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Clinical Psychological Science published online 24 October 2014
DOI: 10.1177/2167702614548891

Empirical Article

Clinical Psychological Science
1–14

DOI: 10.1177/2167702614548891
cpx.sagepub.com

Negative Social-Evaluative Fears Produce Social Anxiety, Food Intake, and Body Dissatisfaction: Evidence of Similar Mechanisms Through Different Pathways

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Abstract

Social anxiety and eating disorders are highly comorbid, which suggests there are shared vulnerabilities that underlie the development of these disorders. Two proposed vulnerabilities are fear of negative evaluation and social appearance anxiety (i.e., fear of negative evaluation regarding one's appearance). In the current experimental study (N = 160 women), we measured these fears (a) through a manipulation comparing fear conditions, (b) with trait fears, and (c) with state fears. Results indicated that participants assigned to the fear of negative evaluation condition increased food consumption, whereas those assigned to the social appearance anxiety condition and high in trait social appearance anxiety experienced the highest amounts of body dissatisfaction. Participants in the fear of negative evaluation and social appearance anxiety conditions experienced elevated social anxiety. These results support the idea that negative-evaluation fears are shared vulnerabilities for eating and social anxiety disorders, but that the way these variables exert their effects may lead to disorder-specific behaviors.

Keywords

social anxiety, eating disorders, body dissatisfaction, fear of negative evaluation, social appearance anxiety

Received 11/18/13; Revision accepted 8/1/14

Eating disorders and anxiety disorders are highly comorbid; more than 45% of patients with eating disorders also meet criteria for at least one type of anxiety disorder (e.g., Pallister & Waller, 2008). Of all the anxiety disorders, social anxiety disorder has the highest prevalence in individuals with eating disorders (e.g., Godart, Flament, Lecrubier, & Jeammet, 2000), and individuals with social anxiety disorder are also likely to meet criteria for an eating disorder (Becker, DeViva, & Zayfert, 2004). However, it is currently unclear what accounts for this high level of comorbidity. Pallister and Waller (2008) suggested that these two disorders may share vulnerabilities. An accumulation of correlational research studies has suggested that two *negative social evaluative fears*, namely, *fear of negative evaluation* (FNE) and *social appearance anxiety* (SAA), may be sources of such underlying shared vulnerability (e.g., Gilbert & Meyer, 2005; Levinson et al., 2013).

Negative Social Evaluative Fears, Social Anxiety, and Disordered Eating

FNE is the fear that one will be negatively judged and rejected because of that judgment. SAA, in contrast, is the fear that one will be negatively judged specifically on characteristics of one's appearance (Hart et al., 2008). Researchers have shown that these fears are highly correlated, yet distinct, constructs (Hart et al., 2008; Levinson & Rodebaugh, 2011).

In the literature on social anxiety, FNE is understood as a cognitive vulnerability for, or core feature of, social anxiety (Haikal & Hong, 2010; Heimberg, Brozovich, &

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Rapee, 2012). Heimberg et al. (2012) outlined a model in which social anxiety stems from heightened FNE in social situations that have the potential for the individual to be evaluated (e.g., giving a speech). Indeed, multiple studies have suggested that individuals high in FNE are likely to feel and exhibit more anxiety in a social evaluative situation (e.g., Haikal & Hong, 2010). FNE has also been linked to disordered eating attitudes and behaviors. Cross-sectionally, FNE predicts drive for thinness (Gilbert & Meyer, 2003; Levinson & Rodebaugh, 2012), prospectively predicts increases in bulimic symptoms (Gilbert & Meyer, 2005; Hamann, Wonderlich-Tierney, & Vander Wal, 2009), and increases the amount of variance in bulimia that the dual-pathway model of bulimia is able to predict (DeBoer et al., 2013; Utschig, Presnell, Madeley, & Smits, 2010). Overall, research has shown that FNE has a clear link with both social anxiety and disordered eating.

SAA (i.e., FNE specifically of one's appearance) is a unique construct that is highly related to social anxiety and disordered eating (Hart et al., 2008; Levinson & Rodebaugh, 2011, 2012). Individuals with a diagnosis of bulimia nervosa have significantly higher levels of SAA than do healthy control participants (Koskina, Van den Eynde, Meisel, Campbell, & Schmidt, 2011). In nonclinical samples, SAA predicts social anxiety over and above neuroticism, depression, negative affect, extraversion, body dissatisfaction, self-esteem, and trait anxiety (Hart et al., 2008; Levinson & Rodebaugh, 2011). In addition, we have shown that SAA predicts disordered eating and body dissatisfaction over and above depression, perfectionism, social-interaction anxiety, fear of scrutiny, FNE, body mass index, and fear of positive evaluation (Levinson & Rodebaugh, 2012; Levinson et al., 2013). In fact, SAA and FNE were the only two social anxiety constructs that were unique predictors of disordered eating in those studies (Levinson & Rodebaugh, 2012; Levinson et al., 2013). Specifically, SAA appears to have a robust relationship with body dissatisfaction, a correlate of disordered eating (Levinson & Rodebaugh, 2012).

Shared Vulnerabilities

The evidence suggests that SAA and FNE are important constructs for both social anxiety and disordered eating. In recent research, we tested these negative social evaluative fears in a single model of comorbidity. We demonstrated that a vulnerability model, in which both SAA and FNE were risk factors for social anxiety and disordered eating, fit the data better than did a model in which these fears were mediators between social anxiety and disordered eating, thereby preliminarily suggesting that these risk factors should be conceptualized as shared vulnerabilities (Levinson & Rodebaugh, 2012). We replicated this vulnerability model in two additional samples while controlling for perfectionism, negative affect, depression, and body mass index (Levinson et al., 2013). However, to the best of our knowledge, SAA has not been explicitly manipulated in an experimental design that tests whether SAA affects food intake, correlates of disordered eating (such as body dissatisfaction), and social anxiety. Furthermore, FNE and SAA have been examined simultaneously in cross-sectional correlational work but not in an experimental design.

