

DISSERTATION

EXPLORING THE UTILITY OF EXPOSURE THERAPY IN ANOREXIA NERVOSA: THE
ROLE OF THE FEAR OF FOOD MEASURE

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ABSTRACT

EXPLORING THE UTILITY OF EXPOSURE THERAPY IN ANOREXIA NERVOSA: THE ROLE OF THE FEAR OF FOOD MEASURE

Background: Approximately 5% of patients diagnosed with anorexia nervosa (AN) die within four years of the diagnosis (Crisp et al., 1992; Moller-Madsen et al., 1970–1987; Patton, 1988). However, current evidence-based treatments for AN show limited efficacy (e.g., McIntosh et al., 2005; Kaidesoja et al., 2023). Exposure therapies have been recommended for use in AN due to the extensive overlap of anxiety disorder and eating disorder (ED) symptoms (e.g., Strober et al., 2004; Steinglass & Walsh, 2006), though which anxieties are central to ED symptomology is understudied (e.g., fear of weight gain, Brown & Levinson, 2022; Fairburn et al., 2009; fear of food, Brown & Levinson, 2022; Steinglass et al., 2010). The Fear of Food Measure (FOFM) examines fears that address all three components of a cognitive-behavioral model of anxiety. This study will examine the efficacy of exposure therapy in AN by examining scores on the FOFM and ED outcomes (using the Eating Disorder Inventory-3 (EDI-3)) after exposure therapy interventions. It will also examine the validity of fear of food (using the FOFM) as a central motivator/component to AN, by examining the connection between scores on the FOFM and the EDI-3. Lastly, this study will examine weight gain and its relationship to the FOFM and EDI-3. Results: Scores on the subscales of the FOFM and the EDI-3 significantly decreased from pre- to post-treatment. Feared Concerns was a significant predictor of all EDI-3 subscales, while Food Anxiety Behaviors was not. Additionally, Anxiety about Eating subscale significantly predicted some of the EDI-3 subscales, including Drive for Thinness and Body

Dissatisfaction. Lastly, subscales on the FOFM were not a significant predictor of weight gain during treatment. Weight gain was also not a significant predictor of decreased scores on the EDI-3 subscales at post-treatment, aside from Drive for Thinness, although post analysis showed significant weight gain among participants from pre- to post-treatment.

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INTRODUCTION

Eating disorders (ED) are characterized by anxiety and fears about food, eating, body image, and social evaluation (Levinson, Sala, et al., 2019). Over 9% of Americans during their lifetime are diagnosed with an ED, and over 10,200 deaths per year can be attributed as a direct result of an ED in the United States (Deloitte Access Economic, 2020). Due to methodological issues in the epidemiology of EDs (individuals with EDs concealing their illness or avoiding treatment), these numbers may be even higher (Smink et al., 2012). In a worldwide meta-analysis of ED mortality rates, EDs were among the deadliest mental disorders, second only to opioid overdose (Arcelus et al., 2011).

Anorexia Nervosa

Anorexia nervosa (AN) is one of eight types of feeding and eating disorders (others include pica, rumination disorder, bulimia nervosa (BN), avoidant/restrictive food intake disorder (ARFID), binge eating disorder (BED), other specified feeding or eating disorder (OSFED), and unspecified feeding or eating disorder (UFED)) recognized by the Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM-5) (American Psychiatric Association, 2013). AN, according to the DSM-5, is categorized by:

- a restriction of energy intake relative to requirements, leading to a significant low body weight in the context of age, sex, developmental trajectory and physical health (less than minimally normal/expected);
- an intense fear of gaining weight or becoming fat or persistent behavior that interferes with weight gain; and

- a disturbance by one's body weight or shape, self-worth influenced by body weight or shape, or persistent lack of recognition of seriousness of low bodyweight (American Psychiatric Association, 2013).

AN may also be categorized under restricting type or binge-eating/purging type and at times is classified as other specified feeding or eating disorder (atypical AN) due to the weight requirements of the disorder.

AN affects approximately 4% of females and 0.3% of males (van Eeden et al., 2021), and has a mortality rate six times higher than the general population, and higher than the mortality rate of other EDs (Papadopoulos et al., 2009). Further, according to the American Psychiatric Association (2013) about 5% of patients diagnosed with AN die within four years of the diagnosis, with the likelihood of death increasing with a longer duration of the illness (Crisp et al., 1992; Moller-Madsen et al., 1996; Patton, 1988).

