

The Fear of Food Measure: A Novel Measure for use in Exposure Therapy for Eating Disorders

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ABSTRACT

Objective: Exposure therapy for meal-time anxiety has preliminarily been effective at increasing food intake and decreasing anxiety in individuals with anorexia nervosa (AN). To enhance our knowledge of exposure therapy for AN researchers and clinicians need a comprehensive measure that assesses outcomes relevant to exposure therapy for AN.

Method: In the current four studies we developed Fear of Food Measure (FOFM) that assesses three cognitive and behavioral outcomes: trait anxiety about eating, food avoidance behaviors, and feared concerns related to eating.

Results: In a community ($N = 399$) and undergraduate female sample ($N = 203$) the FOFM exhibited a good three-factor structure and convergent and divergent validity. In a sample of women ($N = 72$) we showed that the anxiety about eating subscale significantly predicted *in vivo* food intake over and above other established predictors of eating (e.g., restraint).

In a clinical sample diagnosed with an eating disorder ($N = 41$) we showed that anxiety about eating was associated with food intake and anxiety during an exposure meal and that all subscales of the FOFM significantly decreased over the course of a four-session exposure intervention. Finally, we found that participants diagnosed with an eating disorder had higher levels of fear of food than did matched controls ($N = 23$).

Discussion: The FOFM is a psychometrically valid measure that can assess if patients are improving while undergoing exposure therapy and could be used to pinpoint problematic behaviors that can be addressed in exposure therapy. © 2014 Wiley Periodicals, Inc.

Keywords: exposure therapy; anorexia nervosa; anxiety about eating; food avoidance; eating disorders

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Introduction

Exposure therapy has long been considered the gold standard for the treatment of anxiety disorders.¹ Recently, there has been growing support for the idea that exposure therapy should be extended to the eating disorders.² Two reviews of the literature suggested that exposure therapy may be effective for alleviating a wide range of symptoms present in bulimia nervosa and anorexia nervosa (AN), including body image anxiety, and bingeing and purging.^{2,3} These reviews proposed that several different forms of exposure therapy may be effective, including techniques such as virtual reality

and mirror exposure.^{2,3} Regarding AN specifically, exposures concentrated on *in vivo* food exposure appear to be the most promising.⁴ For example, in one randomized control trial comparing exposure and response prevention (ERP) to cognitive processing therapy (CPT) for AN, researchers found that ERP significantly increased caloric intake compared to CPT.⁴ These promising findings suggest that more research on exposure therapy for AN is deeply warranted.

Anxiety disorders are theorized to stem from core fears that are associated with feelings of anxiety and avoidance behaviors, which then reinforce a cycle of negative reinforcement.⁵ A comprehensive cognitive-behavioral model of anxiety suggests that to fully address the anxiety disorder an individual must modify their feelings (anxiety), beliefs or thoughts (core fears), and behaviors (avoidance).⁶ In the eating disorders, exposure therapy for Anorexia Nervosa (AN-ERP) was designed to alleviate symptoms of AN by decreasing eating related rituals and increasing caloric intake.² Thus, the treatment outcome that has primarily been

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utilized in AN-ERP research trials is *in vivo* caloric intake. However, consistent with theories of anxiety disorders, in addition to food intake (which may be difficult for clinicians to measure) exposure therapy should address all three of these cognitive-behavioral components (anxiety, avoidance behaviors, and the feared concerns or maladaptive thoughts that underlie the anxiety). For example, in exposure trials of social anxiety disorder, researchers assess if exposure therapy creates changes in trait levels of social anxiety (e.g., by utilizing trait social anxiety assessments), avoidance behaviors related to social anxiety (e.g., by utilizing an exposure hierarchy), and hypothesized core fears (e.g., by measuring core fears such as fear of negative evaluation).⁷ Therefore, it would be ideal to have a comprehensive assessment that measures each of these outcomes for exposure therapy for AN.

In the current study we developed and tested the psychometric properties of Fear of Food Measure (FOFM) that explicitly assesses all three cognitive-behavioral components of anxiety, including a subscale measuring underlying fears that we hypothesize may serve as potential mechanisms driving change (i.e., the reduction of fear) during exposure therapy. Specifically, we created a measure that assesses three components: (a) trait level fear of food or anxiety surrounding eating, (b) anxiety-related avoidance behaviors inherent in AN, and (c) feared concerns, beliefs, or maladaptive thoughts that may drive the underlying anxiety. It is our hope that this measure can be utilized by clinicians and researchers to measure changes in anxiety surrounding mealtime and the avoidance behaviors encapsulated within AN. This measure could be used in future exposure trials to refine assessment of exposure therapy by testing if exposure therapy reduces trait anxiety about eating, avoidance behaviors, and feared concerns about eating. This measure could also be used to test what mechanisms may drive the underlying anxiety.

In the current studies we tested the psychometric properties of the Fear of Food Measure (FOFM) in four independent samples. First, in a large community sample of adults ($N = 399$) we tested the factor structure, convergent, and divergent validity. Next, in a large sample of undergraduate women ($N = 203$) we cross-validated the factor structure and conducted further tests of convergent and divergent validity. Then, in an experimental study of undergraduate women ($N = 72$) we tested if the anxiety about eating subscale predicted *in vivo* caloric intake and negative affect after food intake, further establishing construct validity. Finally, in a

sample of patients ($N = 41$) diagnosed with Anorexia Nervosa ($N = 36$), Bulimia Nervosa ($N = 4$), or Eating Disorder Not Otherwise Specified ($N = 1$) we tested if the anxiety about eating subscale was associated with food intake and anxiety during an exposure meal and if all three subscales decreased over a short course of exposure therapy. Finally, we tested if the FOFM was elevated in patients with an eating disorder versus healthy matched controls ($N = 23$).

