mechanism across subclinical and clinical stages of mental disorder: Experience sampling study. *JMIR mental health*, *9*(11), e37394. https://doi.org/10.2196/37394

Albano, G., Rowlands, K., Baciadonna, L., Coco, G. lo, & Cardi, V. (2019). Interpersonal difficulties in obesity: A systematic review and meta-analysis to inform a rejection sensitivity-based model. *Neuroscience & Biobehavioral Reviews*, *107*, 846–861. https://doi.org/10.1016/j.neubiorev.2019.09.039

Ansell, E. B., Grilo, C. M., & White, M. A. (2012). Examining the interpersonal model of binge eating and loss of control over eating in women. *International Journal of Eating Disorders*, *45*(1), 43–50. https://doi.org/10.1002/eat.20897

Arcelus, J., Haslam, M., Farrow, C., & Meyer, C. (2013). The role of interpersonal functioning in the maintenance of eating psychopathology: A systematic review and testable model. *Clinical Psychology Review*, *33*(1), 156–167. https://doi.org/10.1016/j.cpr.2012.10.009

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*(3), 497–529. https://doi.org/10.1037/0033-2909.117.3.497

Bolger, N., Davis, A., & Rafaeli, E. (2003). Diary methods: Capturing life as it is lived. *Annual Review of Psychology*, *54*(1), 579–616. https://doi.org/10.1146/annurev.psych.54.101601.145030

Bolger, N., & Laurenceau, J.-P. (2013). *Intensive longitudinal methods: An introduction to diary and experience sampling research*. The Guilford Press.

Brantley, P. J., Waggoner, C. D., Jones, G. N., & Rappaport, N. B. (1987). A daily stress inventory: Development, reliability, and validity. *Journal of Behavioral Medicine*, *10*(1), 61–73. https://doi.org/10.1007/BF00845128

Bruch, H. (1961). Transformation of oral impulses in eating disorders: A conceptual approach. *Psychiatric Quarterly*, *35*(3), 458–481. https://doi.org/10.1007/BF01573614

Cain, A. S., Bardone-Cone, A. M., Abramson, L. Y., Vohs, K. D., & Joiner, T. E. (2010). Prospectively predicting dietary restraint: The role of interpersonal self-efficacy, weight/shape self-efficacy, and interpersonal stress. *International Journal of Eating Disorders*, *43*(6), 505–512. https://doi.org/10.1002/eat.20740

Cardi, V., Matteo, R. D., Corfield, F., & Treasure, J. (2013). Social reward and rejection sensitivity in eating disorders: An investigation of attentional bias and early experiences. *World Journal of Biological Psychiatry*, *14*(8), 622–633. https://doi.org/10.3109/15622975.2012.665479

Cepeda-Benito, A., Gleaves, D. H., Williams, T. L., & Erath, S. A. (2000). The development and validation of the state and trait food-cravings questionnaires. *Behavior Therapy*, *31*(1), 151–173. https://doi.org/10.1016/S0005-7894(00)80009-X

Chao, A., Grilo, C. M., White, M. A., & Sinha, R. (2015). Food cravings mediate the relationship between chronic stress and body mass index. *Journal of Health Psychology*, *20*(6), 721–729. https://doi.org/10.1177/1359105315573448

Cohen, S., Gianaros, P. J., & Manuck, S. B. (2016). A stage model of stress and disease. *Perspectives on Psychological Science*, *11*(4), 456–463. https://doi.org/10.1177/1745691616646305

Cohen, S., Murphy, M. L., & Prather, A. A. (2019). Ten surprising facts about stressful life events and disease risk. *Annual Review of Psychology*, *70*(1), 577–597. https://doi.org/10.1146/annurev-psych-010418-102857

Crosswell, A. D., & Lockwood, K. G. (2020). Best practices for stress measurement: How to measure psychological stress in health research. *Health Psychology Open*, *7*(2), 2055102920933072. https://doi.org/10.1177/2055102920933072

Debeuf, T., Verbeken, S., Van Beveren, M. L., Michels, N., & Braet, C. (2018). Stress and eating behavior: A daily diary study in youngsters. *Frontiers in Psychology*, *9*, 2657. https://doi.org/10.3389/fpsyg.2018.02657