The Current Study

This study is the first to experimentally manipulate FNE and SAA to test, beyond self-report alone, whether these two negative social evaluative fears produce social anxiety and correlates of disordered eating (e.g., food intake, state body dissatisfaction). We tested whether an experimental manipulation of FNE and SAA (a modified speech task explained in the Procedure section) affected food intake, state body dissatisfaction, and social anxiety. We also assessed negative social evaluative fears and tested state levels of negative social evaluative fears as potential mechanisms.

We examined in-vivo eating behaviors (a) because previous research has shown that in-vivo eating behaviors are highly related to incidence of eating disorders (i.e., dieting; e.g., Patton, Selzer, Coffey, Carlin, & Wolfe, 1999; Weinstein, Shide, & Rolls, 1997) and (b) to serve as a proxy for disordered eating, given that it has been proposed that disordered eating may consist of entrenched eating habits (Walsh, 2013). Furthermore, researchers recently have conceptualized eating disorders as disorders of over- or undercontrol (Wildes et al., 2011), which suggests that individuals with disordered eating either fail to exhibit self-control or exhibit excessive self-control. Therefore, we conceptualized food intake in the laboratory as a behavioral expression of over- or undercontrolled eating evoked by negative social evaluative fears elicited by the manipulation. On the basis of prior literature, we expected that the negative social evaluative fears would affect food intake and body dissatisfaction differently.

We specifically hypothesized that FNE would relate to overeating because self-reported trait FNE has been shown to relate to drive for thinness, bulimic symptoms, and negative affect (e.g., Gilbert & Meyer, 2005; Kotov, Watson, Robles, & Schmidt, 2007). Furthermore, in most experimental manipulations of stress, participants exhibit increased (rather than decreased) food intake (Laessle & Schulz, 2009; Stroud, Tanofsky-Kraff, Wilfley, & Salovey, 2000). Given that stress may lead to negative affect (e.g., Watson, 1988), which has been shown to result in increased bulimic behaviors (e.g., Goldschmidt et al.,

2014; Stice, 2001; Stice & Agras, 1998), we expected FNE to relate to increases in food intake. That is, we expected FNE to increase food intake because (a) the construct has shown a specific relationship with bulimic behaviors, which are characterized by periodic, excessive food intake related to both stress and negative affect; and (b) the construct may represent a source of stress in general, which has also been shown to increase food intake.

Our research has suggested that trait SAA is robustly related to body dissatisfaction (Levinson et al., 2013; Levinson & Rodebaugh, 2012), but it is not as strongly related to bulimic symptoms or binge eating (Ostrovsky, Swencionis, Wylie-Rosett, & Isasi, 2013). What is less clear on the basis of previous research is how SAA should relate to level of food intake: The limited relationship with binge eating might imply that this construct should not increase level of food intake. Indeed, it seems plausible to us that when judgment concerns arise that focus specifically on one's appearance, an individual may engage temporarily in particularly high levels of controlled eating because attention is directed toward one's appearance (and, therefore, higher SAA may be related to decreased food intake).

Therefore, we had four main hypotheses stemming from these previous findings. First, FNE (both the experimental condition and the trait) would predict increased food intake during the experiment. Second, SAA would predict increased body dissatisfaction. Third, both conditions and traits (FNE and SAA) would produce increased social anxiety. Fourth, individuals high in trait levels of FNE or SAA would be more sensitive to corresponding, trait-relevant state manipulations (e.g., an interaction between trait and condition) and, therefore, to their consequences (e.g., body dissatisfaction). Finally, we planned to conduct post hoc analyses to test the potential mechanisms related to food intake on the basis of the results of the current study. As described later, results of our a priori tests led us to hypothesize, post hoc, that state FNE would increase food intake, whereas state SAA would decrease food intake.

Method

Participants

Participants were 160 undergraduate women who participated in exchange for course credit. College women are an ideal population for this experiment because they are a high-risk sample for the development of an eating disorder and are likely to place particular emphasis on their appearance and how it is viewed by others (Taylor et al., 2006). Indeed, participants' disordered eating scores (as measured by the Eating Disorder Inventory–2; Garner, Olmsted, & Polivy, 1983) ranged from very low to very high. Scores ranged from 0 to 19 on the Drive for Thinness subscale (M = 4.22, SD = 4.55; 5% scored at or above the mean of a clinical sample of women with eating disorders from Garner et al., 1983), from 0 to 15 on the Bulimia subscale (M = 1.52; SD = 2.60; 5.1% scored in the clinical range), and from 0 to 27 on the Body Dissatisfaction subscale (M = 7.04, SD = 5.84; 10% scored in the clinical range). In addition, participants' social anxiety scores (as measured by the Straightforward Social Interaction Anxiety Scale; Mattick & Clarke, 1998; Rodebaugh et al., 2011) ranged from very low (0) to very high (65), with a mean score of 25.00. A total of 32.9% of participants scored above 28, which has been suggested as a cutoff score for probable social anxiety disorder (Rodebaugh et al., 2011). Participants were mostly White (n = 111, 69.4%). Other races/ethnicities reported were Asian (n = 23, 14.4%), Black (n = 9, 5.6%), Hispanic (n = 6, 3.8%), and multiracial (n = 10, 6.3%); 1 participant reported ethnicity as not listed. Participants had a median age of 19.01 (SD = 1.10), and most participants were in their 1st year of undergraduate school (M = 1.70, Mdn = 1.00, SD = 0.95).

Self-report measures

Trait FNE was measured with the Brief Fear of Negative Evaluation Scale (BFNE; Leary, 1983), which is a 12-item version of the original Fear of Negative Evaluation Scale (Watson & Friend, 1969). The items assess FNE, which has been theorized to be a central component of, or vulnerability factor for, social anxiety disorder (Heimberg et al., 2012). An example item is "I am usually worried about what kind of impression I am making on someone." Scores on the BFNE have been shown to correlate with other measures of social anxiety and to have excellent psychometric properties when the four reverse-scored items are excluded, as they were here (Rodebaugh et al., 2004). This measure was used to assess trait FNE, given that research has shown that FNE is a genetically based, moderately heritable, trait (Stein, Jang, & Liveslay, 2002). Internal consistency in this sample was excellent (α = .91).

