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Healthy versus unhealthy comfort eating for psychophysiological stress recovery in low-income Black and Latinx adults

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ABSTRACT

Low-income Black and Latinx individuals are disproportionately vulnerable to chronic stress and metabolic disease. Evidence suggests that these populations engage in elevated levels of comfort eating (i.e., eating comforting food to alleviate stress), which can harm diet quality. For this reason, many interventions discourage comfort eating. However, if comfort eating does indeed buffer stress, it may be a protective health behavior, particularly if healthy foods (e.g., strawberries) buffer stress as effectively as traditional unhealthy comfort foods (e.g., brownies). By choosing healthy foods, people may be able to simultaneously improve their nutrition and reduce their stress levels, both of which have the potential to reduce health disparities among chronically stressed populations. The present study tested the efficacy of healthy and unhealthy comfort eating for improving psychophysiological stress recovery. A sample of low-income Black and Latinx individuals ($N = 129$) were randomly assigned to consume a healthy food (e.g., grapes), unhealthy comfort food (e.g., chips), or no food after exposure to a laboratory stressor. Throughout, we measured participants' psychophysiological stress responses, including self-reported stress, rumination, autonomic nervous system activation (i.e., electrodermal activity (EDA), heart rate variability (HRV)) and neuroendocrine responses (i.e., salivary cortisol). We compared participants' stress recovery trajectories by condition and found no significant group differences ($p = 0.12$ for self-reported stress; $p = 0.92$ for EDA; $p = 0.22$ for HRV, $p = 1.00$ for cortisol). Participants in all conditions showed decreases in self-reported stress and in cortisol post-stressor ($ps < 0.01$), but rates of decline did not differ by condition (i.e., healthy or unhealthy comfort food, brief no-food waiting period). Although null, these results are important because they challenge the widely-held assumption that comfort foods help people decrease stress.

1. Introduction

Reducing widespread racial and socioeconomic health disparities is a public health priority, and interventions that test actionable strategies for reducing these disparities are desperately needed (Adler et al., 2007; Brownson et al., 2021; Koh et al., 2010). Two domains of health disparities that lend themselves particularly well to behavioral interventions are chronic stress and poor diet, as each of these conditions can be managed, at least partially, by engaging in healthy behaviors (e.g., meditation, eating fruits and vegetables). Although many such behavioral interventions exist, they have largely been tested in White, highly educated populations (Bull et al., 2015; Burton et al., 2017; Dhillon et al., 2022; Khoury et al., 2015; Regehr et al., 2013; Satia, 2009). This is a critical gap in the behavioral health literature, particularly because low-income Black and Latinx individuals are disproportionately vulnerable to chronic stress and to metabolic diseases related to poor diet (Adler et al., 2007; Brown et al., 2018; Hales et al., 2020; Peek et al., 2007; Thoits, 2010). To make progress toward health equity,

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it is important to test behavioral interventions that address chronic stress and diet in populations who are disproportionately affected.

Although there are various underlying causes for racial and socioeconomic disparities in chronic stress and poor diet, one behavioral mechanism that links the two conditions is comfort eating (i.e., eating comforting food to alleviate stress, particularly foods that are high in calories, fat, sugar, or salt; Adam & Epel, 2007; Dallman et al., 2003; Tomiyama et al., 2015). Evidence suggests that Black and Latinx individuals as well as those with low socioeconomic status (SES) engage in elevated levels of comfort eating (Jackson et al., 2010; Jenkins et al., 2005; Striegel-Moore et al., 1999). These findings are supported by recent work on the relationship between stress and emotional eating, which is a broader term than "comfort eating" that refers to eating in response to any negative affect, including stress. For instance, one study found that experiencing race-related stress predicted increased emotional eating in a sample of Black women, even when controlling for general perceived stress (Longmire-Avital & McQueen, 2019). Another study found that acculturative stress (i.e., feeling overwhelmed by adaptation to a new culture) predicted higher levels of emotional eating in a sample of Latinx adolescents (Simmons & Limbers, 2019). A third cross-sectional study found that perceived stress was positively associated with emotional eating in a sample of low-income women (Richardson et al., 2015). Similarly, a survey of English adults found that lower SES was associated with increased psychological distress, which in turn, predicted emotional eating (Spinosa et al., 2019).

Thus, in addition to shouldering the burden of more stress, Black and Latinx populations as well as people with low SES may engage in more comfort eating than other groups. Although there are no published studies that focus on comfort eating at intersection of these two positionalities (i.e., being Black or Latinx; having low SES), because they both add to one's chronic stress burden, we contend that people who are both low-income and Black or Latinx may be particularly likely to engage in comfort eating. This phenomenon may be explained, in part, by the Environmental Affordances (EA) model (Mezuk et al., 2013). The EA model posits that socially disadvantaged groups, such as racial and ethnic minorities, are disproportionately exposed to chronic stress. Moreover, the ways in which they cope with chronic stressors (e.g., discrimination) are often constrained by a lack of social and environmental affordances (e.g., resources, opportunities, systemic barriers). Comfort eating is a low-cost, highly accessible coping behavior, and therefore, it may be particularly attractive to people whose environmental affordances are limited due to discrimination or poverty. Although comfort eating may be useful for relieving perceived stress in the short-term, the EA model theorizes that these dietary choices may contribute to health disparities in the long-term.

