



Short Communication

The (non)-effect of induced emotion on desire for different types of foods

Mahsa Ershadi^a, James A. Russell^a, Rachel S. Herz^{a,b,*}^a Department of Psychology, Boston College, 140 Commonwealth Ave., Chestnut Hill, MA, United States^b Department of Psychiatry and Human Behavior, Alpert Medical School, Brown University, 190 Thayer St, Providence, RI, United States

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ABSTRACT

Extensive prior research has demonstrated the interplay between emotion and eating, but there has not been an empirical examination of the effects of experimentally induced basic emotions on people's desire for foods that vary in caloric density and taste quality. To address this issue, we used validated emotion induction manipulations to elicit feelings of anger, sadness, and happiness in 192 American college students, and then had them rate their desire to consume 16 food items that were either low or high in calories and sweet or savory. Participants desired both low and high calorie sweet foods and high-calorie savory foods over low-calorie savory foods. Some effects on overall desire to eat were also found, but induced emotion had no impact on the type of food desired, even when participants were strongly experiencing the emotion of interest. Our findings disentangle how emotions may influence overall motivation to eat versus desire for particular food types, and highlight the importance of research supporting the null hypothesis.

1. Introduction

Eating and emotion are clearly linked, but the exact nature of that link is not known (see Macht's, 2008, review). Motivation to consume food in general is related to emotion. For example, high arousal emotions such as anger and joy have been shown to increase desire to eat (Macht, 1996; Macht, Roth, & Ellgring, 2002), whereas low arousal, negative emotions (e.g., sadness) have been shown to decrease appetite and consumption (Macht et al., 2002). However, there are also inconsistencies in the literature, as negative valence, low arousal emotions have been shown to increase craving and intake of high calorie palatable foods (Goldschmidt, Tanofsky-Kraff, & Wilfley, 2011). Importantly, the types of foods, in terms of their caloric and taste properties, that are desired to be consumed as a function of the specific emotions that are experienced has not been investigated, though it is commonly believed that different emotions will elicit desires for different food types. For example, Lyman (1982) found that college students assumed that they would prefer to eat junk food when feeling various negative emotions and healthful foods when experiencing positive emotions.

The purpose of the present research was to address this gap in the literature by empirically testing whether experiencing different basic emotions would alter the desire to eat particular types of food. Specifically, we induced the emotions of anger, sadness and happiness, and examined whether the emotion changed the desire to eat foods that differed in their caloric density (high, low) and taste qualities (sweet,

savory). We chose the emotions of anger, sadness and happiness because they vary in arousal and valence in ways that may impact food choice.

2. Method

2.1. Participants and design

One hundred and ninety-two male and female undergraduate students (3 between-subjects emotion conditions × 64 participants per group) recruited through Boston College's SONA system, completed one of three surveys (depending on their respective emotion condition) and received one research credit for participating. Participants in each emotion condition reported similar demographics and general eating behaviors. See Table 1. We asked participants to refrain from eating before the experiment so that they would be motivated for food. In all conditions, participants reported that they had eaten approximately 1.5–3 h before.

2.2. Materials

Three computer-based surveys were developed, one per emotion condition (angry, sad, happy). Each survey included a two-part emotion induction validated by past research (Gerrards-Hesse, Spies, & Hesse, 1994), as well as rating scales and food images (details below).

The first part of the emotion induction manipulation consisted of

* Corresponding author at: Department of Psychiatry and Human Behavior, Alpert Medical School, Brown University, 190 Thayer St., Providence, RI, United States.
E-mail addresses: mahsa.ershadi@bc.edu (M. Ershadi), james.russell@bc.edu (J.A. Russell), rachel_herz@brown.edu (R.S. Herz).

Table 1
Participant demographics by emotion condition.