Trait SAA was measured with the Social Appearance Anxiety Scale (SAAS; Hart et al., 2008), which is a 16-item measure developed to assess anxiety about being negatively evaluated by others because of one's overall appearance, including body shape. Research on the psychometric properties of the SAAS has demonstrated high test-retest reliability, good internal consistency, good factor validity, incremental validity (e.g., it was a unique predictor of social anxiety above and beyond negative body-image indicators), and divergent validity (Hart et al., 2008; Levinson & Rodebaugh, 2011). An example item from the SAAS is "I am concerned people would not

like me because of the way I look." This measure was used to assess trait SAA. Internal consistency in this sample was excellent ($\alpha = .94$).

State social anxiety was measured with the Subjective Units of Distress Scale (SUDS; Wolpe, 1988), which is a behavioral measure often used during exposure treatment and behavioral assessment to measure anxiety. The SUDS has been shown to be a valid and reliable measure of state social anxiety (Kaplan, Smith, & Coons, 1995). SUDS ratings can range from 0 (*completely calm*) to 100 (*highest anxiety*). Other reference points used in this study include 25 (*noticeable, but not bothersome anxiety*), 50 (*bothersome anxiety*), and 75 (*very bothersome anxiety*). These anchors were based on treatment materials for social anxiety disorder (Hope, Heimberg, Juster, & Turk, 2000). The SUDS was used to gain measures of state social anxiety before and after the speech manipulation (explained in the Procedure section).

State body dissatisfaction was measured with the Eating Disorder Inventory–2 (Garner et al., 1983), which is a 91-item self-report questionnaire designed to measure psychological features commonly associated with anorexia nervosa and bulimia nervosa. It has been shown to have good internal consistency and good convergent and discriminant validity (Garner et al., 1983) and is frequently used by clinicians for the assessment of eating-disorder symptoms (Brookings & Wilson, 1994). In the current study, the 9-item Body Dissatisfaction subscale was adapted so that the directions asked for the participant to rate the given behaviors "based on how you feel right now." An example item is "I think my stomach is too big." The Body Dissatisfaction subscale includes items that assess dissatisfaction with overall body shape as well as the size of specific regions of the body, such as hips, stomach, and thighs. Internal consistency in this sample was excellent ($\alpha = .91$).

Hunger was measured with one item that assesses current hunger level on a 7-point scale ranging from 1 (*not at all*) to 7 (*extremely*; as used in Oliver, Wardle, & Gibson, 2000).

Eating behaviors were measured with pretzels, M&M's, potato chips, and dried fruit in bowls, which were weighed in grams with an Eat Smart Precision Pro food scale before and after participants were given the opportunity to snack from each bowl, which created a measure of grams of food eaten (Wallis & Hetherington, 2009). We used grams of food consumed, given that this measurement has been used in previous research with similar manipulations that tested the impact of stress on food intake and that we sought to be consistent with previous research (e.g., Heatherton, Herman, & Polivy, 1992; Oaten, Williams, Jones, & Zadro, 2008; Oliver et al., 2000). We also report mean levels of food intake in calories.

State SAA, state FNE, and state stress were measured with the manipulation check measure. An adapted measure of SAA, FNE, and stress was administered at the end of the speech. This measure was adapted from the trait versions of the BFNE and SAAS and from the Stress subscale of the Depression Anxiety Stress Scale (Lovibond & Lovibond, 1995) and used the same items except that items were reworded to ask about the current time (i.e., how participants were feeling right now). This measure was intended to test whether individuals in each condition were experiencing the corresponding state construct (i.e., individuals in the FNE condition should score higher on the measure of state FNE than on the measure of SAA). There are two different sections of this measure. Section 1 asks participants to rate how they are feeling right now. This section creates subscales of general state FNE ($\alpha = .96$), SAA ($\alpha = .91$), and stress ($\alpha = .91$). Section 2 asks participants to rate how they felt during the speech. This section creates subscales of state FNE ($\alpha = .93$), SAA ($\alpha = .94$), and stress ($\alpha = .85$) during the speech.

Procedure

This study was approved by the institutional review board of Washington University in St. Louis. Participants took part in a one-session, 1.5-hr experiment that was advertised as an experiment about personality and behavior. Participants were asked to eat normally the day before the experiment and to not eat for the hour before their participation. Compliance was verified at the end of the experiment, and when data were analyzed without noncompliers ($n = 3$), there were no substantive changes to results. After participants provided consent, we asked them to complete a short questionnaire packet that consisted of the trait measures described earlier. The experimenter explained the SUDS scale and then explained the speech task. Participants were given a list of speech topics from which they could choose to prepare their speech and were given 2 min to prepare the speech. Speech topics were randomly distributed across conditions and did not affect levels of anxiety or body dissatisfaction (ps > .90). Speeches were on a range of topics, such as hobbies, vacations, and cultural diversity (all topics are available on request from the first author). Participants were asked to fill out the Time 1 measures of state anxiety and body dissatisfaction before beginning the speech (but after preparation). Participants then gave a 6-min speech in one of three conditions, which are described in detail in the following section. All participants received the same directions at the end of the speech ("Please stop speaking. Okay, that's the end of the speech. You can sit down now.") and then completed postspeech questionnaires. Questionnaires were provided in all conditions

at the same time (i.e., before the speech and after the speech). In the FNE and control conditions, experimenters provided the first questionnaires before the speech, collected them, and left the room. At the end of the speech, participants filled out Time 2 measures of state anxiety and body dissatisfaction and the manipulation check measure.

FNE, SAA, and control conditions. Participants were randomly assigned to one of three conditions that used a speech task to elicit (a) FNE (n = 52), (b) SAA (n = 55), or (c) stress (n = 53) associated with speaking (control). The goal of the manipulation was for participants in the FNE condition to experience high levels of state FNE, whereas participants in the SAA condition should experience high state SAA (and may also experience high state FNE because SAA is a specific form of FNE). Participants assigned to the FNE condition were instructed to treat the audio recorder as the audience and told that their speech would be audio recorded and rated later for quality and content of their performance. This speech should theoretically elicit fears of negative evaluation only (and not appearance evaluation) because evaluation was based on audio information only. Experimenters did not sit in with the participants in this condition, to avoid any indication of appearance evaluation.