We hypothesized that (a) the FOFM would exhibit a good three-factor structure, (b) the FOFM would be strongly related to existing measures of disordered eating and eating behaviors (e.g., restraint), moderately related to measures of depression, self-esteem, trait anxiety, neuroticism, and negative affect, but not related to measures of personality such as openness, agreeableness, and extraversion since there is no theoretical reason that they should be related, (c) the anxiety during eating subscale would predict food intake and anxiety during a meal in undergraduate women and in individuals diagnosed with an eating disorder, (d) that all subscales would decrease during exposure therapy and finally, (e) individuals with an eating disorder would report higher scores on the FOFM than healthy matched controls.

Study 1 Method

Participants. Participants were 399 adults recruited from the community to complete a packet of measures online. Approval was granted by the Washington University IRB. There were no exclusion criteria for this study. Participants' average age was 45.85 ($SD = 15.23$, range = 18–80). Participants were mostly female ($n = 320$; 81%) and White ($n = 329$; 84%). Participants had on average completed 15.54 years of school ($SD = 0.15$). Approximately 50% ($n = 195$) were currently married and about 50% ($n = 194$) reported having ever received psychological treatment.

Measures. The Fear of Food Measure (FOFM) was designed to assess three cognitive behavioral components related to mealtime anxiety. All items are rated on a 1 to 7 Likert-type scale ranging from not at all to "very much so." The first subscale is the anxiety about eating subscale, which was designed to assess trait levels of fear and anxiety surrounding eating and food. The original subscale consisted of eight items. An example item is "I feel anxious when I eat." The second subscale is the "Food Avoidance Behaviors," which was designed to assess behaviors that are indicative of avoidance related to anxiety over food. An example item is

“There are certain foods I avoid because they make me anxious.” The original subscale had eight-items. The third subscale is the “feared concerns” subscale, which was designed to assess the core fears or maladaptive thoughts underlying anxiety about eating. An example item is “eating makes me anxious because I am afraid I might get fat.” The original subscale contained nine-items.

Eating Disorder Inventory-2 (EDI-2)⁸ 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 and is frequently used by clinicians for the assessment of eating disorder symptoms.⁸ Three of the eleven subscales were used for this study: the drive for thinness (DT), body dissatisfaction (BD), and bulimia (BN) subscales. Example items are “I eat when I am upset and I think about dieting.” These subscales were used because they assess major vulnerabilities for anorexia nervosa and bulimia nervosa. The DT subscale includes seven items, which assess excessive concern with dieting, preoccupation with weight, and fear of gaining weight. The BD subscale includes nine items, which assess dissatisfaction with overall body shape as well as the size of specific regions of the body, such as hips, stomach, and thighs. The BN subscale includes seven items, which assess bulimic behaviors such as bingeing and purging. In the current sample, body dissatisfaction ($\alpha = 0.92$) and bulimia ($\alpha = 0.90$) exhibited excellent internal consistency and drive for thinness ($\alpha = 0.72$) exhibited good internal consistency.

The Mini-International Personality Item Pool inventory (MINI-IPIP) is a 20-item short form measure of the five basic factors of personality: extraversion, neuroticism, agreeableness, conscientiousness, and openness. It is based on the International Personality Item Pool⁹ and has been shown to have consistent and acceptable internal consistencies, similar coverage of personality facets as other Big Five measures, and good convergent, discriminant, and criterion-related validity with other Big Five measures.¹⁰ In the current study we utilized the neuroticism facet ($\alpha = 0.74$) and the agreeableness ($\alpha = 0.71$) facet.

Beck Depression Inventory II (BDI-2)¹¹ is a 21-item self-report instrument that measures depressive symptoms in adults and adolescents. Items assess symptoms corresponding to criteria for diagnosing depressive disorders. Each symptom is rated for severity based on endorsement of one of a

series of statements arranged in order from least to most symptomatic. The BDI-2 has shown good psychometric properties in psychiatric and non-psychiatric samples. In the current sample, the BDI-2 exhibited excellent internal consistency ($\alpha = 0.91$).

Rosenberg Self-Esteem Scale (RSES)¹² is a 10-item self-report measurement that utilizes a four-point Likert scale, ranging from “strongly agree to strongly disagree.” Items on this measure assess global feelings of self-worth by measuring positive and negative feelings about the self. The RSES has shown strong convergent validity in men and women, various ethnic groups, and in both college and community samples. In the current sample, the RSES showed excellent internal consistency ($\alpha = 0.93$).

Disordered Eating Composite

We standardized and summed the three scales of the EDI-2 to use in multiple regression as one single outcome (instead of conducting three separate multiple regression for each individual outcome). We decided to use this method because composite measures provide a more reliable estimate of the construct and simplify the number of analyses conducted.¹³

Data Analytic Procedure

Because of the seven-point response scale of the FOFM subscales, we considered these items to be categorical for the purpose of confirmatory factor analyses. We used the Mplus program version 7.1¹⁴ and, more specifically, the robust weighted least squares estimator (referred to as WLSMV in Mplus), which is appropriate for categorical data. Global model fit was evaluated using the: (a) comparative fit index (CFI),¹⁵ (b) Tucker-Lewis incremental fit index (TLI),¹⁶ and (c) root mean square error of approximation (RMSEA).¹⁷ The magnitudes of these indices were evaluated with the aid of recommendations by Hu and Bentler (1999),¹⁸ which are considered appropriate for WLSMV. Essentially, for the CFI and TLI, values of 0.90 and above were considered adequate, whereas values of 0.95 or above were considered very good; for the RMSEA, values of 0.09 and below were considered adequate and 0.05 or less were considered very good.

Validity Analyses

To test convergent validity, we tested the zero-order relationships between the FOFM subscales, disordered eating, depression, self-esteem, and neuroticism. To assess divergent validity we

tested correlations between the FOFM and agreeableness because there is no theoretical reason to believe agreeableness should be related to the FOFM. We utilized the Meng et al., test of correlated correlations to test if the convergent relationships were stronger than the divergent relationship and to test if the FOFM was more strongly related to disordered eating than other related constructs.¹⁹ We also tested incremental validity utilizing multiple regression to test if the FOFM subscales could predict disordered eating over and above each other and the other related constructs (e.g., depression).