Dicker-Oren, S. D., Gelkopf, M., & Greene, T. (2022). The dynamic network associations of food craving, restrained eating, hunger and negative emotions. *Appetite*, *175*, 106019. https://doi.org/10.1016/j.appet.2022.106019

Dickerson, S. S., Gruenewald, T. L., & Kemeny, M. E. (2009). Psychobiological responses to social self threat: Functional or detrimental? *Self and Identity*, *8*(2–3), 270–285. https://doi.org/10.1080/15298860802505186

Engel, S. G., Crosby, R. D., Thomas, G., Bond, D., Lavender, J. M., Mason, T., Steffen, K. J., Green, D. D., & Wonderlich, S. A. (2016). Ecological momentary assessment in eating disorder and obesity research: A review of the recent literature. *Current Psychiatry Reports*, *18*(4), 37. https://doi.org/10.1007/s11920-016-0672-7

Epel, E. S., Crosswell, A. D., Mayer, S. E., Prather, A. A., Slavich, G. M., Puterman, E., & Mendes, W. B. (2018). More than a feeling: A unified view of stress measurement for population science. *Frontiers in Neuroendocrinology*, *49*, 146–169. https://doi.org/10.1016/j.yfrne.2018.03.001

Fairburn, C. G., Cooper, Z., & Shafran, R. (2003). Cognitive behaviour therapy for eating disorders: A "transdiagnostic" theory and treatment. *Behaviour Research and Therapy*, *41*(5), 509–528. https://doi.org/10.1016/S0005-7967(02)00088-8

Fletcher, B. C., Pine, K. J., Woodbridge, Z., & Nash, A. (2007). How visual images of chocolate affect the craving and guilt of female dieters. *Appetite*, *48*(2), 211–217. https://doi.org/10.1016/j.appet.2006.09.002

Fowler, N., Mikhail, M. E., Neale, M., Keel, P. K., Katzman, D. K., Sisk, C. L., Burt, S. A., & Klump, K. L. (2022). Between- and within-person effects of stress on emotional eating in women: A longitudinal study over 49 days. *Psychological Medicine*, *53*(11), 1–10. https://doi.org/10.1017/S0033291722002185

Genet, J. J., & Siemer, M. (2012). Rumination moderates the effects of daily events on negative mood: Results from a diary study. *Emotion*, *12*(6), 1329–1339. https://doi.org/10.1037/a0028070

Gibson, E. L. (2012). The psychobiology of comfort eating: Implications for neuropharmacological interventions. *Behavioural Pharmacology*, *23*(5–6), 442–460. https://doi.org/10.1097/FBP.0b013e328357bd4e

Goldschmidt, A. B., Wonderlich, S. A., Crosby, R. D., Engel, S. G., Lavender, J. M., Peterson, C. B., Crow, S. J., Cao, L., & Mitchell, J. E. (2014). Ecological momentary assessment of stressful events and negative affect in bulimia nervosa. *Journal of Consulting and Clinical Psychology*, *82*(1), 30–39. https://doi.org/10.1037/a0034974

Greeno, C. G., & Wing, R. R. (1994). Stress-induced eating. *Psychological Bulletin*, *115*(3), 444–464. https://doi.org/10.1037//0033-2909.115.3.444

Groesz, L. M., McCoy, S., Carl, J., Saslow, L., Stewart, J., Adler, N., Laraia, B., & Epel, E. (2012). What is eating you? Stress and the drive to eat. *Appetite*, *58*(2), 717–721. https://doi.org/10.1016/j.appet.2011.11.028

Harrison, A., Mountford, V. A., & Tchanturia, K. (2014). Social anhedonia and work and social functioning in the acute and recovered phases of eating disorders. *Psychiatry Research*, *218*(1–2), 187–194. https://doi.org/10.1016/j.psychres.2014.04.007

Heatherton, T. F., & Baumeister, R. F. (1991). Binge eating as escape from self-awareness. *Psychological Bulletin*, *110*(1), 86–108. https://doi.org/10.1037/0033-2909.110.1.86

Heron, K. E., Scott, S. B., Mogle, J. A., Howard, L. M., & Everhart, R. S. (2022). Ambulatory assessment of everyday stressors: A two-study experiment evaluating the effect of question format on self-reported daily and momentary stressors. *Journal of Technology in Behavioral Science*, *7*(3), 368–380. https://doi.org/10.1007/s41347-022-00259-1