Evidence-Based Treatments

Treatment of AN typically begins with a focus on acute weight restoration. Behavioral approaches between the 1960s and 1970s were the most common approach in inpatient and day treatment programs (Bemis, 1987) and focused on weight restoration (specifically focused on the utility and efficiency of reinforcement and incentives in “operant conditioning”). However, when weight restoration is the main treatment goal, patients continue to exhibit significant eating disorder psychopathology (e.g., fear of “fat”, excessive preoccupation with shape and weight, and abnormal eating behaviors) (Steinglass et al., 2011). A few studies have shown that after acute treatment, 30-50% of adult hospitalized patients required rehospitalization within one year of discharge (Channon et al., 1989; Eckert et al., 1995; Pike, 1998). These findings suggest that

behavioral therapy alone is not adequate for long-term change and sustained weight improvement.

Due to the lack of evidence for behavioral therapy on its own, cognitive behavioral therapy (CBT) has been incorporated in the treatment of EDs and is commonly used for AN based on its effectiveness for bulimia nervosa and binge eating disorder (Chavez & Insel, 2007; Fairburn et al., 2009; Hay & Claudino, 2010; Schmidt et al., 2007). Fairburn (2008), in a CBT manual, described that the treatment of EDs, specifically for underweight patients, focuses on psychoeducation about starvation, increasing motivation to change behaviors, and addressing the overvaluation of shape and weight. CBT for AN incorporates primarily cognitive techniques focused on the “overconcern with shape and weight” as well as behavioral techniques such as self-monitoring and between session experiments (e.g., discontinuing weighing between sessions) (Steinglass et al., 2011). Nonetheless, while CBT has been used for those with EDs, no gold-standard of treatment for adults with AN is established, and treatment outcomes are mixed (Schmidt et al., 2012). For example, Pike (1998) found that CBT, as compared to nutritional counseling, reduced the relapse rate among weight restored patients with AN. In contrast, McIntosh et al. (2005) found that CBT performed no better than clinical management in improving weight gain in underweight patients with AN. In addition, a treatment trial for patients with AN using CBT specifically aimed at normalizing eating and cognitive restructuring, in conjunction with fluoxetine or a placebo, found that their client sample had relapse rates as high as 57% after one year (Walsh et al., 2006). Further, a systematic review examining the effectiveness of CBT across several EDs found that CBT produces more benefits for people with symptoms of binge eating and/or purging and found limited evidence supporting CBT for those who are significantly low weight (those commonly diagnosed with AN) (Kaidesoja et al., 2023).

Other conventional approaches for treating AN include interpersonal therapy (Klerman et al., 1984) and behavioral family-based approaches (Minuchin et al., 1967) particularly for adolescents with AN (Lock, 2011). However, it is unclear how these approaches specifically impact the full range of unique AN symptomatology, in adults. As a result, other treatments for AN have commonly been based on phenomenological similarities between AN and other psychiatric illnesses. For instance, studies have emphasized the importance of exploring parallel disorders, such as anxiety disorders, that already have efficacious interventions (Steinglass & Walsh, 2006; Strober, 2004; Waller, 2008).

Anxiety and AN

There is sufficient evidence for the overlap of AN and anxiety disorders symptoms including shared symptomology, high comorbidity, shared risk and maintenance factors, and shared biological features (Murray et al., 2018; Strober et al., 2004; Steinglass et al., 2011). Patients with AN commonly endorse feeling nervous and unable to relax. They also endorse other physical symptoms of anxiety including muscle tension, shortness of breath, and fidgeting (Attia et al., 1998). Anxiety disorders are also the most common comorbidity in AN, exceeding the prevalence in the general population, and frequently precede and serve as a risk factor for the onset of AN and other ED symptoms (Bulik et al., 1997; Godart et al., 2002; Kaye et al., 2004; Pallister & Waller, 2008; Swinbourne & Touyz, 2007; Swinbourne et al., 2012). Further, AN and anxiety disorders share the same risk and maintenance factors including harm avoidance, intolerance of uncertainty, and perfectionism (Schaumberg et al., 2021). Neurobiological studies connecting anxiety to EDs show deficits in fear expression and fear extinctions areas of the brain in both those with anxiety disorders and EDs (Fullana et al., 2016; Pittig et al., 2018). Genetic

studies also show a shared genetic influence in the development of eating disorders and anxiety disorders (Silberg & Bulik, 2005).