Initial Development of the Items

After reading the literature on mealtime anxiety, exposure therapy for anxiety disorders, and exposure therapy for eating disorders, we created a measure consisting of three proposed subscales: Anxiety about eating, food avoidance behaviors, and feared concerns. The first author generated the items and an eating disorder clinician reviewed the items for content. Further, six undergraduate research assistants were consulted on the clarity and content of items. We planned to use iterative measure development if confirmatory factor analysis on the proposed structure indicated it was needed. First, we tested the hypothesized three-factor model and removed items that loaded at or below 0.40 on each factor. We also tested models with one and two factors to confirm that a three-factor model exhibited the best fit.

Result

Confirmatory Factor Analysis

We tested the hypothesized three-factor model with all proposed items loading onto each of the three proposed factors. This model had poor to excellent fit (CFI = 0.96, TLI = 0.96, RMSEA = 0.11). Because of the poor fit of the RMSEA we tested an alternative model with items 12 and 14 removed (one at a time) because of their low loadings onto the food avoidance behaviors subscale. This model had adequate to excellent fit (CFI = 0.98, TLI = 0.98, RMSEA = 0.08) and was the best fitting model. We attempted to correlate error variances of similarly worded items, but this did not improve fit. We also tested a one-factor model with all items loading onto one factor. This model had poor to good fit (CFI = 0.95, TLI = 0.95, RMSEA = 0.13). We tested a model including only the anxiety about eating subscale, which had poor to excellent fit (CFI = 1.0, TLI = 1.0,

RMSEA = 0.12). Finally, we also tested models with two subscales (excluding the food avoidance behaviors and then excluding the feared concerns subscales). Both of these models had poor to good fit (CFI = 0.98, TLI = 0.98, RMSEA = 0.11), (CFI = 0.99, TLI = 0.99, RMSEA = 0.09).

Final Structure

Our final model had three-factors with two of the original items removed from the food avoidance behavior subscale. The final scale had eight-items loading onto the anxiety about eating scale, six-items loading onto the food anxiety behaviors scale, and nine-items loading onto the feared concerns scale. All item loadings from Study 1 and Study 2 are shown in **Table 1**. Internal consistency was good to excellent: Anxiety about eating $\alpha = 0.95$; food avoidance behaviors $\alpha = 0.74$; feared concerns $\alpha = 0.90$.

Convergent and Divergent Validity

Please see **Table 2** for the zero-order correlation table. The three subscales were moderately to strongly correlated ($r_s = 0.57$ to 0.76). As hypothesized, anxiety about eating was strongly related to drive for thinness and bulimic symptoms. Anxiety about eating was moderately related to depression, self-esteem, and neuroticism. Also as hypothesized there was no relationship between anxiety about eating and agreeableness. This same pattern was observed for the food avoidance behaviors and feared concerns subscale. Complete correlation tables showing correlations between all variables are available from the first author.

To test if the convergent measures were more strongly related to the FOFM than the divergent measure, as expected, we turned to testing differences between correlated correlations.¹⁹ Meng et al.'s test for correlated correlations is utilized to test if the strength of two correlations with one measure in common from the same sample differ significantly. All convergent relationships with the anxiety about eating subscale were significantly stronger than those between the anxiety about eating subscale and agreeableness ($z_s > 3.09$, $p_s < 0.002$), showing further support for divergent validity. All convergent relationships with the food avoidance behaviors subscale were significantly stronger than those between food avoidance behaviors and agreeableness ($z_s > 2.22$, $p < .002$). All convergent relationships with feared concerns differed significantly from those between the feared concerns subscale and agreeableness ($z_s > 5.57$, $p < .001$).

TABLE 1. The fear of food measure (FOFM)

	Factor loadings	
	Study 1	Study 2
Anxiety About Eating Scale (AE)		
1. I feel anxious when I eat.	0.90	0.92
2. If I have to eat a meal, it makes me uncomfortable.	0.98	0.95
3. Eating makes me uncomfortable.	0.99	0.97
4. I feel tense when I am around food.	0.98	0.99
5. Food makes me anxious.	0.96	0.98
6. I worry about eating.	0.87	0.94
7. It is hard for me to eat because it makes me nervous.	0.93	0.97
8. I don't like it when there is food near me.	0.92	0.94
Food Anxiety Behaviors scale (FAB)		
9. There are certain foods I avoid because they make me anxious.	0.91	0.88
10. I have specific patterns and behaviors that I engage in when I eat.	0.68	0.69
11. I have to eat my food in a certain order.	0.66	0.47
12. There are foods that I will not touch because I don't like how they feel.	0.94	0.42
13. I try and avoid eating when I can.	0.90	0.93
14. I have rules about what I eat.	0.52	0.69
OE 12. There are foods I do not like to eat.	0.40	—
OE 14. I avoid some types of food.	0.36	—
Feared Concerns scale (FC)		
15. Eating makes me anxious because I am afraid I might get fat.	0.89	0.87
16. Eating makes me anxious because I worry I might get sick.	0.81	0.59
17. I don't like eating because of the way my stomach feels after I eat.	0.85	0.84
18. I worry that eating will make me dissatisfied with my body.	0.86	0.89
19. I feel anxious when eating around other people.	0.93	0.94
20. I don't like to eat around other people because they might judge me.	0.92	0.89
21. I don't like to eat in social situations.	0.92	0.90
22. If I don't eat much because I am worried about my weight.	0.67	0.82
23. I don't like the physical sensations I feel when eating.	0.89	0.94

Note. Directions for the FOFM subscales: Please read the below statements and indicate how characteristic they are of you from 1 (not at all) to 7 (very much so). OE = original items that were removed because of low factor loadings.