Because engaging in comfort eating is associated with abdominal obesity (Epel et al., 2004; Jääskeläinen et al., 2014) many interventions have focused on strategies to reduce comfort eating (Corsica et al., 2014; Daubenmier et al., 2016; Katterman et al., 2014; O'Connor et al., 2015). However, the health benefits of such interventions (i.e., to modestly reduce sugar and fat intake) have never, to our knowledge, been considered against comfort eating's potential to reduce stress. If comfort eating reliably works to buffer psychophysiological stress, it may actually be a protective health behavior, particularly for people who face the highest levels of chronic stress.

Much of the evidence base for the stress-buffering benefits of comfort eating comes from rodent models, and it centers on the chronic stress-response network model proposed by Dallman et al. (2003). In short, the chronic stress-response network model states that chronic stress results in continual activation of the hypothalamic-pituitary-adrenal (HPA) axis, and that comfort eating can dampen physiological stress responses (e.g., inhibited adrenocorticotropic hormone, decreased corticosterone). The proposed mechanism for this dampening of stress reactivity is that comfort eating promotes abdominal adiposity, which in turn, results in chronically elevated glucocorticoid levels. These elevated levels of glucocorticoids help to inhibit HPA axis reactivity. This model has been widely tested in animals (see Tomiyama et al., 2015 for a review), but the evidence is still preliminary in humans. In particular, several studies have found that people who comfort eat experience reduced psychophysiological stress reactivity to chronic and acute stressors (Tomiyama et al., 2011; Tryon et al., 2013; Van Strien et al., 2013; van Strien et al., 2019); however, these studies did not experimentally manipulate comfort eating.

Indeed, relatively few studies have experimentally manipulated comfort eating, and none of them, to our knowledge, have explicitly employed a low-SES or racial/ethnic minority sample. The experimental studies that have manipulated comfort eating have focused on mood recovery after a negative mood induction (Macht & Mueller, 2007; Wagner et al., 2014). Results from these studies are mixed, with one set of studies finding evidence for chocolate-induced mood improvements (Macht & Mueller, 2007) and another set of studies finding that comfort eating was no better for mood improvement than a no-food control condition (Wagner et al., 2014). Neither of these reports provided racial/ethnic information for their participants (Macht & Mueller, 2007; Wagner et al., 2014). Thus, there is a clear need for further experimental work to clarify the relationship between comfort eating and stress recovery, particularly in low-income and Black and Latinx populations.

Another crucial gap in the literature is how comfort eating may affect stress recovery. Dallman's chronic stress-response network model (2003) focuses on stress reactivity; however, stress recovery is also an important aspect of the stress response (Linden et al., 1997), as poor stress recovery negatively impacts allostatic load (McEwen, 1998) and contributes to poor health outcomes. For instance, a meta-analysis of 33 studies of stress recovery found that poorer cardiovascular stress recovery to a psychological stressor significantly predicted cardiovascular disease risk and all-cause mortality ($r = 0.09$, $p < 0.05$; Panaite et al., 2015). If eating a comforting food after a stressful event can help a person recover more quickly, this behavior may be protective of health in the long term. Furthermore, although the theoretical foundation for much of the scientific work on comfort eating has focused on its efficacy for stress reactivity, many cultural narratives focus on potential stress recovery benefits of comfort eating (e.g., eating a pint of ice cream after experiencing a breakup with a romantic partner). Potential mechanisms for how comfort eating may aid stress recovery have not been formally articulated; however, we maintain that this empirical question has both scientific and practical relevance. In many cases, people are unable to foresee stressful events (e.g., unusual traffic patterns, a rude comment from a coworker), so using anticipatory comfort eating to minimize their stress reactivity would not be feasible. Instead, if comfort eating can aid in stress recovery, people may be able to use it as a tool to manage their stress levels after the fact.

A final under-studied area of comfort eating is whether a food needs to be unhealthy to be comforting. Traditional studies of comfort eating have focused on highly palatable, unhealthy foods (i.e., foods high in calories, fat, and/or refined sugar; Pool et al., 2015). One reason for this may be that much of the evidence for the chronic stress-response network model comes from rodent models. In these foundational studies, comfort eating is often manipulated by feeding rats a diet of either palatable chow (e.g., high-fat or high-sugar) or bland chow (Dallman et al., 2003; Foster et al., 2009; Pecoraro et al., 2004). However, humans eat a much wider variety of foods, have more food preferences and opinions, and encounter a broader range of stressors than rodents do. Although some research has suggested that sugar (Tryon et al., 2015) or sweet taste (Berridge, 2009) may provide stress relief by inhibiting cortisol secretion or activating endogenous cannabinoid receptors, fruits and vegetables can also be sweet; one serving of carrots, red peppers, clementines, or strawberries each contain 6–7 g of sugar. It is even possible that any food from which individuals derive hedonic pleasure, whether sweet or not, can provide them with comfort. This notion is supported by evidence from the nationally-representative U.S. Health and Retirement Study of older adults, wherein comfort eating (defined as "eating more than normal" to cope with a "stressful event or day") significantly predicted lower all-cause mortality six years later, even when controlling for consumption of high-fat and high-sugar sugar foods (Cummings et al., 2018). Consumption of high-fat/sugar foods also did not mediate the relationship between comfort eating and mortality, suggesting that high fat or sugar content may not be necessary for foods to provide comfort. Clearly, further work is needed to clarify the hedonically comforting potential of fruits and vegetables. If they can be effective, then recommending healthy comfort eating may be a scalable, inexpensive strategy for simultaneously reducing stress and improving diet to reduce health disparities.