Two psychopathological models have proposed a link for anxiety and AN (Strober et al., 2004; and Steinglass & Walsh, 2006). Strober et al. (2004) suggested that individuals with AN have a propensity and pathologic “overexpression of fear-based learning” where they are more prone to learn fear association (specifically a conditioned fear to weight), and therefore develop advanced food avoidance behaviors (such as avoidance of high-fat foods characteristic of AN). Steinglass & Walsh (2006) suggest that symptoms of AN overlap with obsessive-compulsive disorder (OCD) where individuals with AN experience obsessive-like intrusive thoughts around fear of weight gain and compulsive-like behaviors (to suppress this anxiety), and also have a diminished ability to learn new behaviors (i.e., deficits in implicit learning and set shifting), leaving those with AN stuck in rigid, repetitive, stereotyped dieting behavior.

Many studies support that fear-based concerns are central to ED psychopathology, regardless of ED diagnosis, including fear of food and fears of weight gain (Levinson et al., 2014; Levinson, Brosf, et al., 2017; Levinson, Vanzhula, et al., 2019; Levinson & Byrne, 2015; Linardon et al., 2018; Murray et al., 2018; Steinglass et al., 2012; Steinglass et al., 2014). Other research shows that fear of food is a feature of AN (Steinglass et al., 2010). Like anxiety, fear of food/gaining weight/becoming fat could be understood as an irrational belief driving avoidance behavior (i.e., insufficient caloric intake) (Steinglass et al., 2011).

Sunday et al. (1995) used the Yale-Brown-Cornell Eating Disorder Scale (YBC-EDS) and found that 100 patients with anorexia and bulimia commonly endorsed preoccupations, including anxiety in anticipation of a meal, concern about the content of the foods consumed, and fear of the effects of food on shape, weight, and mood. Levison and Williams (2020) found

that, in a sample of 1,622 combined clinical ED and undergraduates, the most common ED fears included fear of disliking how one's body feels due to weight gain (interoceptive awareness), disliking eating in social situations, feeling tense around food, fear of judgement due to weight gain, and food anxiety. Further, these irrational beliefs have been shown to drive specific behaviors. Individuals with AN commonly participate in avoidance behaviors, specifically restricting caloric intake. Laboratory studies of eating behavior have shown that AN patients avoid consuming calorie dense, unfamiliar food (Nova et al., 2001; Sysko et al., 2005; Windauer et al., 1993), and that patients with AN who have high pre-meal anxiety, show a decrease in caloric intake (Steinglass et al., 2010). Fear of food has also been shown to lead to caloric restriction, low dietary variety, and compensatory behaviors performed to undo the feared effects of food consumption in patients with AN (Lloyd et al., 2021) and has been shown to predict a drive for maintaining a low weight, even after discharge (Levinson, Brosos, et al., 2017).

The lack of support for treatments for AN (e.g., CBT and behavioral therapy alone) along with similarities between anxiety disorders and EDs (e.g., fear, avoidance behaviors), suggest the use and exploration of treatments for anxiety disorders, such as exposure therapy, in the treatment of AN.

Exposure Therapy

The efficacy of exposure therapy commonly used to treat anxiety disorders, has been recommended for use in treatment of EDs (Butler & Heimberg, 2020; Koskina et al., 2013; Steinglass et al., 2011). Specifically, exposure-based therapies have been explored for their efficacy in enhancing classic CBT. Reviews from Steinglass et al. (2011), Koskina et al. (2013), and Butler and Heimberg (2020) suggest that exposure therapy is successful in alleviating ED symptoms such as body image anxiety, bingeing and purging, avoidance behaviors, and rituals to

manage eating related anxiety. They also highlight and review studies that show success with several forms of eating disorder exposure therapy, such as virtual reality, mirror exposure, and meal therapy.

Exposure therapies for EDs are focused on extinguishing (or inhibiting) the connection between the feared stimulus and the feared outcome (Butler & Heimberg, 2020). For example, exposure and response prevention tactics used for individuals who binge expose them to typical binge foods, but prevent a binge, thereby decreasing their urge to binge over time. Further, other interventions include feared food exposures, or meal therapy, in which individuals are not able to engage in their anxiety reducing eating disorder behaviors (e.g., purging) after eating foods that they fear might lead to a loss of control or weight gain. Exposure to these feared foods over time is effective at reducing distress, and eventually eliminates the individuals' need or desire to engage in anxiety reducing eating disorder behaviors (Butler & Heimberg, 2020).