We also tested if the three subscales of the FOFM were more strongly related to drive for thinness and bulimic symptoms than to depression, self-esteem, and neuroticism. Anxiety about eating was more strongly related to bulimic symptoms than neuroticism ($z = 4.58$, $p < .001$), depression ($z = 3.39$, $p < .001$), and self-esteem ($z = 2.79$, $p < .001$). Anxiety about eating was more strongly related to drive for thinness than neuroticism ($z = 2.34$, $p < .001$), but not to depression ($z = 1.12$, $p = .131$), or self-esteem ($z = 0.75$, $p = .227$). Food avoidance behaviors were more strongly related to bulimic symptoms and drive for thinness than neuroticism, depression, and self-esteem (all z s > 2.13 , $ps < 0.001$). Feared concerns were more strongly related to bulimic symptoms and drive for thinness than to neuroticism, depression, and self-esteem (all z s > 3.47 , $ps < 0.001$).

Incremental Validity

Utilizing multiple regression, we tested which subscales would predict disordered eating when all subscales were included. Feared concerns was the only significant predictor of disordered eating (part $r = .51$, $b^* = 0.71$, $p < .001$). When feared concerns was removed, anxiety about eating significantly predicted disordered eating (part $r = .37$, $b^* = 0.43$,

$p < .001$), suggesting that anxiety about eating could mediate the relationship between feared concerns and disordered eating.

Next, we tested if the subscales could uniquely predict disordered eating over and above depression, neuroticism, and self-esteem in three independent regressions. Feared concerns (part $r = .52$, $b^* = 0.53$, $p < .001$), food anxiety behaviors (part $r = .26$, $b^* = 0.23$, $p < .001$), and anxiety about eating (part $r = .34$, $b^* = 0.32$, $p < .001$) all predicted disordered eating over and above depression, neuroticism, and self-esteem showing that the FOFM subscales were able to predict disordered eating while including other important constructs known to relate to disordered eating.

Study 1 Discussion

Overall we found good support for a three-factor structure of the FOFM consisting of the following subscales: Anxiety about eating, food anxiety behaviors, and feared concerns. We also found that the FOFM had good convergent and divergent validity and was able to predict disordered eating over and above other constructs (depression, neuroticism, self-esteem) that are known to relate to disordered eating.²⁰ In the next study we cross-validated the factor structure of the three-factor

TABLE 2. Relationships between the Fear of Food Measure and convergent and divergent measures in studies 1 and 2

	Study 1 AE	Study 1 FAB	Study 1 FC	Study 2 AE	Study 2 FAB	Study 2 FC
FAB	0.58**	0.74	0.57**	0.47**	0.78	0.48**
FC	0.76**	0.57**	0.90	0.81**	0.48**	0.90
DT	0.42**	0.35**	0.59**	0.54**	0.32**	0.67**
BN	0.51**	0.35**	0.60**	0.55**	0.26**	0.63**
BD	0.24**	0.13*	0.39**	0.41**	0.18*	0.52**
BDI-2	0.36**	0.23**	0.46**	0.43**	0.34**	0.51**
RSES	0.38**	0.22**	0.46**	—	—	—
Neur	0.29**	0.20**	0.42**	0.38**	0.35**	0.43**
Agree	-0.02	-0.05	-0.05	—	—	—
DEBQ res	—	—	—	0.55**	0.29**	0.65**
Emo Eat	—	—	—	0.33**	0.15*	0.44**
Ext Eat	—	—	—	-0.05	-0.01	0.14
STAI	—	—	—	0.34**	0.39**	0.41**
Restraint	—	—	—	0.55**	0.29**	0.62**
SC	—	—	—	0.51**	0.29**	0.71**
WC	—	—	—	0.54**	0.30**	0.71**
EC	—	—	—	0.70**	0.35**	0.75**
NA	—	—	—	0.47**	0.37**	0.48**
Extra	—	—	—	-0.06	-0.05	-0.07
Consc	—	—	—	-0.10	-0.04	-0.01
Open	—	—	—	0.07	-0.03	-0.04

Notes: AE = Anxiety About Eating; FAB = Food Anxiety Behaviors; FC = Feared Concerns; DT = Drive for Thinness; BN = Bulimic Symptoms; BD = Body Dissatisfaction; Neur = Neuroticism; Agree = Agreeableness; BDI-2 = Beck Depression Inventory; RSES = Rosenberg Self-esteem Scale; DEBQres = Dutch Eating Behavior Questionnaire Restraint Scale; EmoEat = Dutch Eating Behavior Questionnaire Emotional Eating Scale; ExtEat = Dutch Eating Behavior Questionnaire External Eating Scale; STAI = State-Trait Anxiety Inventory; Restr = Eating Disorder Examination Questionnaire Restraint Scale; SC = Eating Disorder Examination Questionnaire Shape Concern Scale; WC = Eating Disorder Examination Questionnaire Weight Concern Scale; EC = Eating Disorder Examination Questionnaire Eating Concern Scale; NA = Negative Affect; Extra = Extraversion; Consc = Conscientiousness; Open = Openness; ** $p < .01$; * $p < .05$. Sample size for Study 1 is 399. Sample size for Study 2 is 203.

model. We also conducted additional tests of the scales' convergent, divergent, and incremental validity utilizing a wider range of disordered eating measures, as well as other measures known to relate to disordered eating (e.g., negative affect, trait anxiety, restraint, and emotional eating) and measures that have no theoretical reason to relate to disordered eating (e.g., extraversion, openness, and conscientiousness). Finally, we tested the test-retest reliability across 3 months.

Study 2 Method

Participants. Participants were undergraduate females ($N = 203$) who participated in an ongoing longitudinal study assessing social anxiety as a risk factor for eating disorders. Participants were included if they were female and enrolled in a psychology class. There were no exclusion criteria. Participants had a mean age of 18.67 ($SD = 1.04$), were primarily Caucasian ($n = 120$, 59.1%), and freshmen ($n = 121$, 59.6%).