Participants assigned to the SAA condition were instructed to treat the experimenter and the two cameras as an audience. They were told that their speeches would be rated later specifically on physical appearance of the speaker during the speech. This speech should theoretically elicit fears specific to appearance evaluation. Participants assigned to the control condition were instructed to give a speech but were not told that they would receive any evaluation (nor was the speech recorded—they gave the speech to an empty room). This condition should control for stress and elicit anxiety related to preparing and giving a speech but should not specifically elicit FNE or SAA because there was no observation or recording of the speech.

Eating behavior dependent variable. Pretzels, M&M's, potato chips, and dried fruit were given to participants in bowls after completion of the Time 2 packet. We gave several types of food to ensure there was food available for all possible food taste preferences. Each bowl was weighed before it was left in the room with the participant and again after it was retrieved from the room to assess total grams of food ingested. Participants were also given a bottle of water that was weighed before and after consumption; however, results using water as a dependent variable are not reported here for conciseness. After the speech, the experimenter brought the food into the room and told the participant,

> I have to go shut down the equipment and prepare for the last part of the session. It takes a little while for me to get ready, so there are snacks and water to eat and drink and magazines to look at while I am getting ready. I will be back in a few minutes.

The experimenter then left the room, and participants were left with the food and water for 10 min, during which they were permitted to eat and drink as they wished. Participants were also given magazines (brought into the room at the same time as the food) to read while the experimenter was gone.

Post hoc analyses. Post hoc structural equation modeling analyses were conducted using Mplus Version 7 (Muthén & Muthén, 1998–2012). We used the Satorra-Bentler chi-square (maximum likelihood mean adjusted) estimator, which estimates standard errors and a mean-adjusted chi-square test statistic that are robust to nonnormality. The number of participants with complete data for related analyses dropped to 158 because of missing data on questionnaires for 2 participants, which is less than 5% of the sample. Therefore, listwise deletion was used with these cases. Model fit was evaluated using the (a) comparative fit index (CFI; Bentler, 1990), (b) Tucker-Lewis incremental fit index (TLI; Tucker & Lewis, 1973), (c) root-mean-square error of approximation (RMSEA; Steiger & Lind, 1980), and (d) standardized root-mean-square residual (SRMR; Bentler, 1990). The magnitudes of these indices were evaluated with the aid of recommendations by Hu and Bentler (1999). Essentially, for the CFI and TLI, values of .90 and above were considered adequate, whereas values of .95 or above were considered very good; for the RMSEA and SRMR, values of .08 and below were considered adequate and values of .05 or less were considered very good. For the CFI, TLI, and RMSEA, we used the Swain correction factor for small samples implemented in the RGui to account for the moderate size of the sample (Boomsma & Herzog, 2013). After establishing an acceptable model fit, we tested for mediation. A bootstrap analysis was conducted to test for indirect effects. As recommended by Hayes (2009), 5,000 draws were implemented.

Results

Descriptive statistics, zero-order correlations, and transformations

Food intake (measured in grams) was nonnormally distributed and, therefore, was transformed using a square-root transformation for analyses. On average, participants consumed 32.95 grams or 134 calories (range = 0–539 calories), which, if eaten daily in excess of calories

Table 1. Zero-Order Correlations and Descriptive Statistics for Measures

Measure	1	2	3	4	5	6	7	8	*M*	*SD*
1. Trait FNE	.91								22.49	7.10
2. Trait SAA	.59***	.94							31.3	12.83
3. Total grams	–.06	–.10							32.95	23.87
4. State social anxiety	.28***	.42***	–.06	.90					70.56	31.29
5. State BD	.44***	.57***	–.06	.31***	.91				54.05	18.12
6. State stress	.33***	.47***	–.09	.62***	.54***	.91			10.97	4.82
7. State FNE	.46***	.53***	.05	.48***	.54***	.64***	.96		14.42	6.19
8. State SAA	.49***	.69***	–.10	.50***	.66***	.65***	.79***	.91	12.29	4.97

Note: Cronbach's alphas are shown on the diagonal. Mean total calories consumed was 134.65 (*SD* = 101.79). FNE = fear of negative evaluation; SAA = social appearance anxiety; Total grams = total grams of food intake (total grams of food consumed are non-square-root transformed); BD = body dissatisfaction.
***$p < .001$.

expended, would lead to approximately 14.5 pounds of weight gained per year. There were no significant differences between conditions on hunger level, $F(2, 157) = 1.79$, $p = .170$. Condition was dummy coded into two variables for use in multiple regression. In the remaining analyses, we refer to the first dummy variable (FNE = 1, SAA and control = 0) as Group 1 (G1-FNE) and the second dummy variable (SAA = 1, FNE and control = 0) as Group 2 (G2-SAA). G1-FNE compares participants who received the FNE manipulation with participants who received all other manipulations, and G2-SAA compares participants who received the SAA manipulation with participants who received all other manipulations.

Table 1 presents descriptive statistics and intercorrelations among the measures and shows that both trait SAA and trait FNE were positively correlated with state social anxiety and state body dissatisfaction, but not with grams of food consumed. Table 2 presents the means and standard deviations of all variables by condition and shows that participants in the FNE condition ate significantly more food than did those in the other two conditions (SAA and control), whereas participants in the SAA condition experienced higher body dissatisfaction than did those in the control and FNE conditions. Participants in the SAA condition experienced higher state social anxiety than did those in the FNE and control conditions. There were no significant differences by condition in trait FNE or SAA.

Manipulation check: What state fears were experienced in each condition?