Hill, A. J. (2007). The psychology of food craving: Symposium on molecular mechanisms and psychology of food intake. *Proceedings of the Nutrition Society*, *66*(2), 277–285. https://doi.org/10.1017/S0029665107005502

Iida, M., Shrout, P. E., Laurenceau, J.-P., & Bolger, N. (2012). Using diary methods in psychological research. In H. Cooper (Ed.), *APA handbook of research methods in psychology: Vol. 1. Foundations, planning, measures, and psychometrics* (pp. 277–305). American Psychological Association. Retrieved from https://doi.org/10.1037/13619-016

Jacobs, N., Van Os, J., Derom, C., Thiery, E., Delespaul, P., & Wichers, M. (2011). Neuroticism explained? From a non-informative vulnerability marker to informative person–context interactions in the realm of daily life. *British Journal of Clinical Psychology*, *50*(1), 19–32. https://doi.org/10.1348/014466510X491397

Jaremka, L. M., Belury, M. A., Andridge, R. R., Malarkey, W. B., Glaser, R., Christian, L., Emery, C. F., & Kiecolt-Glaser, J. K. (2014). Interpersonal stressors predict ghrelin and leptin levels in women. *Psychoneuroendocrinology*, *48*, 178–188. https://doi.org/10.1016/j.psyneuen.2014.06.018

Jaremka, L. M., Fagundes, C. P., Peng, J., Belury, M. A., Andridge, R. R., Malarkey, W. B., & Kiecolt-Glaser, J. K. (2015). Loneliness predicts postprandial ghrelin and hunger in women. *Hormones and Behavior*, *70*, 57–63. https://doi.org/10.1016/j.yhbeh.2015.01.011

Kaplan, H. I., & Kaplan, H. S. (1957). The psychosomatic concept of obesity. *The Journal of Nervous and Mental Disease*, *125*(2), 181–201. https://doi.org/10.1097/00005053-195704000-00004

Klatzkin, R. R., Nolan, L. J., & Kissileff, H. R. (2022). Self-reported emotional eaters consume more food under stress if they experience heightened stress reactivity and emotional relief from stress upon eating. *Physiology and Behavior*, *243*, 113638. https://doi.org/10.1016/j.physbeh.2021.113638

Kupriyanov, R., & Zhdanov, R. (2014). The eustress concept: Problems and outlooks. *World Journal of Medical Sciences*, *11*(2), 179–185. https://doi.org/10.5829/idosi.wjms.2014.11.2.8433

Lataster, T., Valmaggia, L., Lardinois, M., Van Os, J., & Myin-Germeys, I. (2013). Increased stress reactivity: A mechanism specifically associated with the positive symptoms of psychotic disorder. *Psychological Medicine*, *43*(7), 1389–1400. https://doi.org/10.1017/S0033291712002279

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer.

Lemmens, S. G., Rutters, F., Born, J. M., & Westerterp-Plantenga, M. S. (2011). Stress augments food 'wanting' and energy intake in visceral overweight subjects in the absence of hunger. *Physiology & Behavior*, *103*(2), 157–163. https://doi.org/10.1016/j.physbeh.2011.01.009

Leow, S., Beer, N. J., Guelfi, K. J., Rebar, A. L., Alderson, J. A., Jackson, B., & Dimmock, J. A. (2021). Perceived daily tension and food cravings and

consumption: A within- and between-person investigation. *Eating Behaviors*, *40*, 101473. https://doi.org/10.1016/j.eatbeh.2020.101473

Lombardo, C., Iani, L., & Barbaranelli, C. (2016). Validation of an Italian version of the food craving questionnaire-state: Factor structure and sensitivity to manipulation. *Eating Behaviors*, *22*, 182–187. https://doi.org/10.1016/j.eatbeh.2016.06.003

MacCormack, J. K., & Lindquist, K. A. (2019). Feeling hangry? When hunger is conceptualized as emotion. *Emotion*, *19*(2), 301–319. https://doi.org/10.1037/emo0000422