Among adult AN samples, exposure therapies have successfully resulted in a reduction of fears in relation to weight gain (Rushford & Ostermeyer, 1997), a reduction in body dissatisfaction and body anxiety (Key et al., 2002), a reduction in anxiety about food/eating/meals (Boutelle, 1998; Glasofer et al., 2016; Steinglass et al., 2014), a reduction of ED behaviors and symptoms (e.g., avoidance) (Cardi et al., 2019; Glasofer et al., 2016; Key et al., 2002; Levinson et al., 2014; Morgan et al., 2014), and a reduction in state anxiety (Cardi et al., 2019; Levinson et al., 2014; Steinglass et al., 2014). Exposures studies have also been shown to lead to increases in food and caloric intake (Glasofer et al., 2016; Steinglass et al., 2007; Steinglass et al., 2012; Steinglass et al., 2014) as well as weight gain (Butler et al., 2024; Cardi et al., 2012; Channon et al., 1989; Levinson et al., 2014).

Fear of Food Measure

Non-exposure studies have theorized and attempted to determine which fears best categorize symptoms that contribute to the development and maintenance of EDs (e.g., a fear of weight gain (Fairburn et al., 2009; Killen et al., 1996; Levinson & Williams, 2020), an overvaluation of weight and shape (Fairburn et al., 2009; Forrest et al., 2018; Levinson, Zerwas, et al., 2017; Levinson, Brosf, et al., 2018; Levinson, Sala, et al., 2018)). However, current research is still addressing which specific fears (e.g., fear of food, fear of weight gain, fear of fat) best categorize individuals with EDs, specifically AN. In a recent study, Brown and Levinson (2022) researched the prevalence and differences in eating disorder fears across eating disorder diagnoses. The researchers found that individuals diagnosed with AN most frequently endorsed fear of food as opposed to fear of weight gain, fear of personal consequences (i.e., losing control), fear of social consequences (i.e., rejection), exercise-related fears, or fears of discomfort (i.e., feeling physically uncomfortable).

While more research needs to be conducted to examine which specific fears are central to the psychopathology of EDs and specifically AN, a fear of food has shown promising results. The Fear of Food Measure (FOFM) (Levinson & Byrne, 2015), a measure examining an individual's fear of food, has been used to examine the efficacy of food-based concerns and exposure therapies for EDs (Levinson & Byrne, 2015). The development of this measure addressed a gap in the literature: that ED measures have not addressed all components of anxiety (in which exposure interventions were modeled after). A comprehensive cognitive-behavioral model of anxiety indicates three important components to be addressed in the treatment of anxiety disorders: (1) feelings (anxiety), (2) beliefs or thoughts (core fears/feared concerns/maladaptive thoughts that underlie anxiety), and (3) behaviors (avoidance) (Beck et al., 2005). Levinson and Byrne (2015) developed the FOFM which addressed all three cognitive and

behavioral outcomes proposed by anxiety models: (1) Anxiety About Eating (AE)- trait level fear of food or anxiety surrounding eating (2) Feared Concerns (FC)- feared concerns, beliefs, or maladaptive thoughts that may drive the underlying anxiety and (3) Food Anxiety Behaviors (FAB)- anxiety-related avoidance behaviors. The researchers found that the FOFM successfully predicted *in vivo* food intake over and above other established predictors of eating among an undergraduate sample of 72 women. Further, they found that in a clinical sample of 41 patients diagnosed with an ED, the FOFM showed that anxiety about eating was associated with food intake and anxiety during an exposure meal. They also found that all subscales of the FOFM (AE, FC, FAB) decreased significantly after four-sessions of exposure intervention. Finally, in a sample of 23 participants, the researchers determined that individuals diagnosed with an ED had on average higher levels on the FOFM than did matched controls (Levinson & Byrne, 2015). Other studies support this finding that those with EDs generally score higher on FOFM measures. In a study with 345 participants (250 individuals with self-reported eating disorders and 95 healthy controls), researchers found that those with self-reported eating disorders scored higher than healthy controls on the Anxiety about Eating and Feared Concerns subscales of the FOFM, and that healthy controls reported fewer Food Anxiety Behaviors compared to those with EDs (Melles & Jansen, 2023).