Measures. In addition to the FOFM, EDI-2, and BDI-2 described in Study 1, the following measures were utilized:

The Mini-International Personality Item Pool Inventory. In addition to the neuroticism subscale described above we utilized the extraversion ($\alpha = 0.84$), openness ($\alpha = 0.76$), and conscientious-

ness ($\alpha = 0.73$) subscales to assess divergent validity.¹⁰

Dutch Eating Behavior Scale. Dutch eating behavior scale (DEBQ)²¹ is a 32-item measure of eating behaviors. Three of the subscales are restraint, emotional eating, and external eating. These scales have high internal consistency, external, and factor validity.²¹ Example items from the DEBQ are “if you have put on weight, do you eat less than you usually do?” and “Do you have a desire to eat when you are feeling lonely?” This measure was used to assess the traits restraint and emotional eating. Internal consistencies for both subscales were excellent ($\alpha s = 0.94$)

Eating Disorder Examination-Q. Eating disorder examination-Q (EDE-Q)²² is a questionnaire version of the eating disorder examination semi-structured interview²³ designed to assess cognitive and behavioral features of eating disorders. The EDE-Q has been shown to have good reliability and validity.²³ It includes 41 items that are scored on a seven-point, forced-choice rating scheme that focuses on behaviors exhibited in the past 28 days. Example items are “Have you had a definite desire for your stomach to be flat” and “Have you experienced a loss of control over eating?” The four subscales of the EDE-Q and estimates of their internal consistency in the current sample are as follows: restraint ($\alpha = 0.80$), eating concern ($\alpha = 0.71$),

weight concern ($\alpha = 0.83$), and shape concern ($\alpha = 0.90$).

The State Trait Anxiety Measure (STAI-A). The state trait anxiety measure (STAI-A)²⁴ is a measure of trait anxiety. We used a shortened version of the original STAI. Bieling et al. examined the original STAI, and found that it consisted of two factors, only one of which clearly measured anxiety; we use the items that comprise this single factor here. Bieling et al. additionally found that these items (i.e., the STAI-A) exhibited excellent convergent validity with other measures of anxiety. In the current study, the STAI-A exhibited very good internal consistency ($\alpha = 0.86$).

The Positive and Negative Affect Schedule. The positive and negative affect schedule (PANAS)²⁵ is a measure of positive (e.g., excited) and negative (e.g., scared) activated affect. Each type of affect is assessed through ten items on a five point Likert-type scale from 1 (very slightly or not at all) to 5 (extremely). Watson et al. report good internal consistency, convergent, and discriminant validity. The trait (to what extent you generally feel this way; that is, how you feel on average) instructions were given. In the current study, we used the trait negative affect scale ($\alpha = 0.87$).

Procedure. Approval was granted by the Washington University IRB. Participants filled out a packet of measures in the laboratory for course credit. Participants returned 3 months later and recompleted the FOFM to assess test-retest reliability. We used 3 months because (a) 3 months is a long enough time frame that there should be no concern about carry over effects due to memory or practice²⁶ and (b) most exposure protocols for anxiety disorders are ~3 months and we wanted to test the reliability across a similar time period as would occur during a typical exposure intervention.²⁷ Average measure intraclass correlation coefficients (ICC) are reported for test-retest reliability.

Results

Factor Analysis Cross-validation

Fit for the 3-factor model from Study 1 was adequate to excellent (CFI = 0.98, TLI = 0.98, RMSEA = 0.09), replicating our fit in an independent sample. Because of the small sample size we utilized the Swain Correction factor implemented in the RGui, as fit indices, specifically the RMSEA are known to be inflated in small sample sizes. The Swain correction factor for small sample sizes

yielded the following slight improvement in fit (CFI = 0.98; TLI = 0.98; RMSEA = 0.08).

Convergent and Divergent Validity

All relationships between the FOFM and convergent and divergent measures can be seen in **Table 2**. As expected the three subscales of the FOFM were strongly correlated with the measures of disordered eating and eating behaviors from the EDI-2, EDE-Q, and DEB-Q. The FOFM was also moderately correlated with depression, neuroticism, negative affect, and trait anxiety. Also as expected, the FOFM showed divergent relationships with extraversion, conscientiousness, and openness: There was no relationship between the FOFM and these measures of personality.

Incremental Validity

In multiple regression we tested if the three subscales would predict disordered eating as in Study 1. As in Study 1, when all three subscales were entered as predictors of disordered eating, feared concerns (part $r = .55$, $b^* = 0.75$, $p < .001$) was a significant predictor of disordered eating. The same finding was replicated utilizing the EDE-Q total score as the outcome (part $r = .55$, $b^* = 0.78$, $p < .001$). Next, we tested if each subscale was able to predict disordered eating over and above restraint, emotional eating, trait anxiety, and negative affect (in three regressions). Anxiety about eating (part $r = .29$, $b^* = 0.20$, $p < .001$) predicted disordered eating over and above trait anxiety (part $r = .13$, $b^* = 0.10$, $p = .070$), emotional eating (part $r = .29$, $b^* = 0.24$, $p < .001$), restraint (part $r = .53$, $b^* = 0.43$, $p < .001$), and negative affect (part $r = .18$, $b^* = 0.14$, $p = .013$). Feared concerns (part $r = .44$, $b^* = 0.38$, $p < .001$) significantly predicted disordered eating over and above trait anxiety (part $r = .08$, $b^* = 0.05$, $p = .307$), emotional eating (part $r = .28$, $b^* = 0.18$, $p < .001$), restraint (part $r = .42$, $b^* = 0.33$, $p < .001$), and negative affect (part $r = .19$, $b^* = 0.14$, $p = .010$). Food avoidance behaviors did not significantly predict disordered eating over and above these other constructs ($p = .995$).

Test-Retest Reliability

Test-retest reliability was excellent for all subscales across 3 months: Anxiety about eating (ICC = 0.90), food avoidance behaviors (ICC = 0.87), and feared concerns (ICC = 0.89).

Study 2 Discussion

We replicated our results from Study 1 showing that there was good fit for the FOFM consisting of

the following subscales: Anxiety about eating, food avoidance behaviors, and feared concerns. We showed that these scales were strongly associated with disordered eating measures and were moderately related to trait anxiety, negative affect, and depression. Further, we showed that both anxiety about eating and feared concerns were able to predict disordered eating over and above restraint, emotional eating, trait anxiety, and negative affect, showing that these are unique constructs that add to the predictive or incremental variance in disordered eating. We found less support for the incremental validity of the food avoidance behaviors subscale. In the next study, we extended our findings from the first two studies to test if the anxiety about eating subscale had good construct validity and therefore, could predict *in vivo* eating behaviors.

