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Trait anxiety, but not trait anger, predisposes obese individuals to emotional eating

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Abstract

The present study examined whether trait anxiety and trait anger are associated with vulnerability to emotional eating, particularly among obese individuals. Lean (n=37) and obese (n=24) participants engaged in a laboratory study where they completed measures of trait anxiety and trait anger at screening and then completed 3 counterbalanced experimental sessions involving different mood inductions (neutral, anxiety, anger). Following each mood induction, participants were provided with snack foods in a sham taste test. Models predicting snack intake revealed a significant trait anxiety $\times$ body mass index group interaction, such that high trait anxiety was positively associated with food intake for obese individuals, but not their lean counterparts. Contrary to the hypothesis, trait anger was not associated with food intake for obese or lean participants. Results suggest that trait anxiety may be a risk factor for emotional eating among obese individuals.

Keywords

emotional eating; trait anxiety; trait anger; obesity

Introduction

The influence of negative emotions on food intake is complex and not completely understood (Macht, 2008). Research shows that negative emotions can decrease food intake in some individuals and circumstances (e.g., Baucom & Aiken, 1981; Heatherton, Herman, & Polivy, 1991) and increase food intake in others (e.g., Lowe & Maycock, 1988; Willner et al., 1998). The latter is referred to as emotional eating, and to the extent that it leads people to consume more than their daily needs, weight gain and obesity can develop (Hays & Roberts, 2008). Obesity intervention studies also show that emotional eating is associated with poorer weight loss outcomes (Elfhag & Rossner, 2005).

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Emotional eating has been observed in both obese and lean individuals (Greeno & Wing, 1994) and a critical review of the literature concluded that there is no relationship between body mass index and emotional eating (Allison & Heska, 1993). Thus, vulnerability to emotional eating does not appear to be simply a function of weight. Vulnerability to emotional eating is likely influenced by multiple factors. Individual differences in affective traits may account for some of the observed variability in the effects of emotions on eating. Jansen and colleagues (2008) reported that obese individuals high in negative affect consumed more food than individuals low in negative affect following a negative mood induction, relative to a neutral mood induction. In contrast, lean individuals consumed comparable amounts of calories in the negative and neutral mood induction conditions, regardless of their level of negative affect (Jansen et al., 2008). A limitation of this study is the use of state measures of negative affect, which capture transient moods, but not necessarily affective traits. Further research is needed to explore whether trait negative affect could possibly be a risk factor for emotional eating in obese individuals.

Also unknown is whether specific types of trait negative affect differentially impact emotional eating. Initial research suggests that trait anxiety and trait anger may be particularly important predictors of emotional eating. Initial evidence suggests that trait anxiety is associated with higher food consumption under stress (Pollard, Steptoe, Canaan, Davies, & Wardle, 1995). Other support for a role of trait anxiety is provided by studies showing a high prevalence of anxiety disorders (37%) among people with binge eating disorder (Grilo, White, & Masheb, 2009). Similarly, elevated trait anger has been observed in cross-sectional studies of individuals with bulimia (Fassino, Daga, Piero, Leombruni, & Rovera, 2001) and binge eating disorder (Fassino, Leombruni, Piero, Abbate-Daga, & Rovera, 2003) compared to lean and obese individuals without a diagnosed eating disorder. Although emotional eating is a hallmark of bulimia (Ouwens, van Strien, van Leeuwe, & van der Staak, 2009; Stice, Shah, & Nemeroff, 1998) and binge eating disorder (Stein et al., 2007; Wolfe, Baker, Smith, & Kelly-Weeder, 2009), most individuals who endorse emotional eating do not meet criteria for bulimia or binge eating disorder (Fischer et al., 2007; Lindeman & Stark, 2001). Thus, the extent to which trait anger and anxiety increase vulnerability to emotional eating in non-eating disordered populations is not well-explored.