	Condition		
	Angry	Sad	Happy
N	64 (32 males)	64 (32 males)	64 (32 males)
Age			
<i>M</i>	19	19	19
<i>SD</i>	1.20	1.20	1.20
Ethnicity			
African American	4	3	0
Asian	11	8	11
Caucasian	38	46	49
Hispanic	5	4	2
Other	6	3	2
Eating behavior			
Diagnosed eating disorder	1	3	0
Diagnosed food allergy	7	8	2
Vegetarian	2	2	1
Omnivore	62	62	63
Follow special/restricted diet	3	5	7

three short vignettes written in the second person, thus making the reader the story's protagonist, presented above an image depicting the narrative. Participants were instructed to "Please read the following stories and think about times when you experienced similar situations." For the Anger condition, the vignettes were: i) your internet malfunctions and technical support is unhelpful, with an accompanying image of a person yelling into the receiver of a telephone, ii) you are late for an important meeting and stuck behind a slow driver, with an accompanying image of a driver yelling and offensively gesturing at another driver, and iii) you are given the wrong meal at a drive-through but only discover the mistake once you arrive home, with an accompanying image of a person yelling, fork and knife in hand over an empty plate. For the sad condition, the vignettes were: (i) you make the difficult decision to euthanize your sick dog, with an accompanying image of a woman holding her unconscious pet, (ii) circumstances force you to break-up with the love of your life, with an accompanying image of a man walking away from a woman whose head and gaze are focused downward, and (iii) you learn that your grandmother has been diagnosed with terminal cancer and that she has only a short time to live, with an accompanying image of an elderly woman in a hospital bed tenderly holding hands with a younger person seated next to her. For the happy condition, vignettes were: (i) you earn a perfect score on an important class assignment and receive a special academic award as a result, with an accompanying image of someone marking a paper in red with an 'A+', (ii) you successfully complete an important project at work and earn a promotion, with an accompanying image of two people in business suits shaking hands, and (iii) your long-term crush reciprocates your feelings for him/her, with an accompanying image of two people holding hands walking towards a sunset. Pilot testing confirmed that all of the vignettes evoked the designated emotions.

The second part of the emotion induction manipulation consisted of a personal reflection exercise in which participants in the anger condition were instructed to "Close your eyes, and think back to a situation that made you feel REALLY REALLY ANGRY! Relive that situation now. Once you feel like you are back in that moment, in at least three sentences, describe the situation as vividly as possible (where were you?

when was this? who was involved? why did you get so angry?)." The term *angry* was replaced by *sad* or *happy* according to the condition.

2.3. Food stimuli

Participants were presented with images of 16 foods, each against a white background. Images were acquired from the internet. The food pictures were chosen based on a pilot test ($N = 32$) that confirmed that each food image corresponded to our four categories of interest: high or low calorie, sweet or savory. The high-calorie sweet items were: chocolate cake, chocolate candies, chocolate chip cookies, vanilla ice cream. The low-calorie sweet items were: banana, fruit salad, oranges, strawberries. The high-calorie savory items were: cheeseburger, French fries, nachos, pizza. The low-calorie savory items were: chicken soup, grilled vegetables, grilled salmon, hummus. See Fig. 1 for sample images. Additional pilot testing confirmed that each image clearly depicted the food item, and that all of the foods were familiar to our participant sample.

2.4. Procedure

At the start of the study, participants answered two questions to assess hunger: 1. "How long ago did you have something to eat (not including gum and mints)?," response options included 'within the last 15 minutes' (= 1), 'within the last 30 minutes' (= 2), 'within the last hour' (= 3), 'within the last 1.5–3 hours' (= 4) and 'more than 3 h ago' (= 5); and 2. "How hungry do you feel right now?," with response options ranging from 'not at all hungry' (= 1) to 'extremely hungry' (= 9). The emotion induction manipulations followed.

According to their randomly assigned emotion condition, participants were first instructed to "Please read the following stories and think about times when you experienced similar situations." Participants were then presented with the second emotion induction, following which they rated how intensely they had experienced that emotion at the time of its occurrence by responding to the scale item "rate the intensity of how [angry/sad/happy] you felt *at the time of the event*." Participants also indicated how intensely they were experiencing their condition's emotion *now* (at the present time) by responding to the scale item "rate the intensity of how [angry/sad/happy] you feel now." Emotion ratings were made on 5-point scales ranging from 1 = 'very slightly or not at all' to 5 = 'extremely.'