Recall that the goal of the manipulation was to evoke state FNE, state SAA, and state stress during the speech. We tested whether there were different levels of state fears during the speech dependent on condition. A multivariate analysis of variance across conditions indicated that there was a significant multivariate effect on state stress, SAA, and FNE during the speech, $F(3, 155) = 9.753$, $p < .001$, Wilks's $\lambda = .71$, $\eta_p^2 = .16$. Follow-up pairwise comparisons indicated that there were significant differences in state FNE between the participants in the FNE and control conditions, as hypothesized. Also as hypothesized, there were no significant differences in state SAA

Table 2. Levels of State and Trait Constructs by Condition

Condition	State stress	State FNE	State SAA	Total grams	Calories	State body dissatisfaction	State social anxiety	Trait FNE	Trait SAA
FNE	5.69 (2.53)	8.12_{a} (3.04)	3.73 (1.50)	37.69_{a} (22.26)	152.92_{a} (94.97)	49.94 (17.18)	68.41 (27.09)	22.16 (6.81)	29.31 (11.96)
SAA	$7.32_{a,b}$ (2.99)	9.32_{a} (3.82)	$6.80_{a,b}$ (2.97)	32.02 (24.51)	132.03 (111.04)	$59.96_{a,b}$ (19.99)	$82.24_{a,b}$ (35.08)	23.81 (7.41)	34.38 (14.89)
Control	5.19 (2.73)	6.89 (3.46)	4.64 (2.66)	29.26 (24.42)	118.43 (96.87)	51.86 (15.40)	60.58 (27.31)	21.40 (6.96)	30.21 (10.85)

Note: The table presents means for each measure. Standard deviations are shown in parentheses. State stress, state FNE, and state SAA levels reflect how participants felt during the speech presentation. Values with the subscript *a* are significantly ($p < .05$) different from the control condition; values with the subscript *b* are significantly ($p < .05$) different from the FNE condition. For total grams, means reported are non-square-root-transformed amounts. Significance tests were computed with transformed variables to improve normality. FNE = fear of negative evaluation; SAA = social appearance anxiety.

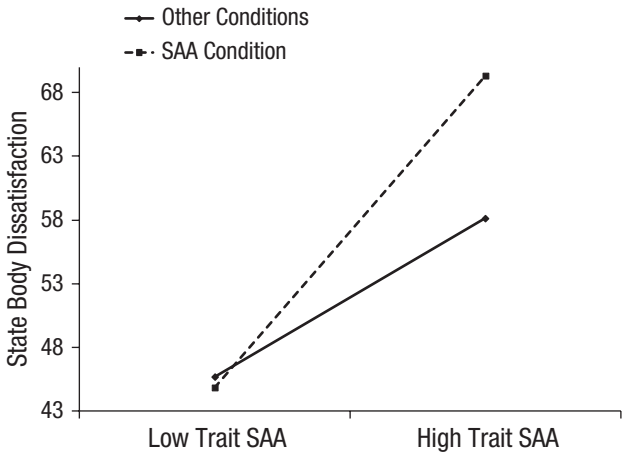

Fig. 1. Results: state body dissatisfaction as a function of condition and trait social appearance anxiety (SAA).

between participants in the FNE and control conditions. Comparisons of participants in the SAA and control conditions showed that there were significant differences in both state SAA and state FNE. However, there was no difference in state FNE among participants assigned to the FNE and SAA conditions (partially as expected; see Table 2).

Overall, these results indicate that the manipulation successfully increased state SAA and state FNE in each corresponding condition. Compared with participants assigned to the control condition, those assigned to the FNE condition experienced increased FNE and those assigned to the SAA condition experienced increased SAA. Consistent with the definition of *SAA* as a specific FNE of appearance, results showed that participants in the SAA condition experienced heightened state FNE (in addition to state SAA), thereby suggesting that manipulating SAA increases both state FNE and state SAA.

Does FNE increase food intake?

To test both the first hypothesis, that trait FNE or participants who experienced the FNE condition would increase food intake, and the fourth hypothesis, that an interaction between condition and trait FNE would increase food intake, we used multiple regression. Each of the dummy-coded condition variables (G1-FNE and G2-SAA), trait FNE, and the interaction between condition (G1-FNE and G2-SAA) and trait FNE were entered into multiple regression. As hypothesized, there was a significant main effect of G1-FNE, such that G1-FNE was associated with increased food intake relative to the other two conditions, partial $r = .16$, $b^* = 0.19$, $p = .044$. There was no significant main effect of trait FNE, partial $r = -.11$, $b^* = -0.19$, $p = .168$. There was no significant interaction between trait FNE and condition predicting total food intake (ps > .238). These results remained unchanged when hunger was included as a covariate and moderator variable; there was also a main effect of hunger on food intake, partial $r = .26$, $b^* = 0.26$, $p < .001$.

Does SAA predict state body dissatisfaction?

Next, we tested the second and fourth hypotheses that trait SAA, G2-SAA, and the interaction between G2-SAA and trait SAA would predict state body dissatisfaction after the speech. There was a significant main effect of G2-SAA, partial $r = .17$, $b^* = 0.14$, $p = .039$, and trait SAA, partial $r = .20$, $b^* = 0.35$, $p = .011$. Both of these main effects were qualified by the hypothesized interaction between trait SAA and G2-SAA, partial $r = .16$, $b^* = 0.23$, $p = .045$. As shown in Figure 1, participants who were in G2-SAA and high in trait SAA exhibited the highest levels of state body dissatisfaction.

Do both FNE and SAA produce state social anxiety?

To test the third and fourth hypotheses, we conducted two regression analyses. First, we tested whether G1-FNE and trait-level FNE (and potentially the interaction of G1-FNE and trait FNE) would predict state social anxiety. In accordance with the hypothesis, both G1-FNE, partial $r = .26$, $b^* = 0.30$, $p < .001$, and trait FNE, partial $r = .25$, $b^* = 0.24$, $p < .001$, predicted state social anxiety. The interaction between condition and trait FNE was not significant ($p = .298$). Finally, we tested the hypothesis that G2-SAA and trait SAA would predict state social anxiety. In accordance with the hypothesis, both G2-SAA, partial $r = .25$, $b^* = 0.26$, $p < .001$, and trait SAA, partial $r = .16$, $b^* = 0.30$, $p = .043$, predicted social anxiety. However, the interaction was not significant ($p = .323$).

Post hoc analyses: What increases versus decreases food intake?