The present study examined whether trait anxiety and trait anger are associated with vulnerability to emotional eating, particularly among obese individuals. Lean and obese participants completed measures of trait anxiety and trait anger prior to undergoing neutral, anxiety, and anger mood inductions on separate days. Following each mood induction, participants were given highly palatable foods in a sham taste test. After the sham taste test, food intake was objectively measured. Two different hypotheses were tested: 1) Whether higher trait anxiety is associated with greater food intake following an anxiety mood induction for obese, but not lean individuals and 2) whether higher trait anger is associated with a greater food intake following an anger mood induction for obese, but not lean individuals.

Methods

Participants

Lean (BMI: 19–25) and obese (BMI >30) adults (N=61) were recruited through study advertisements posted in the community and on a medical center campus. Individuals were ineligible for the study if they: (1) had any uncontrolled health condition (e.g., uncontrolled hypertension, diabetes); (2) met DSM-IV diagnostic criteria for anorexia nervosa, bulimia nervosa, bipolar disorder, psychotic disorder or substance abuse or dependence (3) expressed active suicidal ideation or behavior; (4) were illiterate; (5) were pregnant, intending to become pregnant during the course of the study, lactating, or had a history of

severe premenstrual distress; (6) smoked >3 cigarettes/day or used any other nicotine product daily; (7) were using appetite suppressants; and (8) had a history of obesity surgery. Participants were also excluded if they were not responsive to a negative mood induction (anger and anxiety mood induction) that occurred during the screening session (less than 4 point increase in targeted negative affect states) as described below.

Screening Session

Potential participants responding to study advertisements received an explanation of the study and were initially screened via telephone. Preliminarily eligible persons were then scheduled for a screening visit that lasted no more than 3 hours to determine eligibility. Written consent was obtained and height and weight were assessed on a balance beam scale with shoes removed. Participants were administered the Structured Clinical Interview for DSM-IV, nonpatient version (SCID-NP) (Spitzer, Williams, Gibbon, & First, 1992) to rule out the presence of exclusionary Axis I disorders noted above. Participants completed three additional procedures during the screening session as part of participant pre-testing: 1) memory generation; 2) mood induction and 3) food palatability ratings.

Memory generation—Participants were then interviewed about recent experiences to generate memories for use in the mood induction protocol. To reduce demand characteristics and prevent participants from guessing the nature of the experiment, they were told that the study evaluates whether different everyday situations affect enjoyment of various foods. The focus on mood and affective traits was not mentioned. Based on a procedure developed by Litt and colleagues (Litt, Cooney, Kadden, & Gaupp, 1990), the interviewer asked each participant to describe events within the past year that made them anxious and others that made them angry. For the neutral mood induction, participants were asked to recall a routine household task (e.g., washing dishes), and it was used as long as this memory did not evoke a negative emotion. Other memories were queried that had nothing to do with negative moods, such as a time when they successfully accomplished a task. Participants were encouraged to describe each event in their own words, indicating what led up to the situation, what occurred, how they felt about it and the outcome. The experimenter recorded a brief description of the incident. After generating the memories, participants rated each incident on 1-10 point Likert scales to indicate the degree to which it made them feel various emotions (including anxiety, anger, happiness and sadness) and the vividness of the memory.

Mood induction—Participants were next told that they would be asked to recall two randomly chosen memories that they had just provided. In actuality, the memories were not randomly chosen, rather the researcher used the memory rated highest on anxiety and the memory rated highest on anger (If a memory was equally intense on anger and anxiety it was not used). Two mood inductions were conducted: one for anger and one for anxiety. Participants mood ratings were collected on a 1-10 Likert scale prior to and immediately following the test mood induction. Participants who did not demonstrate an increase of at least 4 points during either mood induction were deemed ineligible due to being non-responsive to the mood induction (excluded: n=49; 28 females, 21 males). These excluded participants did not differ from enrolled participants on BMI ($t=0.40$, $p=.69$) and sex ($\chi^2(1)=3.37$, $p=.07$); however age was significantly different ($t=3.38$, $p=.001$), such that non-responders ($M=42.00$; $SD=11.41$) were slightly older than responders ($M=34.61$; $SD=11.37$). To ensure that participants did not exit the session in a distressed state, participants whose negative affect scores had not returned to baseline by the end of the screening session underwent a positive mood induction prior to leaving the laboratory.