The FOFM was also used to evaluate ED outcomes in an imaginal exposure therapy study with 229 participants ($M_{age} = 29.24$, $SD = 10.25$) (217 females and 9 males) with EDs (AN (31.4%); BN (18.8%); BED (7.8%), Atypical AN (32.3%); Atypical BN (5.7%); Atypical BED (3.1%); AFRID (0.9%)) (Levinson et al., 2020). 98 participants were in current treatment for their ED (three in inpatient programs, three in partial hospitalization programs, one in a residential program, five in intensive outpatient programs, and 86 in outpatient programs). The

average body mass index (BMI) for all participants was 26.04 ($SD = 9.24$), and the average BMI was 16.53 ($SD = 1.43$) for participants with AN. The researchers tested a four-week trial of four sessions of weekly online imaginal exposures where patients wrote about and imagined a core ED fear (identified with a therapist). The participants completed pre, post, and six-month follow up measures of ED symptoms and fears, measured via the Eating Disorder Examination Questionnaire Version 4.0 (EDE-Q) and the FOFM. The researchers found that ED symptoms, and the three subscales of the FOFM (AE, FC, FAB), significantly decreased from pre- to post-treatment and remained significantly decreased during the six-month follow-up (Levinson et al., 2020).

Farrell, Bowie, et al. (2019) used the FOFM to evaluate the effectiveness of food-based exposure therapy interventions in 106 patients in an ED inpatient hospital ($M_{age} = 26.7$, $SD = 10.8$) (89 females and 17 males). Minimum requirement for length of stay at the hospital was 14 days and on average participants length of stay was 23.8 days ($SD = 12.6$). Their sample's diagnoses were comprised of AN restricting type ($n = 43$, 40.6%), AN, binge-eating/purging type ($n = 12$, 11.3%), BN ($n = 24$, 22.6%), BED ($n = 8$, 7.5%), ARFID ($n = 7$, 6.6%), and OSFED ($n = 12$, 11.3%). Further, 73 participants (68.9%) met criteria for at least one anxiety disorder. The sample's average BMI was 18.3 ($SD = 4.9$). The studies exposure interventions included a development of fear hierarchies that were gradually introduced into the patient's dietary plan. The researchers found that ED symptoms (i.e., self-induced vomiting, compulsive exercising) measured by the EDE-Q Version 6.0 and fear of food measured by the FOFM, significantly decreased from pre- to post-treatment (including a decrease on all subscales of the FOFM).

Farrell, Brosf, et al. (2019) examined the FOFM in a hospital-based day treatment program among 71 patients ($M_{age} = 28.11$, $SD = 9.49$) (65 females and 6 males) diagnosed with

EDs (AN restricting type ($n = 16$, 22.5%), AN, binge-eating/purging type ($n = 19$, 14.1%), BN ($n = 30$, 42.3%), BED ($n = 8$, 11.3%), ARFID ($n = 2$, 2.8%), and OSFED ($n = 5$, 7.0%)). Average length of stay in the program was 5.73 weeks ($SD = 1.84$). Patients received 3 hours of exposure daily through exposure homework activities as well as two meals and two snack times. ED symptoms, measured by the EDE-Q Version 6.0, and fear of food measured by the FOFM, showed significant decrease from pre-treatment to post-treatment (including a decrease on all subscales of the FOFM). Further, this study examined how FOFM predicted ED symptomology. The researchers found that AE and FC predicted the severity of ED pathology throughout treatment (lower scores on the subscales at the 2-week time point was predictive of decreased global ED severity at discharge) (Farrell, Brosos et al., 2019).

Lastly, Butler et al. (2024) examined the FOFM in a community-based sample of 36 individuals ($M_{age} = 28.90$, $SD = 10.80$) (33 females, 2 males, 1 unreported) who met a current diagnosis of AN, BN, or OSFED (primarily atypical AN). Participants completed a 10-session manualized combined in vivo and imaginal exposure intervention called “Facing Eating Disorder Fears” which was based upon a prolonged exposure for PTSD. Participants received exposure to individualized ED fears via a collaboratively written fear script and were given in vivo exposure homework in between sessions. ED symptoms, measured via the EDE-Q, and FOFM measures significantly decreased over the course of treatment. Researchers found that FOFM total scores, and AE and FAB all decreased from pre- to post-treatment and from pre-treatment to a 1-month follow up. They also found that FC decreased from pre-treatment to post-treatment and from post-treatment to a 1-month follow up. Lastly, they found that a reduction of ED symptoms persisted at the 1-month follow up.