Study 3 Method

Participants. Participants were 72 undergraduate females who participated in a larger experimental study reported on previously, and for which results do not overlap.²⁸ Participants' mean age was 18.60 (SD = 1.06) and most participants were primarily Caucasian ($n = 49$, 68.1%). Most participants were in their freshmen year of school ($n = 45$, 62.5%).

Measures. In addition to the FOFM and DEBQ described above, we utilized:

Food intake was measured with. pretzels, M & Ms, 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.²⁹ We utilized grams of food consumed as has been utilized in previous research with similar manipulations testing the impact of stress on food intake as we sought to be consistent with previous research utilizing similar manipulations.^{30,31} We also report food intake in calories.

Hunger Measure. Hunger was measured with one item that assesses current hunger level on a seven-point Likert scale ranging from 1 = not at all to 7 = extremely, as used in Oliver et al.³¹

The positive and negative affect schedule (PANAS)²⁵. was utilized to assess state negative affect (i.e., "to what extent are you feeling this way right now") after participants were left with food (see procedure below).

Procedure. Approval was granted by the Washington University IRB. Participants took part in a

90-min experiment that was advertised as an experiment about personality and behavior. Participants were asked to eat normally the day before the experiment and not to eat for one hour before the experimental session. Participants were consented and completed a short questionnaire packet consisting of the measures listed above. Participants completed an experimental manipulation to induce stress or negative evaluation fears not focused on here and for which results do not overlap or impact the results presented here. There were no significant interactions between the FOFM and conditions from the experimental manipulation ($ps > 0.482$) and the anxiety about eating scale remained a significant predictor of food intake (see below) over and above condition (for more information on the manipulation, see Levinson and Rodebaugh, 2014).²⁸ Participants were left with food and water for 10 min while the experimenter "prepared for the final part of the session." After participants were left with the food they completed the measure of state negative affect.

Results

Zero-order Correlations

As can be seen in **Table 3**, as hypothesized, the anxiety about eating scale was significantly negatively related to food intake, such that high anxiety about eating was associated with lower food intake. Additionally as hypothesized, anxiety about eating was positively correlated with state negative affect after the presence of food.

Does Anxiety About Eating Predict Food Intake?

First we tested if anxiety about eating could predict food intake over and above experimental conditions. Anxiety about eating was a significant predictor of food intake over and above condition (part $r = -.28$, $b^* = -0.29$, $p = .013$). Next, we tested if the three subscales predicted food intake. Anxiety about eating (part $r = -.28$, $b^* = -0.48$, $p = .021$) significantly predicted food intake, over and above food anxiety behaviors (part $r = -.07$, $b^* = -0.08$, $p = .528$) and feared concerns (part $r = .14$, $b^* = 0.23$, $p = .246$). Finally, anxiety about eating (part $r = -.33$, $b^* = -0.37$, $p = .006$) remained a significant predictor of food intake over and above restraint (part $r = -.07$, $b^* = -0.08$, $p = .552$), emotional eating (part $r = .10$, $b^* = 0.10$, $p = .439$), external eating (part $r = .31$, $b^* = 0.29$, $p = .010$), and hunger (part $r = .31$, $b^* = 0.29$, $p = .009$).

TABLE 3. Zero-order correlations between the Fear of Food Measure and convergent and divergent measures in studies 3 and 4

	Study 1 AE	Study 1 FAB	Study 1 FC	Study 2 AE	Study 2 FAB	Study 2 FC
FAB	0.34**	0.74	0.36**	0.49**	0.87	0.54**
FC	0.81**	0.36**	0.89	0.72**	0.54**	0.91
TotCal	-0.30*	-0.11	-0.18	—	—	—
TotGram	-0.30*	-0.15	-0.17	—	—	—
Water	0.05	-0.03	0.21	—	—	—
Anxiety	0.29*	0.18	0.22	—	—	—
NA	0.31**	-0.07	0.23	—	—	—
EmoEat	0.46**	0.33**	0.56**	—	—	—
ExtEat	0.04	-0.04	0.12	—	—	—
Restraint	0.53**	0.17	0.62**	—	—	—
Meal percent	—	—	—	0.16	0.10	0.08
T4 Mealpercent	—	—	—	-0.38*	-0.08	-0.34*
T1 SUDS before	—	—	—	0.38*	0.37*	0.20
T1 during	—	—	—	0.48**	0.53**	0.30
T1 after	—	—	—	0.54**	0.53**	0.28
T4 SUDS before	—	—	—	0.39*	0.42**	0.41**
T4 during	—	—	—	0.45**	0.59**	0.35*
T4 after	—	—	—	0.45**	0.36*	0.35*

Notes. AE = Anxiety about Eating; FAB = Food Anxiety Behaviors; FC = Feared Concerns; TotCal = Total Calories; Water = Water Intake; TotGram = Total Grams Square Root; EmoEat = Dutch Eating Behavior Questionnaire Emotional Eating Scale; ExtEat = Dutch Eating Behavior Questionnaire External Eating Scale; Restraint = Dutch Eating Behavior Questionnaire Restraint Scale; Anxiety = Subjective Units of Distress; NA = State Negative Affect; SUDSbefore = Subjective Units of Distress Before; SUDSafter = Subjective Units of Distress After; SUDS during = Subjective Units of Distress During; MealPercent = Meal Percentage; ** $p < .01$; * $p < .05$. Sample size for Study 3 is 72. Sample size for Study 4 is 41.

Does Anxiety About Eating Predict Negative Affect After Food Intake?

We found that anxiety about eating had a medium effect size predicting state negative affect after food intake (part $r = .23$, $b^* = 0.37$, $p = .055$), over and above food avoidance behaviors (part $r = -.19$, $b^* = -0.20$, $p = .107$) and feared concerns (part $r = .01$, $b^* = 0.01$, $p = .991$).