Food palatability ratings—Immediately following the test mood induction, participants rated the palatability of 38 snack foods (e.g., peanut butter cups, pretzels, potato chips, chocolate chip cookies) representing a variety of tastes, textures, and macronutrient composition on a 0-10 scale, where 0 was ‘do not enjoy this food at all’ and 10 was ‘enjoy this food extremely’. The timing of the completion of this measure was in keeping with the cover story that the study examined the influence of memories on food enjoyment. To obtain meaningful palatability ratings, participants were informed of brand names of food items when possible and were asked to avoid rating unfamiliar foods. Participants were scheduled for three experimental sessions to be between 1 and 6 days apart. Of the 67 participants who met eligibility criteria following the screening session, five declined to participate and one did not complete any experimental sessions, leaving a final sample of 61 that completed all 3 experimental sessions.

Experimental conditions

Participants completed 3 experimental mood induction sessions, neutral, anxiety and anger, in counterbalanced order. The use of anxiety and anger mood inductions enabled the coupling of the trait measures with their comparable state induced negative emotions, which provides a particularly strong test of the hypotheses. Participants were administered a brief dietary recall interview at the beginning of the session to ensure that they followed instructions to not consume any food or energy-containing beverages in the previous 2 hours. Those who had been rescheduled for a different day (n=1). Participants then completed a mood questionnaire (Profile of Mood States) and rated their hunger on a scale of 0–10 (0 is not at all hungry and 10 is extremely hungry). The experimenter then introduced the relevant mood induction task (as in Rusting & Nolen-Hoeksema, 1998). Participants were reminded that the study examines how different everyday situations affect the enjoyment of various foods. After informing the participant of the randomly selected memory (anxious, angry or neutral, depending on the session), the experimenter read the brief description of the related memory they shared during their screening visit. They were then given the following instructions as used in Wright & Michel (1982) and Rusting & Nolen-Hoeksema (1998):

“During the next 7 minutes, try to re-experience the memory you’ve retrieved as vividly as you can. Picture the event happening to you all over again. Picture in your “mind’s eye” the surroundings as clearly as possible. See the people or objects; hear the sounds; experience the events happening to you. Think the thoughts you actually had in that situation. Feel the same feelings you felt in that situation. Let yourself react as if you were actually there right now. Don’t be afraid to really get into it, because we can bring you back to feeling as you did when you began the session.”

The mood induction continued for 7 minutes. Participants then completed the mood questionnaire at the end of the mood induction. After rating their mood, 6 foods that were previously rated as highly palatable (score of 6 or higher on the 1-10 likert scale) by the participant were presented in 400 kcal portions (total 2400 kcal). The participant was instructed to sample each food and to eat as much or as little as they would like of each food to accurately rate palatability. They were told that all leftover food would be discarded after the session and that they do not have the option of taking any home. Participants were left alone for 20 minutes. At the end of 20 minutes, the researcher returned and the participant completed the palatability ratings and the mood questionnaire. A positive mood induction was then performed if mood had not returned to baseline levels to ensure participants did not exit the session in a worsened mood state. For the positive mood induction, participants were asked to recall one of the happy memories they listed during the screening visit. All

procedures were approved by the University of Illinois-Chicago and the University of Massachusetts Medical Schools Institutional Review Boards.

Measures

Body mass index (BMI)—Participants had their height and weight measured without shoes using a stadiometer and balance beam scale. Participants were not fasting. BMI was calculated using the formula (weight in pounds/(height in inches² × 704.3). BMI cutoffs were used to define lean (BMI 18.5–24.9) and obese (BMI ≥ 30.0) groups.

Axis I disorders—Axis I exclusion criteria was assessed by the structured interview modules for mood disorders, substance use disorders, anxiety disorders, and eating disorders of the Structured Clinical Interview for DSM-IV, Nonpatient Version (SCID-NP) (Spitzer et al., 1992). Satisfactory reliability data for these diagnoses have been reported, and the SCID compares favorably with other diagnostic assessment methods (Williams, 1992). Items in the mood disorders module addressing suicidality were administered regardless of whether a participant endorsed other depressive symptomatology.