The present study, therefore, tested the efficacy of healthy and unhealthy comfort foods for improving psychophysiological stress recovery in a sample of low-income Black and Latinx adults. After consulting with a registered dietitian, we decided to define "healthy" comfort foods as fruits and vegetables and "unhealthy" comfort foods as processed foods that are high in calories, fat, sugar, and/or salt. We hypothesized that both unhealthy and healthy comfort eating would reduce self-reported stress, autonomic nervous system activation, and neuroendocrine stress responses to a greater extent than eating no food. We also expected those in the two comfort eating conditions to report lower post-stressor rumination than those in the no-food control condition. Rumination and perseverative cognition are key components of the stress response and serve to prolong and exacerbate acute stress responses (Smyth et al., 2013). Here, we tested whether the act of eating a comforting food may have distracted participants from perseverative thinking about their performance during the laboratory stressor.

2. Methods

2.1. Eligibility criteria

To be eligible for this study, participants needed to be at least 18 years old, Black or Latinx, fluent in English, and low income (i.e., report an annual income below 200% of the federal poverty line). People who were unable to participate fully in study procedures and anyone who reported a condition incompatible with salivary cortisol sampling were excluded. Specifically, we excluded those who reported: history of an eating or substance use disorder, current metabolic or endocrine disease, current major illness or injury, current opiate use, strict dietary restrictions, chronic asthma, and anyone who was post-menopausal.

2.2. Participants

Participants were recruited from the Greater Los Angeles area via Facebook advertisements, Craigslist posts, flyers posted at community centers and local businesses, and from our university's subject pool. The study advertisement stated that the researchers were conducting "a study that aims to understand how experiences of stress are linked to health and well-being." These recruitment efforts led 922 people to take our brief screening survey, 227 of whom were deemed eligible. In total, 129 of the eligible individuals participated in this study. This sample size was determined via a power analysis for a minimum power of 0.90 and expected effect size of $d = 0.67$ (based on a meta-analysis of cortisol secretion in response to the lab stressor used; Dickerson & Kemeny, 2004). Demographic information for the sample is depicted in Table 1. All participants were low-income and Black or Latinx by self-report. Participants did not differ significantly by condition on any of the demographic information collected (i.e., age, sex, race/ethnicity, annual income, BMI, trait emotional eating).

2.3. Selection of comfort foods

Prior to their lab visits, participants provided information about their preferred healthy and unhealthy comfort foods by selecting three healthy and unhealthy foods from a list "that would make [them] feel better if [they] were in a bad mood." These selections were embedded among distractor items to maintain blinding to study hypotheses. The two lists of food options were thoroughly piloted (see *Supplemental Material*) and included ten foods each. All the healthy comfort food options were fruits and vegetables (e.g., strawberries, oranges), and all the unhealthy comfort food options were high in calories, fat, or sugar (e.g., brownies, pizza). In addition to selecting their preferred comfort foods, participants were asked to provide details about each food they selected (e.g., brand, flavor, accompanying condiments). These details were collected so that the study team could purchase items that would be maximally appealing to participants (e.g., Doritos, cucumbers with tajín, salted caramel ice cream), adding to the ecological validity of this study.

Table 1
Sample demographics by condition.

Demographic	Mean [SD] or Frequency (%)		
Condition	*Healthy Food Group (n = 40)*	*Unhealthy Food Group (n = 45)*	*No Food Group (n = 44)*
Age	24.73 [9.68]	24 [9.79]	23.89 [8.79]
Sex			
Female	29 (72.5%)	35 (77.78%)	31 (70.45%)
Male	11 (27.5%)	10 (22.22%)	13 (29.55%)
Race/ethnicity			
Hispanic or Latinx	28 (70%)	34 (75.56%)	32 (72.73%)
Black or African American	10 (25%)	7 (15.56%)	9 (20.45%)
Bi-racial	2 (5%)	3 (6.67%)	2 (4.55%)
Other	0 (0%)	1 (2.22%)	1 (2.27%)
Annual income level per family member	$7963 [$4779]	$7850 [$5991]	$8760 [$4916]
Body Mass Index (BMI)			
Underweight (<18.5)	0 (0%)	0 (0%)	1 (2.27%)
Normal weight (18.5–24.99)	17 (42.5%)	22 (48.89%)	17 (38.63%)
Overweight (25–29.99)	9 (22.5%)	15 (33.33%)	12 (27.27%)
Obese (30+)	13 (32.5%)	8 (17.78%)	14 (31.81%)
Trait Emotional Eating	2.57 [0.98]	2.43 [0.91]	2.30 [0.91]

Note. Participants who indicated "Bi-racial" or "Other" as their race/ethnicity also identified as either "Hispanic or Latinx" or "Black or African American." One participant from the healthy comfort food condition is missing BMI category data because their height was not properly recorded.