Next, participants were shown 16 food images. Different random orders of images were generated for each participant. For each image, participants were instructed to "Please look at this picture and then answer the questions that follow." Three questions appeared under each image: 1. "How much do you want to eat a piece/take a bite of this food right now?" 2. "Do you consider this to be a high or low calorie food?" 3. "How healthy do you consider this food to be?" Each question was answered with a 9-point rating scale, where 1 was the lowest and 9 the highest score. Questions 2 and 3 served as a manipulation check.

After the food image procedure, all participants again rated their feelings of anger, sadness, and happiness, using a 5-point scale from 1 = 'very slightly or not at all' to 5 = 'extremely', and then answered a series of general eating behavior questions, and routine demographic questions from which the participant data shown in Table 1 were tabulated.



Fig. 1. Example images of food items in each food category.

3. Results

3.1. Manipulation check

The emotion inductions were effective. After the emotion induction, participants in the Anger condition reported that they had felt ‘quite a bit’ angry ($M = 4.42$, $SD = 0.71$); those in the Sad condition reported having felt ‘extremely’ sad ($M = 4.69$, $SD = 0.53$); and those in the Happy condition reported having felt ‘extremely’ happy ($M = 4.83$, $SD = 0.38$). In response to how angry/sad/happy (depending on the condition) they felt *now*, participants in the Anger condition reported feeling ‘moderately’ angry ($M = 2.97$, $SD = 0.94$); those in the Sad condition reported feeling ‘moderately’ sad ($M = 3.34$, $SD = 0.91$); and those in the Happy condition reported feeling ‘quite a bit’ happy ($M = 3.83$, $SD = 0.72$).

To evaluate the persistence of the induced emotion, participants also rated how angry, happy, and sad they were at the end of the study. Participants in the Anger condition reported feeling ‘a little’ angry ($M = 1.73$, $SD = 0.84$), which was significantly less angry than they felt immediately after the emotion inductions, $t(63) = 9.27$, $p < 0.001$. Participants in the Sad condition reported feeling ‘a little’ sad ($M = 2.11$, $SD = 1.03$), which was significantly less sad than they felt immediately after the emotion inductions, $t(63) = 10.63$, $p < 0.001$. Participants in the Happy condition reported feeling ‘moderately’ happy ($M = 2.89$, $SD = 0.80$), which was significantly less happy than they felt immediately after the emotion inductions, $t(63) = 8.23$, $p < 0.001$. Thus, though the intensity of the induced emotion diminished across all conditions, participants continued to experience some of their condition’s emotion through to the end of the experiment.

Confirming our food image selection and pilot study, participants perceived the foods as high or low calorie and as sweet or savory in the predicted categories. Repeated measures ANOVA showed a significant difference in caloric content estimation between the food categories, Wilks’ Lambda = 0.61, $F(3, 184) = 939.28$, $p < 0.001$, $\eta_p^2 = 0.94$. Low-calorie sweet foods ($M = 2.64$, $SD = 1.09$) were rated as being significantly lower in caloric content than low-calorie savory ($M = 4.02$, $SD = 1.04$), high-calorie sweet ($M = 7.49$, $SD = 0.99$) and high-calorie savory ($M = 8.06$, $SD = 0.76$) and foods. High-calorie savory foods were perceived as significantly higher in calories than all other food categories. A repeated measures ANOVA for healthiness ratings revealed similar differences between the food categories, Wilks’ Lambda = 0.04, $F(3, 184) = 1534.33$, $p < 0.001$, $\eta_p^2 = 0.96$. Low-calorie sweet foods ($M = 7.98$, $SD = 0.86$) were rated as significantly healthier than low-calorie savory ($M = 6.90$, $SD = 0.81$), high-calorie sweet ($M = 2.05$, $SD = 0.82$) and high-calorie savory ($M = 2.27$, $SD = 0.91$) foods. High-calorie sweet foods were perceived as significantly less healthy than all other food categories.