Trait Anxiety—Participants completed the State-Trait Anxiety Scale (STAI) (C. Spielberger, Gorsuch, & Lushene, 1970) at baseline to measure trait anxiety. The STAI is a well-validated and widely-used measure of trait anxiety that asks participants to rate the frequency with which they generally feel certain anxious and non-anxious mood descriptors on a 4-point scale. The trait subscale of the STAI demonstrated excellent reliability in the current study ($\alpha=.90$).

Trait Anger—Participants also completed the State Trait Anger Scale (STAS) (C. D. Spielberger, 1980) at baseline to measure trait anger, which has a similar response format and instructions as the STAI. The reliability of the STAS in the current study was good ($\alpha=.85$).

Anxiety and Anger Affect—The 65-item Profile of Mood States (POMS) (McNair, Lorr, & Droppelman, 1971) was used to measure changes in negative affect during experimental sessions. Participants rated the extent to which they experienced affective states at the time of assessment from “0-not at all” to “4-extremely”. Subscales used for the current study include tension-anxiety and anger. Post-mood induction scores were subtracted from the baseline scores to assess anxiety and anger reactivity to the mood induction.

Hunger—Hunger was assessed at baseline, prior to each mood induction session, via a 0-10 rating of hunger with 0 as ‘not hungry at all’ and 10 as ‘extremely hungry’.

Food Intake—Participants were served 400 kcal portions of six foods (2400 total calories) that they had previously rated as highly palatable. Geliebter and colleagues (Geliebter, Hassid, & Hashim, 2001) reported that the maximum caloric intake of obese binge eaters during a test meal session was 1641 for males and 1073 for females. The 2400 total available calories ensured that participants would not consume all of the food. Each 400 kcal portion was weighed (in grams) before consumption. The food remaining after the experimental session was weighed again to reflect the intake. The difference between the pre-session food weight and post-session weight was then calculated and converted from grams to kilocalories.

Analytic plan

Due to the repeated measures design of the study, a repeated measure analysis of variance (ANOVA; SPSS 17.0, Chicago, IL, USA) with food intake during the three mood induction

conditions as the repeated measures factor was used to examine whether BMI group interacted with either trait anxiety or trait anger to predict food intake. In addition to including BMI group, trait anxiety and trait anger in the model, ten covariates were included. Covariates included age, sex, mood induction sequence and hunger during the three mood induction conditions. To control for the mood responses to the mood inductions, POMS anxiety mood reactivity during the anxiety and neutral mood induction conditions and POMS anger mood reactivity during the anger and neutral mood induction conditions were also included in the model.

Because we hypothesized different predictors of food intake (trait anxiety versus trait anger) in the anxiety and anger mood induction conditions, significant three-way interactions of mood induction condition $\times$ BMI group $\times$ either trait anxiety or anger were followed by separate regression equations to ease interpretation. For these significant interactions, hierarchical linear regression (SPSS 17.0, Chicago, IL, USA) was used to examine whether BMI group moderated the relationship between trait anxiety or trait anger and food intake. The covariates age, sex, mood induction sequence, were included in the first step of the model. Hunger during the neutral condition was also included as a covariate and hunger during the anxiety or anger mood induction conditions was included depending on whether the anxiety or anger mood induction condition was the focus of the analysis. The relevant mood reactivity measures (either POMS anxiety or POMS anger) from the neutral and either anxiety or anger mood induction conditions (depending on mood induction condition) were also included as covariates. The terms for main effects of BMI group and either trait anxiety or trait anger (depending on condition) were added in the second step of both models. The final step of the models included the appropriate interaction term: BMI group $\times$ trait anxiety or BMI group $\times$ trait anger. Simple effects analyses were conducted by examining the relationship between trait (anger or anxiety) and food intake, separately for the lean and obese groups, for a significant BMI group $\times$ trait (anxiety or anger) interaction.