2.4. Procedure

This study protocol (#14–001311) was approved by the Institutional Review Board at the University of California, Los Angeles, and informed consent was obtained from all participants. First, participants took a brief screening survey to determine their eligibility. Once deemed eligible, participants were invited in for a 3-h lab visit. All study visits were scheduled at 1:30 p.m., and participants were asked not to consume caffeine during the 3 h prior, not to exercise during the 2 h prior, and not to eat anything within 1 h of the visit. During the study visit, participants provided informed consent, were randomly assigned to between-subjects condition (i.e., healthy comfort food, unhealthy comfort food, or no food), and met with a research assistant who set up all physiological measurement equipment. Fig. 1 depicts the ensuing study flow and measurement timepoints. Participants provided baseline psychological and physiological stress measures and underwent a gold-standard social-evaluative acute stress paradigm, the Trier Social Stress Test (Kirschbaum et al., 1993), which is known to elicit reliable physiological stress responses. Immediately after the stressor, participants completed a brief measure of psychological stress. Then, they spent 5 min by themselves in the lab room for an eating or waiting period (depending on their study condition). Because participants may have been accustomed to eating more than one serving of their comfort food, participants in the eating conditions were given two servings of either their preferred healthy or unhealthy comfort food and were asked to eat

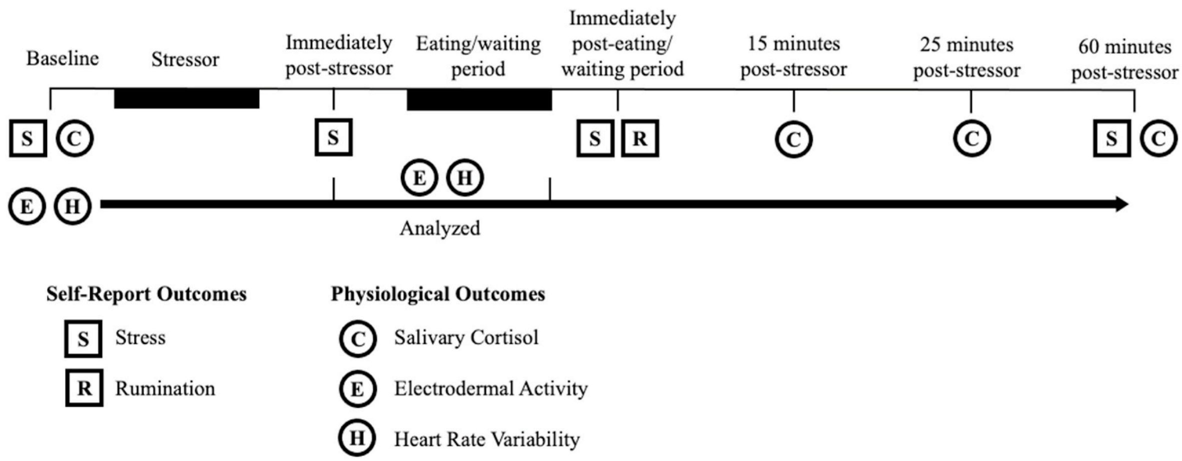

Fig. 1. *Summary of Study Flow and Measurement Timepoints.*

at least one of the two servings. To avoid demand characteristics, participants were not explicitly given a reason for why they were being provided with food, but research assistants told them that they were given the food "to enjoy," and to "help [themselves]" to the second serving if they would like more. Research assistants did not refer to these servings of food as "comfort foods," nor did they provide any information about whether a food was considered "healthy" or "unhealthy." In the no food condition, participants simply waited for 5 min. Afterwards, participants completed a series of questionnaires and then were compensated and debriefed.

Note. The timeline represents the order in which outcomes were measured and analyzed. Stress, rumination, and cortisol were measured and analyzed at distinct timepoints (as marked on the upper line) and electrodermal activity and heart rate variability were collected continuously throughout the study session (as indicated on the arrow). Electrodermal activity and heart rate variability were analyzed at baseline and from immediately post-stressor through the first 5 min of the eating/waiting period. This timeline is not to scale.

2.5. *Measures*

2.5.1. *Self-reported stress*

Participants reported the extent to which they currently felt distressed, irritable, jittery, and nervous on a scale from 1 (*very slightly or not at all*) to 5 (*extremely*). These items were taken from the Positive and Negative Affect Schedule (Watson et al., 1988) and averaged to create an index of self-reported stress (αs ranging from 0.61 to 0.72). Participants completed this measure at baseline, immediately post-stressor, immediately post-eating/waiting session, and 60-min post-stressor.

2.5.2. *Rumination*

Rumination (i.e., repetitive, intrusive thoughts about a negative experience) was measured immediately post-eating/waiting session using the Negative Thoughts Subscale of the Modified Thoughts Questionnaire (Zoccola et al., 2008). This subscale comprises 14 items that ask about how much participants thought about certain statements since a stressor has ended. Participants answered questions such as, "How often did you think about how bad your speech was?" and "How often did you think that you must have looked stupid?" on a 5-point scale from 1 (*never*) to 5 (*very often*). Participants' responses were averaged to create a composite rumination score ($\alpha = 0.95$).