3.2. Food desire

Our dependent measure, “food desire,” referred to the rating each participant gave for how much they wanted to eat/take a bite of the depicted food items. We combined the ratings for the four foods within each category because our pilot study indicated that each food was an equally valid exemplar of the category. Thus, for the ‘high-calorie sweet’ category, a participant’s food desire score was the pooled mean of how much they wanted to eat/take a bite of cake, candies, cookies, and ice cream. Our main independent variable was emotion induction condition (sad, angry, happy). Sex was included as another independent variable because prior research has suggested that sex differences mediate the emotions that induce increases in comfort food consumption (Dubé, LeBel, & Lu, 2005).

A repeated measures ANOVA with emotion condition and participant sex as between-subject factors, and food category (low-calorie sweet, low-calorie savory, high-calorie sweet, high-calorie savory) as

the within-subjects factor was conducted. All post-hoc comparisons reported included a Bonferroni correction. This analysis revealed that regardless of emotion condition or sex, participants wanted to eat low-calorie savory foods ($M = 4.25$, $SD = 1.66$) the least. Desire to eat low-calorie sweet foods ($M = 6.04$, $SD = 1.78$), high-calorie sweet foods ($M = 5.91$, $SD = 1.96$), and high-calorie savory foods ($M = 5.76$, $SD = 2.19$) did not differ statistically. Importantly, there was no significant effect of induced emotion, $F(1, 186) = 0.20$, $p = 0.65$, $\eta_p^2 = 0.004$, no significant effect of sex, $F(2, 186) = 0.39$, $p = 0.68$, $\eta_p^2 = 0.001$, and most critically no significant interaction between emotion condition and type of food desired, $F(6, 558) = 0.66$, $p = 0.69$, $h_p^2 = 0.007$.

It could be argued that the laboratory emotion induction was too weak to influence food desires. To examine this possibility, we conducted a further analysis and excluded participants in each condition who rated themselves as feeling less than ‘quite a bit’ (< 4 on a 5-point scale) of their condition’s emotion after completing the emotion induction. Using this modified dataset of 95 participants ($N_{Anger} = 19$, 10 males; $N_{Sad} = 29$, 16 males; $N_{Happy} = 47$, 17 males), we found a significant effect for food category as before, Wilks’ Lambda = 0.43, $F(3, 87) = 39.00$, $p < 0.001$, $\eta_p^2 = 0.57$; low calorie savory foods were least desired overall. We also found a main effect of induced emotion, $F(1, 89) = 4.27$, $p = 0.02$, $h_p^2 = 0.09$. Post-hoc comparisons revealed that participants in the Anger condition rated all foods as generally more desirable to eat ($M = 6.24$, $SD = 1.10$) than participants in the Happy condition ($M = 5.18$, $SD = 1.25$). There was no significant difference in desire for food between participants in either the Angry or Happy conditions and those in the Sad condition ($M = 5.43$, $SD = 1.61$). Additionally, we found a main effect of sex, $F(1, 89) = 4.62$, $p = 0.03$, $h_p^2 = 0.05$. Post-hoc comparisons revealed that male participants, regardless of emotion condition or food category, rated all food as generally more desirable to eat ($M = 5.93$, $SD = 1.39$) than did female participants ($M = 5.30$, $SD = 1.35$). Most notably, no significant interaction between emotion and type of food desired was obtained, $F(6, 267) = 0.85$, $p = 0.53$, $h_p^2 = 0.019$.

It could also be argued that variations in hunger mitigated the effect of emotion. In order to examine this possibility, we conducted an analysis where individual differences in hunger were controlled for and hunger was used as a covariate in a repeated measures ANCOVA. Here we found that participants in the Sad condition reported a significantly lower desire to eat across all four food categories than did participants in the Angry and Happy conditions, $F(2, 185) = 4.68$, $p = 0.010$, $\eta_p^2 = 0.05$. See Table 2. There was no effect of subject sex, $F(1, 185) = 0.11$, $p = 0.74$, $h_p^2 = 0.001$, and most importantly, a significant interaction between emotion condition and type of food desired was not found, $F(6, 555) = 0.71$, $p = 0.64$, $h_p^2 = 0.008$.