Results

Preliminary analyses

Sample characteristics are shown in Table 1. The independent (i.e., trait anxiety, trait anger, BMI group) and dependent variables (caloric consumption after the neutral, anxiety and anger mood inductions) were normally distributed (skew range: 0.23 – 1.02 and kurtosis range: -0.20 – 2.12). For the anxiety condition, data were incomplete for two participants; one participant did not complete the STAI and one did not complete a measure of baseline hunger during the anxiety condition. These participants were excluded from the anxiety condition analyses. For the anger condition, data were incomplete for two participants who did not complete the trait anger scale. These participants were excluded from the anger analyses. Chi-squares and t-tests were performed to compare BMI groups on categorical and continuous measures that could influence food intake (i.e., sex, age). There was a larger percentage of females in the obese group ($\chi^2_{(1,N=61)}=3.86, p=.05$), but no differences between BMI groups in ethnicity or history of major depressive disorder. The obese BMI group was significantly older than the lean group ($M=38.96$ years vs. $M=31.78$ years; $t_{(59)}=-2.51, p=.02$). Thus, sex and age were included in the analyses as covariates.

As a manipulation check, we examined the degree to which the anxiety and anger mood inductions elicited a change in POMS anxiety and anger ratings, respectively. Anxiety and anger reactivity were calculated as the change in POMS anxiety and anger ratings from baseline to immediately following the corresponding mood induction. POMS anxiety ratings significantly increased from baseline to mood induction ($M=5.56$; $SD=6.10$ vs. $M=13.54$; $SD=7.95$; $t_{(60)}=8.48, p<.001$) and POMS anger ratings significantly increased from baseline to mood induction ($M=1.9$; $SD=4.37$ vs. $M=17.6$; $SD=11.16$; $t_{(60)}=11.32, p<.001$).

Repeated measures model analysis

The repeated measures ANOVA demonstrated that the BMI group $\times$ mood induction condition $\times$ trait anxiety significantly predicted caloric intake ($F(2,41)= 3.39, p=.04; \eta^2=.14$) and the simple contrast comparing the anxiety and neutral mood induction conditions was significant ($F(1,42)= 4.95, p=.03$). Conversely, the BMI group $\times$ mood induction condition $\times$ trait anger interaction did not significantly predict caloric intake ($F(2,41)= 2.93, p=.06$), nor did the main effect of trait anger predict caloric intake ($F(2,41)= 0.24, p=.79$). Thus, multiple regression analyses were only conducted to understand the significant BMI group $\times$ mood induction condition $\times$ trait anxiety interaction.

Primary analyses: Trait Anxiety

Results demonstrated that the BMI group $\times$ trait anxiety interaction significantly predicted intake ($t=2.77, p=.008, R^2\Delta=.04$; Figure 1). Simple effect analyses controlling for covariates demonstrated that, for lean participants, trait anxiety did not predict food intake ($t=0.03, p=.98$). However, for obese participants, trait anxiety was significantly associated with food intake, such that greater trait anxiety predicted greater intake following the anxiety induction ($t=2.65, p=.02, R^2\Delta=.13$). A post-hoc analysis examined a potential confounding factor; whether BMI group was associated with trait anxiety. A t-test comparing lean and obese participants on trait anxiety revealed that lean and obese participants were comparable on trait anxiety ($t=0.02, p=.99$).

Discussion

Results revealed that trait anxiety is associated with greater intake following an anxiety mood induction relative to a neutral mood condition for obese individuals, but not for their lean counterparts. Contrary to our hypothesis, trait anger was not associated with intake following an anger mood induction. Results extend Jansen and colleagues (2008) findings that obese individuals high in state negative affect consume more calories in response to a negative mood compared to obese individuals low in state negative affect, and to lean individuals. The present study suggests that trait anxiety might be an important vulnerability factor in emotional eating among the obese. Further research is needed to understand why trait anxiety, but not trait anger, presents a vulnerability to emotional eating and why this effect is specific to obese, but not lean individuals.