2.5.3. *Electrodermal activity (EDA)*

EDA (a measure of sympathetic nervous system activation) was measured throughout the study session using equipment from BIOPAC Systems Inc (Goleta, California, U.S.A.). Research assistants placed non-invasive electrodes on each participant's non-dominant hand, with one on the index finger and one on the middle finger. EDA was collected continuously throughout the study session, and EDA values were extracted, averaged, and assessed at baseline and for six 1-min epochs (i.e., from immediately post-stressor through the first 5 min of the eating/waiting period).

2.5.4. *Heart rate variability (HRV)*

HRV (a measure of parasympathetic nervous system activation) was measured throughout the study session using equipment from BIOPAC Systems Inc. Research assistants placed electrodes on participants' lowest left rib, lowest right rib, and right collarbone. HRV values were calculated using the root mean square of successive differences in normal heartbeats (i.e., RMSSD, a widely-used metric of HRV; Shaffer & Ginsberg, 2017). Values were extracted and assessed at baseline and for six 1-min epochs (i.e., from immediately post-stressor through the first 5 min of the eating/waiting period).

2.5.5. *Salivary cortisol*

Participants provided salivary cortisol samples to assess hypothalamic-pituitary-adrenal responses to stress at baseline and at 15-, 25-, and 60-min post-stressor. All saliva samples were sealed and stored at −20 °C until they were assayed in batch at the Technical University of Dresden, Germany.

2.5.6. *Body mass index*

Participants were weighed and measured at the beginning of their lab visit, and BMI was calculated using the standard formula (i.e., weight (kg)/height^2(cm)).

2.5.7. *Trait emotional eating*

Participants reported their levels of trait emotional eating using the 13-item Emotional Eating Subscale of the Dutch Eating Behavior Questionnaire (van Strien et al., 1986). They were asked how frequently they felt a desire to eat when experiencing a range of emotions (e.g., irritated, lonely, disappointed, anxious, bored). Participants answered on a scale from 1 (*never*) to 5 (*very often*), and responses were averaged to create a composite score of trait emotional eating ($\alpha = 0.93$).

2.6. *Statistical approach*

Study hypotheses and our data analytic plan were specified prior to data collection. Except for transformations for normality, no data-driven analyses were conducted. Statistical analyses were conducted using RStudio (version 1.4.1717) and SPSS (version 28). All outcome variables were examined for normality, and self-reported stress, HRV, and cortisol values were natural log transformed to correct values of skewness >1.

All repeated measures outcomes (i.e., self-reported stress, EDA, HRV, cortisol) were tested using one-way repeated measures ANCOVA models controlling for baseline values. Each repeated measures ANCOVA model included condition, time, and the interaction between condition and time as predictors. Tests of self-reported stress modeled change across three time points: immediately post-stressor, immediately after the eating/waiting period, and 60 min post-stressor. Tests of EDA and HRV modeled change across six time points: from immediately post-stressor through the first 5 min of the eating/waiting period. Tests of cortisol modeled change across three time points: 15-, 25-, and 60-min post-stressor. Rumination was measured at a single timepoint, so we used a one-way ANOVA model to test for differences by condition. For all analyses, we used the alpha criterion $p < 0.05$.

3. Results

3.1. Data availability statement

All data reported here has been made publicly available on the Open Science Framework. To view and download study data and analysis scripts, please visit: https://osf.io/kybnx/?view_only=8da53c3d68f84789a644923f1eb79bc6.

3.2. Manipulation check

To confirm that the laboratory stressor was effective in inducing stress, we used repeated-measures ANOVA models to compare baseline and post-stressor values for each of our repeated stress measures (e.g., self-reported stress, EDA, HRV, salivary cortisol). Each of the stress outcomes significantly increased from baseline to immediately post-stressor (all *ps* < 0.01) except for EDA ($p = 0.11$). To probe further, we compared participants' EDA values at baseline to timepoints during the laboratory stressor (i.e., during the speech task, during the math task), and found that participants' EDA significantly increased between baseline and each of these mid-stressor timepoints (*ps* < 0.01). For descriptive statistics, see *Supplemental Material*. Thus, we concluded that the laboratory stressor was effective.

3.3. Psychological stress outcomes

Participants in all conditions showed significant decreases in self-reported stress from immediately post-stressor to 60-min post-stressor ($F(2, 122) = 28.73$, $p < 0.01$, $\eta^2_p = 0.32$; see Table 2 for full test statistics). However, there was no evidence that these trajectories differed significantly by condition ($F(4, 246) = 1.84$, $p = 0.12$, $\eta^2_p = 0.03$; see Fig. 2). We also found no differences in rumination by condition ($F(2,124) = 0.32$, $p = 0.73$, $\eta^2_p = 0.01$; see Fig. 3). Thus, our hypotheses were not supported.

3.4. Physiological stress outcomes

Contrary to our hypotheses, we did not find any evidence for differences in participants' EDA trajectories ($F(10, 220) = 0.45$, $p = 0.92$, $\eta^2_p = 0.02$, see Fig. 4), HRV trajectories ($F(5, 97) = 1.52$, $p = 0.19$, $\eta^2_p = 0.07$), or salivary cortisol trajectories by condition ($F(4, 236) = 0.01$, $p = 1.00$, $\eta^2_p = 0.00$, see Fig. 5). However, the repeated measures ANCOVA model for salivary cortisol did reveal that participants in all conditions experienced significant decreases in cortisol between 25- and 60-min post stressor, which suggests that participants experienced physiological stress recovery whether or not they ate a comforting food.