Weight Gain

A few studies have examined the relationship between weight gain, ED symptoms, and other psychological symptoms. Eckert et al. (1982) found that among 105 hospitalized females diagnosed with AN, increases in weight predicted a decrease in depressive symptoms. Another study with 121 inpatient adolescents with AN found that weight gain significantly predicted improved disorder pathology later in treatment (Accurso et al., 2014). However, other studies have shown no connection between weight gain and improvement in psychological (i.e., depression, anxiety) and ED symptoms (Coulon et al., 2009; Kawai et al., 2008; Laessle et al., 1988; Mattar et al., 2012). Therefore, the link between weight gain and ED outcomes is not well understood.

Further, there is some evidence to suggest that weight gain varies by an individual's endorsed fear of food. For example, McFarlane et al. (2008) and Steinglass et al. (2010) found that fear of food was an obstacle to weight restoration when in ED treatment. Brown and Levinson (2022) also found that participants with an underweight BMI most frequently endorsed a fear of food as opposed to participants with normal weight/over-weight/obesity BMIs. Fear of food has also been shown to predict a drive for maintaining low weight even after intensive treatment and discharge (Levinson et al., 2017). Further, Lloyd et al. (2021) suggests that fear of food, specifically in individuals with AN, leads to an increase in ED behaviors to compensate for the feared effects of food consumption, such as weight gain. Murray, Loeb, et al. (2016) and Murray, Treanor, et al. (2016) also suggest that the association between food and the outcome of weight gain creates anxiety for those with AN. Therefore, the relationship between fear of food, weight gain, and ED outcomes is unclear.

Current Study

Previous research suggests that over the course of exposure therapy, fears of food (Boutelle, 1998; Glasofer et al., 2016; Steinglass et al., 2014), and eating disorder symptomology (Cardi et al., 2019; Glasofer et al., 2016; Key et al., 2002; Levinson et al., 2014; Morgan et al., 2014), such as avoidance of foods, decrease. Further, previous research has theorized about which fears best categorize symptoms of eating disorders (e.g., a fear of weight gain, Fairburn et al., 2009; Killen et al., 1996; Levinson & Williams, 2020, an overvaluation of weight and shape, Fairburn et al., 2009; Forrest et al., 2018; Levinson, Zerwas, et al., 2017; Levinson, Brosf, et al., 2018; Levinson, Sala, et al., 2018)). Additionally, only one study has confirmed that fear of food is the most prevalent fear among those with AN (Brown & Levinson, 2022). Therefore, while fear of food among those with AN is a promising finding, which fears best map onto eating disorder symptomology is still understudied, specifically for individuals with anorexia nervosa.

In addition, the studies exploring eating disorder fears have not included all the components of anxiety even though exposure interventions are modeled after anxiety due to the overlap of anxiety and anorexia nervosa symptoms (Strober et al., 2004; Steinglass & Walsh, 2006). The only studies to address evidence-based cognitive behavioral models of anxiety used the Fear of Food Measure (Butler et al., 2024; Farrell, Bowie, et al., 2019; Farrell, Brosf, et al., 2019; Levinson & Byrne, 2015; Levinson et al., 2020). Despite the success of the use of the Fear of Food Measure, it has only been evaluated in a few studies, of these studies only two examined the use of the Fear of Food Measure in predominately hospital-based settings (Farrell, Bowie, et al., 2019; Farrell, Brosf, et al., 2019), and only two studies have examined whether the Fear of Food Measure scores predicted eating disorder outcomes (Farrell, Brosf, et al., 2019; Levinson & Byrne, 2015). Farrell, Brosf, et al. (2019) found that measures on the Anxiety and Eating and Feared Concerns subscales predicted the severity of eating disorder pathology throughout

treatment (lower scores on the subscales at the 2- week time point was predictive of decreased global eating disorder severity at discharge). This study only examined how scores at the 2-week time point on the Fear of Food Measure predicted eating disorder severity at discharge. This study did not examine if fear of food at both admission and discharge predicted eating disorder outcomes. Levison and Byrne (2015) and Melles and Jansen (2023) were also able to determine that on average, individuals diagnosed with an eating disorder had higher Fear of Food Measure scores than did matched controls. However, their studies didn't examine differences between eating disorder symptom severity on eating disorder outcome measures, and only examined differences between those with eating disorder diagnoses and those without.