MacIntyre, R. I., Heron, K. E., Crosby, R. D., Engel, S. G., Wonderlich, S. A., & Mason, T. B. (2021). Measurement of the influences of social processes in appetite using ecological momentary assessment. *Appetite*, *161*, 105126. https://doi.org/10.1016/j.appet.2021.105126

Mason, A. E., Saslow, L., Moran, P. J., Kim, S., Wali, P. K., Abousleiman, H., Richler, R., Schleicher, S., Hartogensis, W., Epel, E. S., & Hecht, F. (2019). Examining the effects of mindful eating training on adherence to a carbohydrate-restricted diet in patients with type 2 diabetes (the DELISH study): Protocol for a randomized controlled trial. *JMIR Research Protocols*, *8*(2), e11002. https://doi.org/10.2196/11002

McIntyre, K. M., Mogle, J. A., Scodes, J. M., Pavlicova, M., Shapiro, P. A., Gorenstein, E. E., Tager, F. A., Monk, C., Almeida, D. M., & Sloan, R. P. (2019). Anger-reduction treatment reduces negative affect reactivity to daily stressors. *Journal of Consulting and Clinical Psychology*, *87*(2), 141–150. https://doi.org/10.1037/ccp0000359

Meule, A., & Kübler, A. (2012). Food cravings in food addiction: The distinct role of positive reinforcement. *Eating Behaviors*, *13*(3), 252–255. . https://doi.org/10.1016/j.eatbeh.2012.02.001

Monteleone, A. M., Treasure, J., Kan, C., & Cardi, V. (2018). Reactivity to interpersonal stress in patients with eating disorders: A systematic review and meta-analysis of studies using an experimental paradigm. *Neuroscience & Biobehavioral Reviews*, *87*, 133–150. https://doi.org/10.1016/j.neubiorev.2018.02.002

Moreno, S., Rodríguez, S., Fernandez, M. C., Tamez, J., & Cepeda-Benito, A. (2008). Clinical validation of the trait and state versions of the food craving questionnaire. *Assessment*, *15*(3), 375–387. https://doi.org/10.1177/1073191107312651

Moss, R. H., Conner, M., & O'Connor, D. B. (2021). Exploring the effects of daily hassles and uplifts on eating behaviour in young adults: The role of daily cortisol levels. *Psychoneuroendocrinology*, *129*, 105231. https://doi.org/10.1016/j.psyneuen.2021.105231

Myin-Germeys, I., van Os, J., Schwartz, J. E., Stone, A. A., & Delespaul, P. A. (2001). Emotional reactivity to daily life stress in psychosis. *Archives of General Psychiatry*, *58*(12), 1137–1144. https://doi.org/10.1001/archpsyc.58.12.1137

O'Connor, D. B., Jones, F., Conner, M., Mcmillan, B., & Ferguson, E. (2008). Effects of daily hassles and eating style on eating behavior. *Health Psychology*, *27*(1), S20–S31. https://doi.org/10.1037/0278-6133.27.1(Suppl.).S20

O'Connor, D. B., Thayer, J. F., & Vedhara, K. (2021). Stress and health: A review of psychobiological processes. *Annual Review of Psychology*, *72*(1), 663–688. https://doi.org/10.1146/annurev-psych-062520-122331

O'Neill, S. C., Cohen, L. H., Tolpin, L. H., & Gunthert, K. C. (2004). Affective reactivity to daily interpersonal stressors as a prospective predictor of depressive symptoms. *Journal of Social and Clinical Psychology*, *23*(2), 172–194. https://doi.org/10.1521/jscp.23.2.172.31015

Owens, S. A., Helms, S. W., Rudolph, K. D., Hastings, P. D., Nock, M. K., & Prinstein, M. J. (2019). Interpersonal stress severity longitudinally predicts adolescent girls' depressive symptoms: The moderating role of subjective and HPA axis stress responses. *Journal of Abnormal Child Psychology*, *47*(5), 895–905. https://doi.org/10.1007/s10802-018-0483-x

Pannicke, B., Kaiser, T., Reichenberger, J., & Blechert, J. (2021). Networks of stress, affect and eating behaviour: Anticipated stress coping predicts goal-congruent eating in young adults. *International Journal of Behavioral Nutrition and Physical Activity*, *18*(1), 9. https://doi.org/10.1186/s12966-020-01066-8