3.5. Post hoc analyses

After exploring our *a priori* hypotheses, we conducted a few additional tests to see if any of the relationships between study condition and stress recovery were moderated by BMI or trait emotional eating. Findings for these 3-way interaction analyses, which were largely null, are reported in our *Supplemental Material*.

Table 2
Tests of Psychophysiological Recovery by Condition.

Test	n	F	df	p	η^2_p
Self-Reported Stress					
Time	127	28.73	2, 122	**< 0.01**	0.32
Time x Condition (Unhealthy, Healthy, No food)	127	1.84	4, 246	0.12	0.03
Rumination					
Condition (Unhealthy, Healthy, No food)	127	0.32	2, 124	0.73	0.01
Electrodermal Activation (EDA)					
Time	117	1.28	5, 109	0.28	0.06
Time x Condition (Unhealthy, Healthy, No food)	117	0.45	10, 220	0.92	0.02
Heart Rate Variability (HRV)					
Time	105	1.52	5, 97	0.19	0.07
Time x Condition (Unhealthy, Healthy, No food)	105	1.33	10, 196	0.22	0.06
Salivary Cortisol					
Time	122	12.38	2, 117	**< 0.01**	0.18
Time x Condition (Unhealthy, Healthy, No food)	122	0.01	4, 236	1.00	0.00

Note. To correct skew > 1, self-reported stress, HRV, and cortisol values were log transformed. Tests of self-reported stress model change across three time points: immediately post-stressor, immediately post-eating/waiting session, and 60-minutes post-stressor. Tests of EDA and HRV model change across six time points: from immediately post-stressor through the first 5 minutes of the eating/waiting period. Tests of cortisol model change across three time points: 15-, 25-, and 60-minutes post-stressor. All repeated measures tests were conducted controlling for baseline values.

4. Discussion

Given widespread racial/ethnic and socioeconomic health disparities, there is an immense need for low-cost, scalable interventions for improving nutrition and decreasing the burden of stress. In a randomized, controlled trial, we tested the strategy of healthy comfort eating as one such intervention among low-income Black and Latinx adults. Contrary to our hypotheses, we found that those who ate unhealthy or healthy comfort foods experienced similar psychological and physiological stress recovery to control participants. A post-hoc power analysis revealed that we achieved a power of 0.87 to detect small effect sizes ($f = 0.15$), so it is unlikely that these findings are due to our planned statistical tests being underpowered. Although these are null findings, it is important to emphasize that participants in *all* conditions felt better at the same rate within an hour of experiencing the stressor. For many, unhealthy comfort eating may be an enjoyable habit, but this evidence suggests that it is not necessarily any more effective at improving psychophysiological stress recovery than engaging in the healthier behavior of eating a fruit or vegetable or simply resting for a few minutes.

These findings align with a similar study conducted by our group (Finch et al., 2019), in which we tested whether substituting healthy foods for traditional unhealthy comfort foods might reduce stress reactivity and recovery in a predominantly Asian and White student sample. We embarked on the current investigation because we theorized that comfort eating may be particularly effective for people who face high levels of chronic stress and who frequently engage in comfort eating (i.e., Black, Latinx, and low-SES samples). Although we did not find support for the efficacy of comfort eating in our laboratory-based experiment, it is possible that comfort eating "in the real world" has benefits that we were unable to capture with our study design. For example, it is possible that eating a comfort food in a small, unfamiliar lab space is simply not as comforting an experience as eating in one's home, car, or

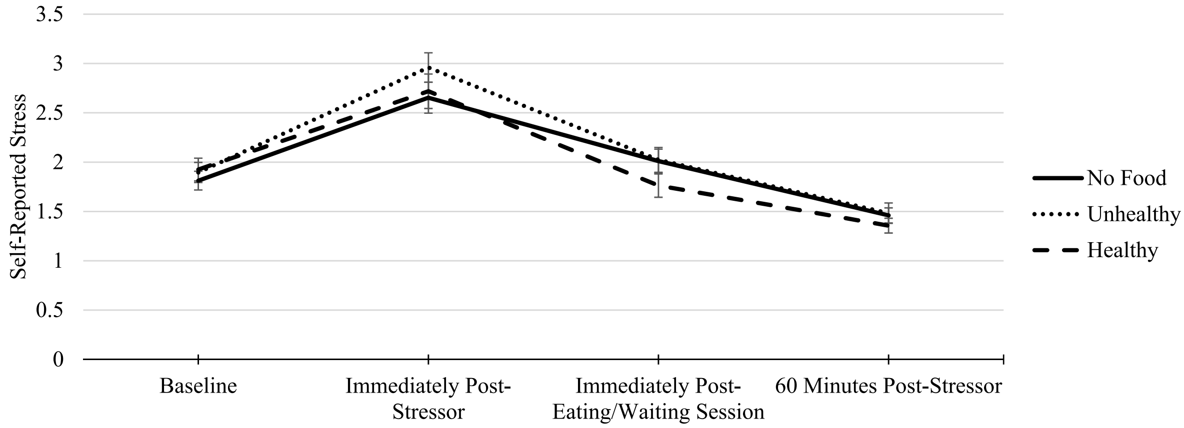

Fig. 2. *Self-Reported Stress Over the Study Visit by Condition.*
Note. Figure depicts raw (i.e., untransformed) values for self-reported stress. Error bars represent standard errors.