The current study will build upon and expand previous research and will assess whether exposure therapy interventions lead to a reduction in an individual's fear of food, whether exposure therapy interventions lead to a reduction in an individual's overall report of eating disorder symptoms, as well as whether a reduction in fear of food predicts reductions in reported eating disorder symptoms after exposure therapy interventions. This study will also examine the validity of fear of food, using the Fear of Food Measure, as a predictor of severity of eating disorder symptoms at pre- and post-treatment.

Lastly, this study will assess the role of weight gain. Previous studies suggest that fear of food influences weight gain (Levinson et al., 2017; McFarlane et al., 2008) and that those with underweight BMIs endorse fear of food more frequently than their counterparts (Brown & Levinson, 2022). Other research also suggests that weight gain has an influence on eating disorder outcomes (Accurso et al., 2014; Eckert et al., 1982). Further, Lloyd et al. (2021) suggests that fear of food leads to an increase in eating disorder behaviors to compensate for the feared effects of food consumption, such as weight gain. Therefore, the relationship between

weight gain, fear of food, and eating disorder outcomes is unclear. This study will assess the relationship between weight gain and fear of food as well as the relationship between weight gain and eating disorder outcomes.

Hypotheses

Relying on previous findings that show a reduction of fear of food as well as other eating disorder outcomes after the implementation of exposure therapy interventions, it was hypothesized that the Fear of Food Measure subscales (Anxiety about Eating, Feared Concerns, Food Anxiety Behaviors) and eating disorder outcomes on the Eating Disorder Inventory-3 (EDI-3) (Drive for Thinness (DT), Bulimia (B), Body Dissatisfaction (BD), Perfectionism (P), and the Eating Disorder Risk Composite score (EDRC)) would decrease after the utilization of exposure interventions. In addition, based on previous findings that suggest that subscales on the Fear of Food Measure predict eating disorder severity, it was hypothesized that a reduction on the Fear of Food Measure subscales from pre- to post-treatment would predict a reduction in eating disorder outcomes on the EDI-3 (Drive for Thinness (DT), Bulimia (B), Body Dissatisfaction (BD), Perfectionism (P), and the Eating Disorder Risk Composite score (EDRC)) from pre- to post-treatment. It was also hypothesized that higher scores on the Fear of Food Measure subscales would predict higher scores on the eating disorder outcomes on the EDI-3 (Drive for Thinness (DT), Bulimia (B), Body Dissatisfaction (BD), Perfectionism (P), and the Eating Disorder Risk Composite score (EDRC)) at pre-treatment and post-treatment. In addition, based on previous findings that weight gain influences and is influenced by measures of fear of food and eating disorder outcomes, it was hypothesized that a reduction on the Fear of Food Measure subscales from pre- to post-treatment would predict an increase in weight gain from pre- to post-treatment. Lastly, it was hypothesized that an increase in weight gain from pre- to

post-treatment would predict lower scores on the eating disorder outcomes on the EDI-3 (Drive for Thinness (DT), Bulimia (B), Body Dissatisfaction (BD), Perfectionism (P), and the Eating Disorder Risk Composite score (EDRC)) at post-treatment.

METHOD

Power Analysis

An a priori power analysis was conducted using RStudio's "pwr" package to determine the minimum sample size required to test this study's hypotheses. Results indicated the required sample size to achieve 80% power (medium effect) using a significance criterion of $\alpha = .05$, was $N = 99$ for the multiple linear regressions.

Participants

The study's sample was comprised of 100 individuals ($M_{\text{age}} = 27.02$, $SD_{\text{age}} = 9.38$) (ages ranged from 18-63) (86 women, 7 men, 1 transgender woman, 1 transgender man, 4 genderqueer/gender fluid individuals, and 1 gender questioning individual) from an ED-specialty adult partial hospitalization (PHP) and transitional intensive outpatient program (IOP) in the Southwest. Patients were required to be in the program for a minimum of 14 days to be included in this study, similar to Farrell, Bowie, et al. (2019), to ensure the patients received enough of the exposure intervention. Participants were all 18 years or older and identified racially as White ($N = 80$; 80%), African American or Black ($N = 2$; 2%), Hispanic or LatinX ($N = 6$; 6%), Asian or Asian American ($N = 3$; 3%), or Multiracial ($N = 9$; 9%). 38 participants (38%) had completed some college or junior college and 28 participants (28%) had completed an undergraduate/bachelor's degree. Other participants had either completed some high school ($N = 6$; 6%), received a high school diploma ($N = 7$; 7%), received an associate's degree ($N = 6$; 6%), completed a master's degree, ($N = 5$; 5%), or selected other/didn't select their level of education ($N = 10$; 10%).