One potential explanation for the discrepancy between the effects of anger and anxiety on food intake relates to whether these emotions are mediated by different underlying motivational systems. Anxiety and anger were initially both attributed to the avoidance motivational system, since they are negative emotions (Watson, Wiese, Vaidya, & Tellegen, 1999). However, Carver & Harmon-Jones (2009) proposed that anger may be related to approach motivation (i.e., goal attainment), not avoidance motivation (i.e. avoid punishment) because anger is triggered when a goal is thwarted. That food intake following negative affect is motivated by avoidance is supported by research showing that use of avoidant coping strategies is associated with higher eating dysfunction scores (Kof & Sangani, 1997) and emotional eating (Spoor, Bekker, van Strien, & van Heck, 2007) and palatable food intake can regulate negative emotions that have an avoidance motivational component, such as “ego threat” (Wallis & Hetherington, 2004). In contrast, anger is typically conceptualized as an emotional response to a frustrated attempt to achieve an attainable goal, and serves to “drive” further attempts to pursue a goal with increased vigor. Therefore, our finding that food intake was linked to trait anxiety and not trait anger may reflect the fact that only anxiety involves the avoidance motivational system and is subject to regulation by strategies such as eating.

Trait anxiety might selectively influence emotional eating in obese individuals for several reasons. First, obese individuals high in trait anxiety might be more reactive to an anxiety mood induction, compared to their lean counterparts high in trait anxiety, possibly due to physiological differences between obese and lean individuals. However, in the current study, the BMI $\times$ trait anxiety interaction was not associated with the magnitude of mood responses to the anxiety induction ($t=-0.55$, $p=.59$), indicating that trait anxiety does not differentially influence emotional eating in obese and lean individuals by altering the emotional intensity of the mood induction, as reported by participants. Given that physiological responses to the mood induction were not measured, it is possible that physiologically, obese participants may have responded differently to the mood induction, compared to their lean counterparts, which differentially influenced consumption.

Second, obese trait anxious individuals, compared to lean trait anxious individuals, may be more likely to eat to regulate negative emotions, rather than use other active coping strategies. Some initial research supports the disproportionate use of food to cope with negative emotions in obese individuals, compared to their lean counterparts. A study of coping styles and BMI among African-American women at risk for coronary heart disease found that lean women were 3–4 times more likely to use an active confrontive coping style, compared to their overweight and obese counterparts (Strickland, Giger, Nelson, & Davis, 2007). An observational study of obese women found that those who decreased their use of disengaged coping styles, like avoidance, were significantly more likely to lose weight at 6 months (Conradt et al., 2008). Weight loss interventions have started to address deficits in coping behaviors by incorporating mindfulness (Lillis, Hayes, Bunting, & Masuda, 2009; Tapper et al., 2009) relaxation strategies (Manzoni et al., 2009) and behavioral activation (Schneider et al., 2008). More research should examine whether interventions that increase use of active coping strategies could curb emotional eating in obese individuals high in trait anxiety.

Given prior findings linking trait anxiety to obesity (Cugini et al., 1999) and emotional eating to obesity risk (Hays & Roberts, 2008), this study suggests the need for additional research on the potential mechanisms linking these factors. A potential physiological mechanism is cortisol reactivity given that heightened cortisol has been observed in individuals with high trait anxiety (van Eck, Berkhof, Nicolson, & Sulon, 1996) and obesity, (Mussig, Remer, & Maser-Gluth, 2010) and increased cortisol responses have been associated with food intake, (Epel, Lapidus, McEwen, & Brownell, 2001; Newman, O'Connor, & Conner, 2007) although not consistently (Appelhans, Pagoto, Peters, & Spring, 2010). Future studies could help elucidate the role of cortisol and the hypothalamic–pituitary–adrenocortical axis in vulnerability to emotional eating among obese individuals with high trait anxiety. Because stress responses can be tempered by use of effective coping strategies, rather than food intake, future research should also focus on understanding which coping strategies serve as an effective means of decreasing vulnerability to emotional eating.