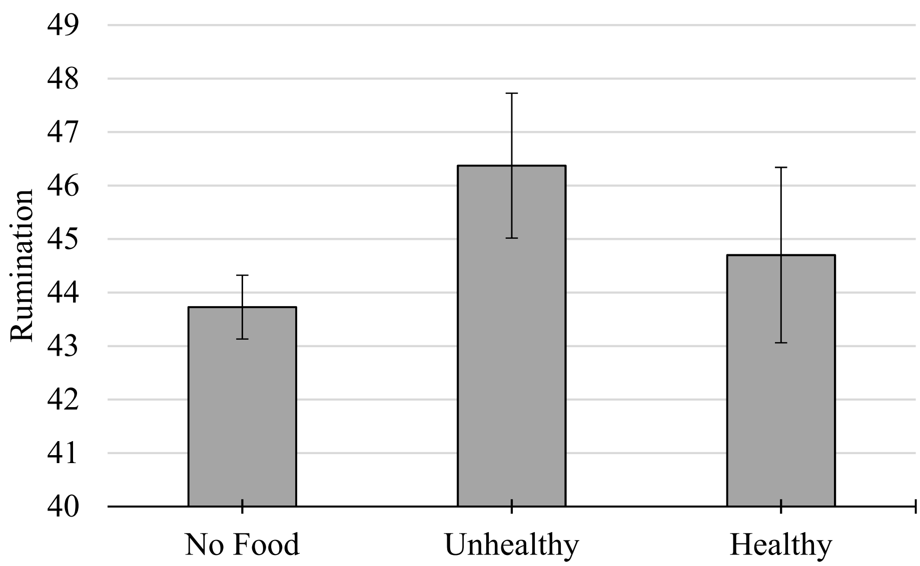

Fig. 3. *Rumination by Condition.*
Note. Rumination was measured immediately after the eating/waiting period. Error bars represent standard errors.

in a favorite restaurant. Although participants were left alone during the eating period and encouraged to enjoy their food, they may have felt watched or monitored due to the nature of the lab environment. It is also possible that participants were distracted or made uncomfortable by the electrodes worn on their non-dominant hands (for EDA data collection). In either case, people may not have been able to gain as much stress relief from eating as they would under normal circumstances. Likewise, perhaps the experience of being served with comfort food in the lab is less effective at aiding stress recovery than engaging in the ritual of obtaining a comfort food for oneself (i.e., deciding to comfort eat, going to the store to buy ice cream, anticipating eating it on the trip home). In both of these examples, real-world comfort eating may allow people an opportunity to regain feelings of control after experiencing some uncontrollable stressor, which was not the case in our experiment. It is also important to point out that even if there are circumstances in which healthy foods can provide comfort, these foods are often not readily accessible to individuals with low SES. For instance, healthy foods tend to cost more than unhealthy ones (Rao et al., 2013), and there are also racial/ethnic and socioeconomic disparities in the availability of local supermarkets and the variety of food options carried in local stores (Walker et al., 2010). These barriers mean that many people of color and people with low SES must travel farther to obtain healthy foods.

Despite these limitations, this study fills an important gap in the literature by testing whether healthy comfort eating is a viable intervention strategy for improving diet quality and improving stress recovery in low-income Black and Latinx populations. Given the pervasiveness of health disparities, it remains particularly important for behavioral scientists to test stress-reduction interventions in populations who are at disproportionately high risk for stress and chronic disease. Moreover, our randomized experiment allowed us to test the causal effects of comfort eating, improving upon the majority of prior studies that used non-experimental designs.

In sum, we did not find evidence that comfort eating (in a laboratory setting) effectively improves psychological or physiological stress recovery. Public health and nutrition professionals have generally condemned unhealthy comfort eating, but they have done so primarily on the basis that unhealthy comfort eating worsens diet quality. Our findings suggest that curbing unhealthy comfort eating is advisable, but on the novel basis that it does not actually reduce stress more effectively than engaging in a healthier behavior.