Study 3 Discussion

We found that anxiety about eating was able to predict *in vivo* food intake. Further, we found that anxiety about eating continued to predict food intake when accounting for restraint, emotional eating, external eating, and hunger levels. These results show that the anxiety about eating subscale is able to uniquely predict eating behaviors in a laboratory, such that individuals who have higher levels of anxiety about eating consumed fewer grams of food. Finally, we found that anxiety about eating was associated with negative affect after food intake. These results are compelling and perhaps provide the strongest evidence of the scales' construct validity. Ideally a measure should be able to predict variability in the behavior of what it is purported to measure and we found that our measure was indeed able to do so.³² We should also note that these findings were present in the context of stress, suggesting that anxiety about eating is associated with food intake and negative affect when experiencing stress. Similarly, the presence of

stress, anxiety, and fear is usually observed during mealtimes in individuals with eating disorders.³³ In the next and final study we tested if the FOFM was able to predict eating behaviors outside of the laboratory in a clinical sample of individuals diagnosed with an eating disorder. We also tested if the FOFM subscales decreased across a 4-session course of exposure therapy and if individuals with an eating disorder reported higher scores on the FOFM than did matched healthy controls.

Study 4 Method

Participants. Clinical Participants. Participants were recruited from a community eating disorder facility for participation in a treatment trial reported on in Levinson et al.³⁴ Participants ($N = 41$) were diagnosed with anorexia nervosa ($n = 36$; 10 = binge-purge type, 26 = restricting type), bulimia nervosa ($n = 4$), or eating disorder not otherwise specified ($n = 1$). We included participants with AN, BN, and EDNOS because we hypothesized that FOFM might be a transdiagnostic fear across the eating disorders. However, there were no substantive changes to results when participants with only AN were included in the analyses. Participants were mostly female ($n = 40$; 97.5%). The average age of participants was 25.27 (SD: 9.75; range 15–49) and participants were mostly Caucasian ($n = 40$; 97.5%). Participants exhibited high levels of comorbidity with at least one anxiety ($n = 34$, 82.9%) or depressive ($n = 31$, 75.6%) disorder. The most

common comorbid diagnoses were generalized anxiety disorder ($n = 30$, 73.2%), followed by social anxiety disorder ($n = 25$, 61.0%). Participants' mean BMI at Time 1 was 20.51 (SD = 2.27; range 15.34–27.64). Most participants ($n = 34$) were no longer considered underweight (they were above a BMI of 18.5) but a substantial percentage ($n = 7$; 17.1%) were underweight.

Matched Controls. Participants ($N = 23$) were recruited from the community to complete diagnostic and self-report instruments of personality and health behaviors. Participants were age, gender, and ethnicity matched to the clinical participants to control for these demographic variables. Participants were excluded if they had a history or current diagnosis of an eating disorder, mania, or psychotic symptoms. Participants were not excluded for any other additional diagnoses. Participants' average age was 25.83 (SD = 8.97; range 18–49) and most participants were Caucasian ($n = 22$; 95.6%). All participants were female. Most participants did not meet criteria for any anxiety or depressive disorder, with the exception of one participant who met criteria for Dysthymia. Participants' average BMI was 23.83 (SD = 5.27; range 18.42–37.79).

Measures. In addition to the FOFM described above we assessed the following:

We measured food intake utilizing: food percentage, which was measured by kitchen staff who measured total caloric intake of meals based on grams.

Anxiety was measured with the Subjective Units of Distress Scale (SUDS),³⁵ which is a behavioral measure often used during exposure treatment and behavioral assessment to measure anxiety. The SUDS scale has been shown to be a valid and reliable measure of state anxiety for both clinical and research outcomes.³⁶ SUDS ratings can range from 0 (completely calm) to 100 (highest anxiety). Other reference points used in this study (e.g., when describing the scale to patients) included 25 (noticeable, but not bothersome anxiety), 50 (bothersome anxiety), and 75 (very bothersome anxiety). SUDS were measured before, during, and after the meal.

Procedure

Clinical Participant Procedure. Approval was granted by the Washington University IRB. Participants were given a formal assessment using two structured clinical interviews (the Mini International Neuropsychiatric Inventory³⁷ and the Structured Clinical Interview for DSM-IV Eating Disorder Module³⁸ to determine diagnosis and

eligibility. At intake participants completed the FOFM. Participants then completed four sessions of a 45-min mealtime exposure intervention focusing on mealtime anxiety. More details on this intervention can be found in Levinson et al.³⁴ For analyses presented here we focus on the first and final exposure sessions. During these sessions participants reported SUDS levels before, during (every 5–8 min), and after the exposure. Food percentage was measured at the end of the meal. At the end of the four session intervention the FOFM was assessed again.

Matched Controls Procedure. Participants were given the same two formal diagnostic assessments to determine diagnoses. They then completed the FOFM and other measures not reported on here. Finally, participants had their height and weight measured to calculate BMI.

Results

Zero-order Correlations

As can be seen in **Table 3**, anxiety (SUDS) during both the first and final exposure meals were correlated with the anxiety about eating and food avoidance behaviors subscales. Meal intake was correlated with anxiety about eating (SUDS) during the final exposure.

Does Fear of Food Predict Anxiety and Food Intake in Patients with an Eating Disorder?

We entered all three subscales into a multiple regression with total anxiety during the first exposure meal as the outcome. Both anxiety about eating (part $r = .43$, $b^* = 0.53$, $p = .008$) and food avoidance behaviors (part $r = .41$, $b^* = 0.42$, $p = .012$) significantly predicted anxiety during the exposure. When total anxiety during the last exposure meal was used as the dependent variable, these relationships remained the same: Anxiety about eating (part $r = .33$, $b^* = 0.39$, $p = .045$) and food avoidance behaviors (part $r = .46$, $b^* = 0.47$, $p < .001$) predicted total anxiety. No subscale uniquely predicted food intake at the first exposure ($ps > 0.472$). However, there was a medium effect size (comparable to the effect size in Study 3) for anxiety about eating (part $r = -.23$, $b^* = -0.31$, $p = .176$) predicting food intake at Time 4.