Hypotheses. We noted that results were consistent with the hypotheses overall but also noted an interesting paradox in the findings: Although the FNE condition, which led to increased state FNE, led to increased food intake, the SAA condition, which also led to increased state FNE, did not lead to increased food intake. We speculated that state levels of FNE and SAA might carry opposing indirect effects of condition or trait levels of FNE and SAA on food intake. That is, we hypothesized, on the basis of the initial findings, that participants might increase food intake when they experience increased levels of state FNE, but that when they experience concurrently increased state levels of SAA, they may decrease food intake. This

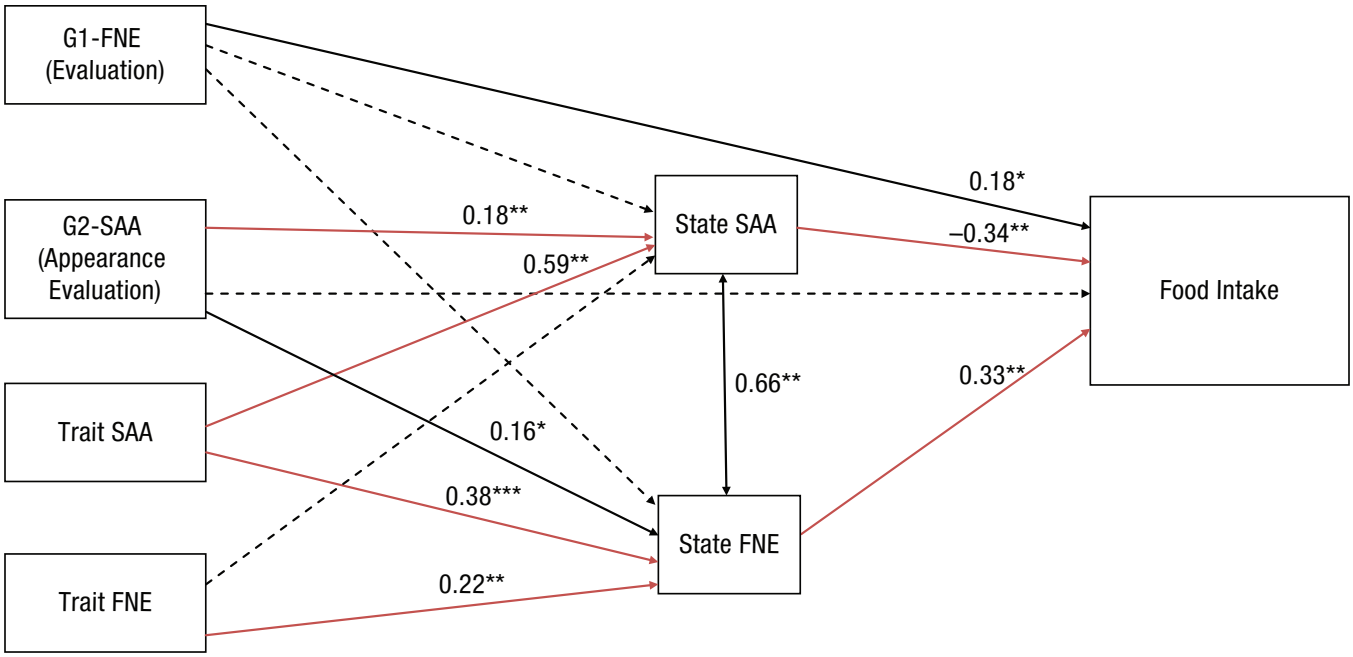

Fig. 2. Mediation model showing the effect of condition (G1-FNE and G2-SAA) and trait-level fears (SAA and FNE) on food intake as mediated by state-level fears (SAA and FNE). All effect sizes are direct effects. Significant paths are bolded, nonsignificant paths are dashed, and pathways through which there are significant indirect effects through state SAA and state FNE are red. Bolded values show that state SAA decreases food intake, whereas state FNE increases food intake. The value between state SAA and food intake is negative, which shows that high state SAA decreases food intake from the group mean. When the direct paths from trait SAA and trait FNE on food intake are included, they are nonsignificant (when df = 0). G1-FNE = participants coded as 1 for FNE condition and 0 for SAA and control conditions; G2-SAA = participants coded as 2 for SAA condition and 0 for FNE and control conditions; SAA = social appearance anxiety; FNE = fear of negative evaluation. Asterisks indicate significant paths (*p < .05, **p < .01).

hypothesis would explain why participants consumed higher grams of food when FNE was primed and SAA was not (as for participants in G1-FNE), but not when FNE and SAA were both primed (as for participants in G2-SAA). It may be that FNE initially increases the urge to eat but that when one also feels evaluated specifically on one's appearance (in addition to experiencing general FNE), this urge decreases because thoughts are directed toward one's appearance and how to regulate (potentially by decreasing food intake) appearance-evaluation concerns.

Model. We tested a model including food intake, state SAA, state FNE, G1-FNE, G2-SAA, trait FNE, and trait SAA. Our primary model did not include any interactions because in multiple regression, there were no significant interactions predicting food intake. We also tested a fully saturated model that included all of the listed variables in addition to all interactions.

Model fit. Model fit was excellent, df = 2, CFI = 1.00, TLI = 1.00, RMSEA = .00, SRMR = .01. When we used the Swain correction for small sample size, model fit remained excellent, CFI = 1.00, TLI = 1.00, RMSEA = 0.00 (see Fig. 2 for the hypothesized mediation model and path estimates). We also tested a fully saturated model that included all paths and potential interactions, which by definition had perfect fit, df = 0, CFI = 1.00, TLI = 1.00, RMSEA = .00, SRMR = .00. There were no substantive changes to results when all paths were included (i.e., all main and indirect effects reported in Table 3 and Fig. 2 remained significant).

Indirect effects: Testing for mechanisms. Table 3 presents a summary of all indirect effects, confidence intervals, and p values. As hypothesized, there was a significant indirect effect from G2-SAA to food intake through state SAA, such that G2-SAA indirectly decreased food intake through heightened state SAA. Furthermore, there was a significant indirect effect from trait SAA to food intake through state FNE and through state SAA. It is notable the direct effects from state FNE and state SAA on food intake were in opposing directions, such that increases in state FNE increased food intake, whereas increases in state SAA decreased food intake. In each case, increasing state SAA would predict lower food intake: For example, the tendency for higher trait SAA to lead to increased state SAA, particularly in the G2-SAA condition, would result in lowered food intake. Finally, there was a marginally significant indirect effect from trait FNE to food intake through state FNE.