Ethical statement

This study protocol (#14–001311) was approved by the Institutional

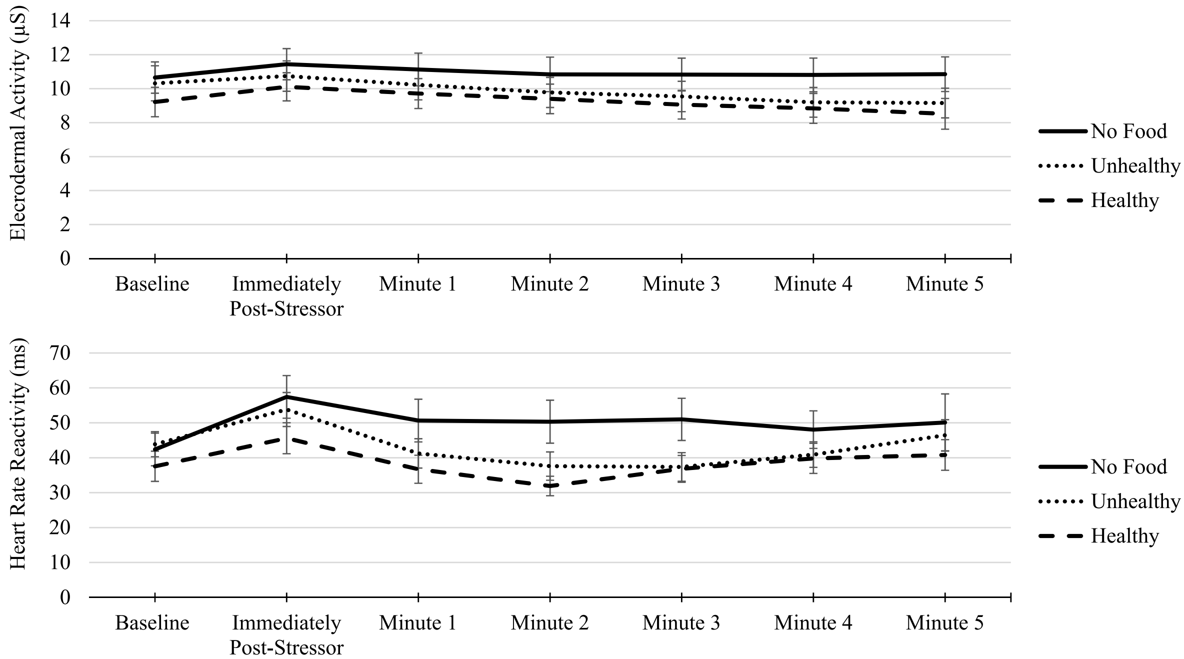

Fig. 4. *Electrodermal Activity and Heart Rate Variability Over the Study Visit by Condition.*
Note. Figure depicts raw (i.e., untransformed) EDA and HRV values, which were extracted and assessed at baseline and analyzed across six 1-min epochs (i.e., from immediately post-stressor through the first 5 min of the eating/waiting period). EDA was measured in microsiemens (µS), which are conductance units. HRV was calculated using RMSSD and was measured in microseconds (ms). Error bars represent standard errors.

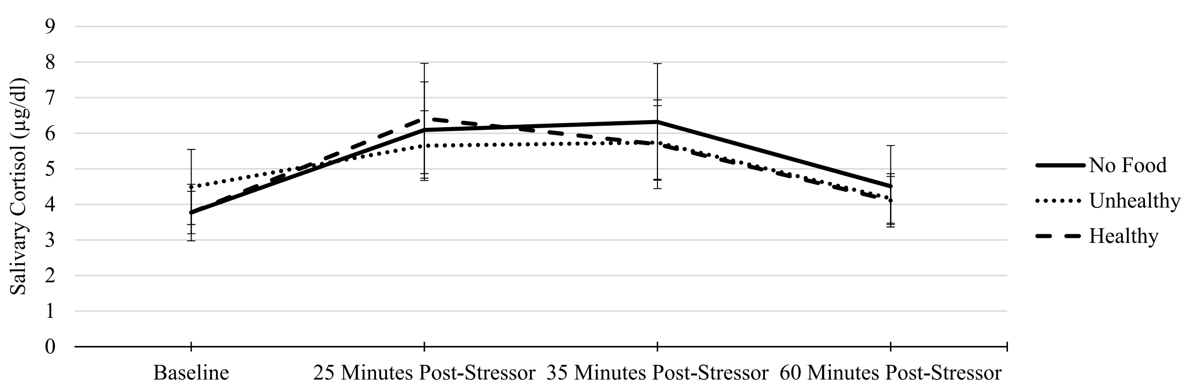

Fig. 5. *Salivary Cortisol Over the Study Visit by Condition.*
Note. Figure depicts raw (i.e., untransformed) values for salivary cortisol, measured in µg/dl. Error bars represent standard errors.

Review Board at the University of California, Los Angeles, and informed consent was obtained from all participants. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards, as well as in compliance with American Psychological Association ethical standards for the treatment of human subjects.

This project was not pre-registered prior to data collection because it began in 2016, before members of the study team were familiar with standard pre-registration protocols. However, we have taken care to conduct analyses as planned in our initial funding proposal and have made study data and analysis scripts publicly available online.

Author contributions

L.E.F. and A.J.T. conceived of the original study idea, secured funding for the project, and supervised E.C.S. throughout. L.E.F. developed the initial protocol and materials, and E.C.S. edited them as needed throughout the process of data collection. E.C.S. coordinated participant recruitment, research assistant training, and data collection efforts with the help of E.S. E.S. and K.M.L. coordinated a transition to an additional data collection site with support and supervision from O.N.B. and A.J.T. L.E.F. oversaw physiological data reduction and prepared the data for analysis, and E.C.S. conducted study analyses. O.N.B., L.T.H, J.P., and K.M.L contributed intellectually to the preparation of the manuscript, and K.M.L. also assisted with data collection. E.C.S. and A.J.T. wrote the first draft of the manuscript, and all other authors provided substantial feedback. All authors have approved the final article.

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Declaration of competing interest

The authors have no conflicts of interest to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2022.106140.

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