4. Discussion

Successfully inducing the basic emotions of anger, sadness, and happiness had no effect on participants’ desire to eat foods that varied in caloric density or taste quality. Negative emotions of both high and low arousal and a positive high arousal emotion were unable to alter how much participants wanted to eat foods that were high or low in calories and sweet or savory in taste. Although our results support the null hypothesis, they are important for researchers studying emotion

Table 2
Average food desire rating (9-point rating scale) across all food categories before and after statistically controlling for hunger.

Hunger	Condition		
	Angry	Sad	Happy
Not Controlled	5.61	5.39	5.46
Controlled	5.75	5.12	5.60

and food to know, and may explain why there is no published literature to date addressing how specific emotions affect the desire for particular types of food, as null effects are rarely published. Now knowing that induced emotion does not seem to affect the type of food that healthy college students rate as most desirable to eat when experiencing various basic emotions is valuable for researchers in this field.

Interestingly, at least one past study has reported the absence of an effect for different emotions to alter food consumption when the eating behavior of participants was considered. Cools, Schotte, and McNally (1992) supplied popcorn while participants watched either horror, comedy or neutral film clips and found that among restrained eaters, popcorn consumption during horror and comedy (e.g., high emotional arousal) films clips increased compared to their consumption during a neutral film clip. By contrast, unrestrained eaters consumed the same amount of popcorn regardless of their emotion (film clip) condition. Although Cools et al. (1992) did not compare consumption for different types of food, their finding suggests that individual differences related to eating may be important to evaluate.

We did not examine the trait of dietary restraint in our study, however, we did ask participants to refrain from eating prior to the experiment so as to intensify their potential interest in food. When we statistically controlled for hunger by removing individual differences in this variable, we found that participants induced to experience sadness rated their overall desire for food, irrespective of caloric content and taste, lower than participants induced to experience anger or happiness. This finding indicates that overall appetite may be influenced by induced emotions and is consistent with prior research showing that depressed moods decrease desire to eat (Baucom & Aiken, 1981), but fails to show that the type of food that is desired varies as a function of the emotion experienced.

General desire to eat was also altered when we only examined participants who were highly affected by our emotion induction. We found that participants who felt very angry had more desire to eat all foods than participants who felt very happy. This is consistent with prior research showing increased motivation to eat when feeling anger (Macht, 1996), but inconsistent with research showing increased motivation to eat when happy (Macht et al., 2002). Our results for sadness when we controlled for hunger are also at odds with research showing that negative valence, low arousal moods increase craving and intake for high calorie palatable foods (Goldschmidt et al., 2011). The present findings underscore that methodological issues may explain some of the inconsistencies in the literature on food consumption and mood that have been noted.

Overall, our participants desired sweet foods of both low and high caloric content as well as high-calorie savory foods over low-calorie savory foods. This is unsurprising as they were predominately freshman recruited from a US college who, according to prior research, are

especially susceptible to consuming a diet that exceeds the recommended intake of saturated fats, sodium and refined grain (McGuire, 2011).

A constraint of our study was that we did not measure actual food intake and only assessed desire to eat pictorial representations of specific types of food. Another shortcoming was that we only tested three basic emotions (anger, happiness, sadness), and did not include a control condition where no emotion was manipulated. Since we could not manage the varying degrees of emotion that individuals might be naturally experiencing in a no-manipulation condition, we elected not to include a “neutral” group. Future research on induced emotion and food choice should include a more comprehensive investigation of emotions and tests of actual food consumption. In spite of the limitations, our finding that feeling sad, angry or happy does not alter the desire to eat foods that vary in caloric density and taste quality is an important contribution to the literature. Reporting data that does not reject the null hypothesis can help refine future research, and we have highlighted the importance of disentangling the effects of the desire for specific foods in contrast to overall motivation to eat.

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