Pietromonaco, P. R., & Collins, N. L. (2017). Interpersonal mechanisms linking close relationships to health. *American Psychologist*, *72*(6), 531–542. . https://doi.org/10.1037/amp0000129

Ranzenhofer, L. M., Engel, S. G., Crosby, R. D., Anderson, M., Vannucci, A., Cohen, L. A., Cassidy, O., & Tanofsky-Kraff, M. (2014). Using ecological momentary assessment to examine interpersonal and affective predictors of loss of control eating in adolescent girls. *International Journal of Eating Disorders*, *47*(7), 748–757. https://doi.org/10.1002/eat.22333

Raspopow, K., Matheson, K., Abizaid, A., & Anisman, H. (2013). Unsupportive social interactions influence emotional eating behaviors. The role of coping styles as mediators. *Appetite*, *62*, 143–149. https://doi.org/10.1016/j.appet.2012.11.031

Rauschenberg, C., van Os, J., Goedhart, M., Schieveld, J. N., & Reininghaus, U. (2021). Bullying victimization and stress sensitivity in help-seeking youth: Findings from an experience sampling study. *European Child & Adolescent Psychiatry*, *30*(4), 591–605. https://doi.org/10.1007/s00787-020-01540-5

Reichenberger, J., Pannicke, B., Arend, A. K., Petrowski, K., & Blechert, J. (2021). Does stress eat away at you or make you eat? EMA measures of stress predict day to day food craving and perceived food intake as a function of trait stress-eating. *Psychology and Health*, *36*(2), 129–147. https://doi.org/10.1080/08870446.2020.1781122

Reichenberger, J., Richard, A., Smyth, J. M., Fischer, D., Pollatos, O., & Blechert, J. (2018). It's craving time: Time of day effects on momentary hunger and food craving in daily life. *Nutrition*, *55–56*, 15–20. https://doi.org/10.1016/j.nut.2018.03.048

Reichenberger, J., Smyth, J. M., Kuppens, P., & Blechert, J. (2019). I will fast … tomorrow": Intentions to restrict eating and actual restriction in daily life and their person-level predictors. *Appetite*, *140*, 10–18. https://doi.org/10.1016/j.appet.2019.04.019

Rintala, A., Wampers, M., Lafit, G., Myin-Germeys, I., & Viechtbauer, W. (2023). Perceived disturbance and predictors thereof in studies using the experience sampling method. *Current Psychology*, *42*(8), 6287–6301. https://doi.org/10.1007/s12144-021-01974-3

Ruf, A., Neubauer, A. B., Koch, E. D., Ebner-Priemer, U., Reif, A., & Matura, S. (2022). Individual differences in the dietary response to stress in ecological momentary assessment: Does the individual-difference model need expansion? *Applied Psychology: Health and Well-Being*, *15*(2), 1–21. https://doi.org/10.1111/aphw.12400

Schepers, R., & Markus, C. R. (2015). Gene×cognition interaction on stress-induced eating: Effect of rumination. *Psychoneuroendocrinology*, *54*, 41–53. https://doi.org/10.1016/j.psyneuen.2015.01.013

Schilling, O. K., Gerstorf, D., Lücke, A. J., Katzorreck, M., Wahl, H.-W., Diehl, M., & Kunzmann, U. (2022). Emotional reactivity to daily stressors: Does stressor pile-up within a day matter for young-old and very old adults? *Psychology and Aging*, *37*(2), 149–162. https://doi.org/10.1037/pag0000667

Schneiders, J., Nicolson, N. A., Berkhof, J., Feron, F. J., van Os, J., & de Vries, M. W. (2006). Mood reactivity to daily negative events in early adolescence: Relationship to risk for psychopathology. *Developmental Psychology*, *42*(3), 543–554. https://doi.org/10.1037/0012-1649.42.3.543

Scott, S. B., Ram, N., Smyth, J. M., Almeida, D. M., & Sliwinski, M. J. (2017). Age differences in negative emotional responses to daily stressors depend on time since event. *Developmental Psychology*, *53*(1), 177–190. https://doi.org/10.1037/dev0000257

Scott, S. B., Sliwinski, M. J., & Blanchard-Fields, F. (2013). Age differences in emotional responses to daily stress: The role of timing, severity,

and global perceived stress. *Psychology and Aging*, *28*(4), 1076–1087. https://doi.org/10.1037/a0034000