Table 3. Summary of Indirect Effects From Trait Social Appearance Anxiety (SAA), Trait Fear of Negative Evaluation (FNE), G1-FNE, and G1-SAA

Indirect effect	*b*	95% confidence interval
From G1-FNE to food intake		
G1-FNE to state FNE to food intake	–0.06	[–0.297, 0.174]
G1-FNE to state SAA to food intake	0.07	[–0.128, 0.277]
From G2-SAA to food intake		
G2-SAA to state FNE to food intake	0.28	[–0.041, 0.651]
G2-SAA to state SAA to food intake	–0.32	**[–0.581, –0.054]**
From trait FNE to food intake		
Trait FNE to state FNE to food intake	0.03	*[0.00, 0.048]*
Trait FNE to state SAA to food intake	–0.01	[–0.032, 0.009]
From trait SAA to food intake		
Trait SAA to state FNE to food intake	0.03	**[0.007, 0.041]**
Trait SAA to state SAA to food intake	–0.04	**[–0.061, –0.017]**

Note: G1-FNE = participants coded as 1 for FNE condition and 0 for SAA and control conditions; G2-SAA = participants coded as 2 for SAA condition and 0 for FNE and control conditions. Boldface confidence intervals are significant at $p < .05$; italic confidence intervals are significant at $p < .10$.

Can SAA be manipulated without manipulating FNE?

Given the results of the main four hypotheses tested, we noted that the experimental manipulation proved unable to manipulate SAA without also manipulating FNE. To investigate this issue further, we conducted a follow-up analysis to test to what extent it was possible to experience FNE without SAA and vice versa in these conditions. To do so, we tested the correlation between FNE and SAA across conditions via multiple regression. There was a significant interaction between condition and state FNE predicting state SAA (partial $r = .33$, $b^* = 0.28$, $p < .001$). We probed this interaction and determined that in the SAA condition, there was a high correlation ($r = .71$) between state SAA and FNE. In contrast, in the FNE and control conditions, this correlation was lower ($rs = .32$ and .64, respectively), which suggests that there was a lower correlation between FNE and SAA when participants experienced overall evaluation not focused on appearance, but that this correlation was much higher when participants experienced appearance evaluation. That is, the results suggest that when appearance is evaluated, the relationship between FNE and SAA is magnified, whereas when FNE is primed for factors other than appearance, the relationship between FNE and SAA is not as strong.

Discussion

Overall, results suggest that both FNE and SAA are important negative social evaluative fears in the context of social anxiety, food intake, and body dissatisfaction. We observed three major results: (a) experimental manipulation of FNE increased food intake, (b) experimental manipulation of SAA in participants with a preexisting tendency toward it increased body dissatisfaction, and (c) in terms of both individual differences and experimental manipulations, FNE and SAA each independently increased social anxiety.

These results support the idea that the negative social evaluative fears affect social anxiety, body dissatisfaction, and food intake, but they do so in somewhat different ways. Specifically, we found that the pathways through which these mechanisms produce symptoms may differ. For example, individuals who were vulnerable to worrying about negative evaluation regarding their appearance and who then experienced an appearance-evaluative condition were likely to experience high state body dissatisfaction. That is, both a trait vulnerability and environmental condition increased body dissatisfaction. In contrast, participants experienced heightened social anxiety in either evaluative condition or if they had high levels of the evaluation traits, but the environment did not interact with the trait. In other words, body dissatisfaction may be particularly high if a negative appearance-evaluation vulnerability and an environment highly focused on appearance are present, whereas social anxiety may develop if only one of these is present. Furthermore, participants who were told they would be evaluated on their content and performance of their speech, but were not evaluated on their appearance (and, therefore, were experiencing heightened state FNE but not heightened state SAA), increased food intake versus participants in the other two conditions. This effect was not dependent on trait-level FNE (e.g., there was no interaction between trait and condition).

State body dissatisfaction versus state social anxiety

Although preliminary, these results may in part explain why some individuals develop only social anxiety disorder, whereas others develop both social anxiety disorder and an eating disorder. It may be that disordered eating (in addition to social anxiety disorder) develops if both of these variables (trait SAA and an appearance-evaluative environment) are present, whereas social anxiety disorder may develop if either pathway is present in isolation. For example, individuals may develop social anxiety disorder when one of many conditions exists: an environment that evokes evaluation fears (either FNE or SAA) or when individuals are vulnerable to high levels of the negative-evaluation traits. The notion that eating disorders may stem from a combination of traitlike vulnerability and environmental exposure to risk factors is consistent with the sociocultural model of bulimia nervosa that suggests that sociocultural factors contribute serious risk for the development of bulimia (Stice, 1994). In this case, an appearance-evaluative environment may be a sociocultural factor affecting body dissatisfaction, and a tendency to experience SAA may be a vulnerability that interacts with such an environment. Similarly, this hypothesis is consistent with theory that has suggested that there are multiple risk factors that interact with each other that precede the development of eating disorders, such as weight concern, low self-esteem, and disturbance in interpersonal relationships (Wilfley, Pike, & Striegel-Moore, 1997) and that critical comments about eating and weight are one of the most potent risk factors for the development of disordered eating and body dissatisfaction (Jacobi et al., 2011).

Body dissatisfaction is a well-established risk factor for eating disorders, especially bulimia nervosa (Attie & Brooks-Gunn, 1989; Killen et al., 1996; Stice & Shaw, 2002), and is sometimes thought of as the prodromal stage of development of an eating disorder (Stice, Ng, & Shaw, 2010). It may be that during an extended period of time, individuals who have elevated trait SAA and are in highly appearance-evaluative environments develop higher body dissatisfaction, which then leads to the development of an eating disorder. To the best of our knowledge, this study is the first empirical demonstration that SAA directly leads to state body dissatisfaction (via experimental manipulation of SAA). However, more research is needed to test a full model in which SAA leads to body dissatisfaction, which then leads to disordered eating over time.

State negative social-evaluative fears

We also provided data further clarifying the relationship between state FNE and state SAA. When we considered the results between groups, we conceptualized the SAA condition as having the highest level of all state negative social evaluative fears overall and the FNE condition as having high levels of FNE but not high levels of SAA. Indeed, post hoc analyses showed that state FNE and SAA were more related in the SAA condition than in the FNE or control conditions. This finding suggests that when SAA is primed, the two states have an increased tendency to move in concert with each other.