Does Fear of Food Decrease During an Exposure Therapy Intervention?

Across the exposure therapy intervention scores on all three subscales significantly decreased:

TABLE 4. The Fear of Food Measure subscales before and after exposure intervention in participants with an eating disorder and means levels of fear of food in matched controls from study 4

	<i>M</i>	<i>SD</i>	Cohen's <i>d</i>
Anxiety about eating			
AE before (<i>N</i> = 41)	47.74	8.51	
AE after (<i>N</i> = 41)	43.76	9.47	0.44
Healthy controls (<i>N</i> = 23)	9.91	4.74	4.21
Food anxiety behavior			
FAB before (<i>N</i> = 41)	32.76	6.52	
FAB after (<i>N</i> = 41)	30.51	6.65	0.34
Healthy controls (<i>N</i> = 23)	18.04	6.41	1.76
Feared concerns			
FC before (<i>N</i> = 41)	53.00	7.52	
FC after (<i>N</i> = 41)	49.76	8.95	0.39
Healthy controls (<i>N</i> = 23)	12.05	5.17	5.09

Cohen's *d* is reported for both within (before and after exposure) and between (eating disorder versus control) group effects.

anxiety about eating $t(34) = 3.41$, $p = .002$; food avoidance behaviors $t(33) = 2.82$, $p = .008$; feared concerns $t(33) = 4.56$, $p < .001$, though effect sizes were small to moderate (Cohen's $d = 0.34$ to 0.44). Please see **Table 4** for the means before and after exposure therapy.

Is Fear of Food Higher in Patients with an Eating Disorder than in Healthy Controls?

As expected, participants diagnosed with an eating disorder had significantly higher levels of anxiety about eating $t(62) = 15.79$, $p < .001$, food avoidance behaviors $t(62) = 6.88$, $p < .001$, and feared concerns $t(62) = 19.54$, $p < .001$ than did matched healthy controls. Please see **Table 4** for means and standard deviations.

Overall Discussion

We found strong support for the validity of the Fear of Food measure, consisting of three cognitive-behavioral subscales: Anxiety about eating, food avoidance behaviors, and feared concerns. Across four studies we showed that this measure had good factor, convergent, divergent, and incremental validity. We showed that the anxiety about eating scale was associated with *in-vivo* food intake in both undergraduate females and a clinical sample of patients with eating disorders. Further, we showed that the anxiety about eating subscale was associated with negative affect and anxiety reported during and after a meal. We also found that all three subscales were elevated in participants diagnosed with an eating disorder versus healthy controls. Finally, and most importantly, we found that over the course of exposure therapy

scores on all three subscales decreased. Overall, we showed that the Fear of Food Measure is a valid assessment that can be used to assess outcomes before, during, and after exposure therapy for mealtime anxiety.

Exposure therapy is a promising treatment for the eating disorders.^{2,3} We hope that this measure will provide a tool that both clinicians and researchers can utilize when implementing exposure therapy for eating disorders, perhaps specifically for anorexia nervosa. We foresee several ways in which this measure could be used. First, this measure could be used to assess for high levels of trait anxiety about eating. All individuals with an eating disorder may not present with significant anxiety over eating. Individuals who do present with high levels of this trait may then be referred specifically to undergo exposure therapy for mealtime anxiety. Additional research is needed to determine if this measure can identify who can maximally benefit from exposure therapy and to determine appropriate cut-offs. Second, clinicians could utilize this measure to assess problematic avoidance behaviors that should be addressed in conjunction with exposure therapy³⁹ as assessed by the food avoidance behavior subscale.

Third, there is some initial indication that the three subscales of the FOFM decrease slightly during exposure therapy. Clinicians and researchers could use the FOFM to test if these fears are decreasing during exposure therapy. Similarly, this measure could be used in clinical trials as a tool to test if exposure therapy (or modifications to exposure therapy) is decreasing fear of food. However, more research is needed to test if the FOFM decreases during a full course of exposure therapy for eating disorders as compared to a control treatment. Finally, this measure can be used to help researchers better understand these underlying constructs and how they may lead to restriction and avoidance of food. For example, it is possible that anxiety about eating could mediate the relationship between feared concerns and disordered eating. We expect, similar to findings in the anxiety disorder literature, that these core fears (feared concerns) may give rise to anxiety over eating, which may then lead to restrictive and avoidance behaviors in a negative reinforcement cycle.⁴⁰ However, because our data is cross-sectional we cannot test for causality. Future longitudinal research will be needed to test this theory and to test if addressing these feared concerns in therapy can reduce anxiety about eating and decrease avoidant restrictive behaviors.

One of the main limitations of this study is the small sample size of the clinical sample, which may have limited our ability to detect effects in Study 4. It would have been ideal to have larger samples of both AN and BN participants to test if FOFM differs across diagnostic categories. Further, it would have been ideal to design a study in which food intake was measured at a test meal before undergoing exposure therapy to measure food intake in a more controlled manner across exposure therapy. Additionally, most of our data is cross-sectional and it would be ideal to have longitudinal data to test causal effects. Finally, it would be ideal to test the test-retest reliability over a shorter period of time (i.e., 4 weeks) that reflects the length of exposure trials specifically for anorexia nervosa.⁴ However, we think that many of these limitations are offset by the large samples in the first three studies and that this work represents an important first step in the development of this measure. Ultimately, in the future it would be ideal to test the Fear of Food Measure in a larger sample of patients diagnosed with an eating disorder in a prospective design.

In summary, the studies presented here fill a gap in the literature on exposure therapy and eating disorders. We developed a novel measure of trait fear of food that measures three major cognitive behavioral components of anxiety: Anxiety about eating, food avoidance behaviors, and feared concerns. The FOFM is the first measure, of which we are aware, that has been designed specifically to test outcomes during exposure therapy for eating disorders. We hope that this measure will be utilized by both clinicians and researchers alike to help alleviate the extreme suffering associated with eating disorders.

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