This study has several limitations worth noting. One possible explanation for the discrepancy between the effects of trait anxiety and trait anger on emotional eating is that the anger mood induction was less potent than the anxiety induction. Participants were asked to recall negative memories to induce anxious and angry mood states, rather than via in vivo tasks such as the Trier Social Stress task for anxiety (Kirschbaum, Pirke, & Hellhammer, 1993) or harassment during a challenging task for anger (e.g., (Burns et al., 2009); (Burns et al., 2008). However, the negative memory recall successfully increased anxiety and anger, respectively, and this procedure has been used successfully in other mood induction studies (Brewer & Doughtie, 1980); (Wright & Mischel, 1982); (Rusting & Nolen-Hoeksema, 1998). Participants reported comparable mood responses to the anxiety and anger mood inductions, which suggests that differential reactivity to the mood inductions does not

account for the differences in the associations between trait anger and trait anxiety in predicting emotional eating among the obese. A related limitation is the lack of physiological measures such as heart rate or skin conductivity to validate the subjective mood states. Although both males and females were recruited, the study sample is predominately female, especially in the obese group. The analyses controlled for sex, but replication with a more sex balanced or entirely male sample may be necessary before generalizing results to males. Another limitation is that participants did not all receive the same foods during the sham taste test, although the caloric amount was consistent. We wanted to ensure that all participants received six foods that they found highly palatable and standardizing the foods would inevitably have lead to some participants receiving foods they did not like, which would have a negative impact on intake. However, having some variability in the food choices, but keeping the total amount of calories standard would not negatively impact intake. Lastly, this study was conducted in a laboratory and thus may not represent eating behavior in a more naturalistic setting.

Results demonstrated that trait anxiety, but not trait anger, predicted emotional eating in obese individuals. While food consumption may be an effective mood-regulatory strategy in the short term, this vulnerability likely hinders weight loss attempts in obese individuals with high trait anxiety, further contributing to mood dysregulation. Addressing the vulnerability prior to a weight loss attempt may improve weight loss outcomes and mood regulation for obese individuals high in trait anxiety.

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Figure 1.
The effect of trait anxiety on calorie consumption for normal and obese individuals (n=59).

Table 1

Overall sample characteristics and split by BMI group (lean, obese)

	Variable n	Total (N=61)	Lean (n=37)	Obese (n=24)
		<i>M (SD)</i>		
Age (years)*	61	34.61 (11.37)	31.78 (10.59)	38.96 (11.36)
Body mass index *	61	27.56 (6.60)	22.79 (1.72)	34.91 (4.02)
Trait anxiety	60	38.07 (10.11)	38.19 (10.26)	37.87 (10.09)
Trait anger	59	27.46 (6.52)	26.78 (6.51)	28.52 (6.54)
Anxiety reactivity	61	7.98 (7.35)	8.24 (8.05)	7.58 (6.28)
Anger reactivity	61	15.69 (10.83)	15.30 (9.65)	16.29 (12.63)
Hunger				
Neutral mood condition	61	6.39 (2.09)	6.16 (2.25)	6.75 (1.80)
Anxiety mood condition	60	6.34 (2.29)	6.19 (2.42)	6.56 (2.10)
Anger mood condition	61	6.44 (1.90)	6.27 (2.09)	6.71 (1.57)
Food intake (kcal)				
Neutral mood condition	61	1000.23 (363.80)	995.67 (410.80)	1007.26 (284.65)
Anxiety mood induction	61	976.10 (399.86)	966.32 (423.05)	991.17 (369.57)
Anger mood induction	61	996.14 (317.47)	1008.1 (342.1)	977.64 (281.35)
		<i>n (%)</i>		
Sex *	61			
Female		45 (73.78)	24 (64.86)	21 (87.50)
Male		16 (26.22)	13 (35.14)	3 (12.50)
Ethnicity	61			
Caucasian		50 (82.0)	29 (78.4)	21 (87.5)
African-American		6 (9.8)	4 (10.8)	2 (8.3)
Asian, Pacific Islander		4 (6.6)	3 (8.1)	1 (4.2)
Multi-ethnic		1 (1.6)	1 (2.7)	0 (0.0)

* p<.05 for differences between lean and obese