These findings are consistent with the definition of SAA, which posits that it is a specific form of FNE specific to appearance evaluation. These results help clarify the nature of state SAA and its relation with FNE and show that the extent to which the state fears are related depends on context. For example, in an appearance-evaluative environment, state SAA and FNE may be highly related, whereas in a non-appearance-evaluative condition, they may not be as highly associated. If that account is accurate, it suggests that it may be possible to increase FNE without increasing SAA, but that in an appearance-evaluative environment, anything that increases either FNE or SAA will also tend to increase the other state fear. It must be noted, however, that we did not exhaust all possible manipulations in this study, so it remains possible that other manipulations could, for example, invoke solely SAA despite an appearance-evaluative environment. Defining such conditions would be helpful to future research. These findings specifying the nature of the negative social evaluative fears helped us better understand how state SAA and FNE exerted indirect effects from condition and trait-level fears on food intake.

Impact of state fears on food intake: Restriction (overcontrolled) versus increased (undercontrolled) food intake

We found that state FNE increased food intake, whereas state SAA decreased food intake. These findings may help explain why participants assigned to the FNE condition consumed more food than did those assigned to the SAA condition; perhaps evaluation fears increase eating only to the extent that one does not feel evaluated on appearance (which may then decrease eating because of attempts to regulate fears of appearance evaluation by restraining from food). If individuals are feeling evaluated overall, they may regulate their fears by using food-related habits (e.g., Muraven & Baumeister, 2000; Rieger et al., 2010; Walsh, 2013). However, if they are evaluated specifically on their appearance, they are likely to turn their attention toward their body, feel increased body dissatisfaction, and perhaps prefer to regulate through restriction of food (or through alternative means). These findings are consistent with research on the risk factors of eating disorders, which has suggested that concerns

related specifically to shape and weight increase the risk for the development of an eating disorder (e.g., Jacobi et al., 2011).

In this case, SAA, which is specific to appearance, may cause restrictive eating in the short term and serve as a signal to regulate stress through means other than increased eating (perhaps because attention is focused on one's appearance), whereas general evaluation fears increase eating. However, we expect that when individuals no longer experience appearance evaluation, this strategy may later be replaced with other maladaptive forms of self-regulation (e.g., bingeing). Thus, it remains perfectly plausible that participants showing overcontrolled eating in this study due to SAA might later exhibit undercontrolled eating when they are no longer in an appearance-evaluative environment (e.g., when alone). For example, over the long term, overcontrolled restriction may lead to undercontrolled binge eating as a coping strategy, a possibility consistent with findings that have shown that restraint predicts higher food intake when coupled with stress and anxiety (e.g., Greeno & Wing, 1994).

Limitations

A major limitation of this research is that we used a nonclinical student sample. However, this limitation is partially offset both because undergraduate women are at high risk for the development of an eating disorder (Taylor et al., 2006) and because we had clinical levels of disordered eating and social anxiety in our sample. In addition, we used an experimental design to begin to identify specific causal mechanisms. However, it is possible that in a clinical or population-based sample, these results would differ. Some researchers have recently argued that it is useful to use a normative sample when (possibly genetically based) traits are studied and that studying only the extremes of traits limits researchers' breadth of knowledge for the entire population (Plomin, Haworth, & Davis, 2009). Indeed, there is support for FNE as a genetically based, moderately heritable trait (Stein et al., 2002). One additional limitation is that participants were not instructed to eat at a certain time before participation and, therefore, could have eaten at variable hours before participation, which could have affected food intake. However, hunger levels were distributed equally across conditions, and removal of participants who did not follow instructions regarding eating did not alter substantive interpretation. Moreover, participants were not explicitly asked whether they had guessed the purpose of the study.

Furthermore, several of our measures were developed specifically for this study, including the manipulation check measure. It would have been ideal to have a measure that has previously shown validity measuring the state fears and that was measured during instead of after the speech. Finally, future researchers may want to consider the use of different manipulations of these negative social evaluative fears. For example, it could be argued that there would have been better experimental control if we had removed the experimenter from the speech in all conditions instead of in only the control and FNE conditions. Future research should also test whether there are moderators and mediators, such as depression, perfectionism, or emotional eating, that affect the relationship between food intake and negative social fears. Future research should also manipulate additional constructs, such as guilt, that are known to affect disordered eating to attempt to delineate additional mechanisms that affect social anxiety and disordered eating (Berg et al., 2013).

Implications for a shared treatment model

Overall, these results suggest that negative social evaluative fears are stressors that lead to food intake, social anxiety, and body dissatisfaction. These results support our previous research that has suggested that SAA is highly related to body dissatisfaction, whereas FNE is related to disordered eating correlates, such as increased food intake (Levinson & Rodebaugh, 2012). However, in the current study, we found that state SAA also had an impact on food intake (i.e., to decrease food intake). Finally, these results provide support for the idea that social anxiety and disordered eating share vulnerabilities, but that the pathways through which these vulnerabilities arise may be what produce disorder-specific behaviors. If research continues to provide support for these shared vulnerabilities, it may be possible to design novel interventions that focus on these risk factors instead of on categorical disorders. These interventions may show that it is possible to treat (or ideally prevent) multiple disorders in one protocol. For example, cognitive-behavioral Internet-based programs have been shown to significantly reduce weight and shape concerns and to decrease the risk of onset of an eating disorder (Taylor et al., 2006). Similarly, it may be possible to develop treatment interventions focused on negative evaluation fears that target both social anxiety and eating disorders in the same protocol.

Author Contributions

C. A. Levinson developed the study concept, collected and analyzed the data, and wrote drafts of the study as part of her dissertation. T. L. Rodebaugh provided input and feedback on all parts of the study and write-up. Both authors approved the final version of the manuscript for submission.

Acknowledgments

We would like to thank Bailey Davidson, Julia Belsky, Simona C. Kaplan, Rina Matsumoto, and Elizabeth N. Riley for their research assistance and Juliette M. Iacovino, Andrea E. Kass, Elizabeth N. Riley, and Greg Smith for their helpful feedback.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

Funding

This research was funded by National Institute of Mental Health Grant F31-MH096433-01 to C. A. Levinson.

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