Sheets, E. S., & Craighead, W. E. (2014). Comparing chronic interpersonal and noninterpersonal stress domains as predictors of depression recurrence in emerging adults. *Behaviour Research and Therapy*, *63*, 36–42. https://doi.org/10.1016/j.brat.2014.09.001

Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological momentary assessment. *Annual Review of Clinical Psychology*, *4*, 1–32. https://doi.org/10.1146/annurev.clinpsy.3.022806.091415

Smyth, J. M., Wonderlich, S. A., Heron, K. E., Sliwinski, M. J., Crosby, R. D., Mitchell, J. E., & Engel, S. G. (2007). Daily and momentary mood and stress are associated with binge eating and vomiting in bulimia nervosa patients in the natural environment. *Journal of Consulting and Clinical Psychology*, *75*(4), 629–638. https://doi.org/10.1037/0022-006X.75.4.629

Smyth, J. M., Wonderlich, S. A., Sliwinski, M. J., Crosby, R. D., Engel, S. G., Mitchell, J. E., & Calogero, R. M. (2009). Ecological momentary assessment of affect, stress, and binge-purge behaviors: Day of week and time of day effects in the natural environment. *International Journal of Eating Disorders*, *42*(5), 429–436. https://doi.org/10.1002/eat.20623

Srivastava, P., Lampe, E. W., Michael, M. L., Manasse, S., & Juarascio, A. S. (2021). Stress appraisal prospectively predicts binge eating through increases in negative affect. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, *26*(7), 2413–2420. https://doi.org/10.1007/s40519-020-01082-4

Tomiyama, A. J. (2019). Stress and obesity. *Annual Review of Psychology*, *70*(1), 703–718. https://doi.org/10.1146/annurev-psych-010418-102936

Trull, T. J., & Ebner-Priemer, U. W. (2020). Ambulatory assessment in psychopathology research: A review of recommended reporting guidelines and current practices. *Journal of Abnormal Psychology*, *129*(1), 56–63. https://doi.org/10.1037/abn0000473

Tryon, M. S., DeCant, R., & Laugero, K. D. (2013). Having your cake and eating it too: A habit of comfort food may link chronic social stress exposure and acute stress-induced cortisol hyporesponsiveness. *Physiology & Behavior*, *114–115*, 32–37. https://doi.org/10.1016/j.physbeh.2013.02.018

Uink, B., Modecki, K. L., Barber, B. L., & Correia, H. M. (2018). Socioeconomically disadvantaged adolescents with elevated externalizing symptoms show heightened emotion reactivity to daily stress: An experience sampling study. *Child Psychiatry and Human Development*, *49*(5), 741–756. . https://doi.org/10.1007/s10578-018-0784-x

van der Stouwe, E. C., Groenewold, N. A., Bos, E. H., de Jonge, P., Wichers, M., & Booij, S. H. (2019). How to assess negative affective reactivity to daily life stress in depressed and nondepressed individuals? *Psychiatry Research*, *279*, 259–266. . https://doi.org/10.1016/j.psychres.2019.03.040

Weingarten, H. P., & Elston, D. (1990). The phenomenology of food cravings. *Appetite*, *15*(3), 231–246. https://doi.org/10.1016/0195-6663(90)90023-2

Wolff, G. E., Crosby, R. D., Roberts, J. A., & Wittrock, D. A. (2000). Differences in daily stress, mood, coping, and eating behavior in binge eating and nonbinge eating college women. *Addictive Behaviors*, *25*(2), 205–216. https://doi.org/10.1016/S0306-4603(99)00049-0

Wouters, S., Jacobs, N., Duif, M., Lechner, L., & Thewissen, V. (2018). Negative affective stress reactivity: The dampening effect of snacking. *Stress and Health*, *34*(2), 286–295. https://doi.org/10.1002/smi.2788

Zenk, S. N., Horoi, I., McDonald, A., Corte, C., Riley, B., & Odoms-Young, A. M. (2014). Ecological momentary assessment of environmental and personal factors and snack food intake in African American women. *Appetite*, *83*, 333–341. https://doi.org/10.1016/j.appet.2014.09.008

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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