Procedures

Patients upon admission and discharge completed pre-test and post-test data. Patients at pre-test (admission) and post-test (discharge) completed the Fear of Food Measure and the Eating Disorder Inventory-3. Patients' weight and body mass index were also gathered during pre- and post-data. Patients in the PHP program were weighed on a biweekly basis, while patients in the IOP program were weighed once a week. The treatment program ran during weekdays for 10 hours (Monday-Friday) and weekends for 8 hours (Saturday-Sunday). PHP patients were required to attend program all days of the week, while those in transitional IOP attended anywhere from three to seven days of program (only after completion of PHP).

To facilitate exposure to feared food, meal therapy was conducted. Meal therapy is an exposure technique aimed at restoring/implementing regular mealtimes/snack times with individuals who on average exhibit difficulty eating and/or consume fewer calories than other individuals. The purpose is like other exposure techniques for eating disorders, in which the aim is to extinguish (or inhibit) the connection between the feared stimulus and the feared outcome by exposing individuals with EDs to feared foods and eliminating their ability to engage in anxiety reducing eating disorder behaviors (e.g., purging). Further, meal therapy often occurs in front of others (e.g., staff, peers) adding another component and exposure to the meal eating process. Meal therapy has been shown to be a successful form of exposure therapy for those with eating disorders, specifically people with anorexia nervosa, since mealtime is commonly associated with a heightened state of anxiety and increased frequency of disordered eating behaviors (Cardi et al., 2015; Gianini et al., 2015; Steinglass et al., 2010; White et al., 2015).

PHP patients were required to attend three meals (breakfast, lunch, dinner) and two snacks per day. IOP patients were required to attend one meal (generally lunch), and one to two snacks per day. Lunch and dinner were served as "blind meals", meaning the patients were

unaware of the meal components. Patients at breakfast were able to choose their meal components from a provided list but were still required to choose components based off their meal plan. Throughout treatment, and through suggestions from their dietician, patients would complete “challenge meals and snacks” where fear foods were incorporated into their meal plan. Meals and snacks were facilitated by milieu therapists, and on occasion, dieticians. Meals and snacks took place in a dining room where patients were surrounded by their peers. Milieu therapists and dieticians encouraged and supported the patients throughout meal and snack completion and other food challenges. Milieu therapists and dieticians, for example, would encourage the patient to complete their meal, and would also verbally identify/discourage any ED behaviors a patient was displaying to the patient in real time (e.g., avoiding, restricting). During the COVID pandemic, meal therapy was conducted virtually for three weeks. Patients were delivered packed meals and were encouraged to eat them with their primary therapist and/or dietician virtually. Patients were also advised to document and photograph completed meals during this time to further encourage accountability.

Meal therapy in this study was not manipulated and participants were not randomly assigned to specific meal therapy exposure interventions. Therefore, this study is not a clinical trial, but an observational study, aimed to examine the treatment outcomes of an exposure-based intervention, including the correlations of those outcomes with particular predictor variables.

The treatment program predominately utilized exposure-based CBT and Cognitive Behavioral Therapy-Enhanced (CBT-E). CBT-E was created specifically for the use of EDs and explores the cognitive and behavioral processes within EDs (Fairburn, 2008). Within these modalities, patients were encouraged to identify the maladaptive thoughts and behavioral processes maintaining their ED (e.g., fear of food), and worked to recognize the disordered

thinking to normalize their eating thoughts and behaviors (Fairburn, 2008). Patients during the week at minimum, in addition to meal therapy, received two individual therapy sessions (PHP patients) or one individual therapy session (IOP patients) with their primary therapist, as well as one session with their family therapist, dietician, and psychiatrist. Exposure therapy interventions, aimed at addressing patient's fear of food, were further explored, and utilized in these sessions.

Instruments

Fear of Food Measure

The Fear of Food Measure (FOFM) (Levinson & Byrne, 2015) (see Appendix) was used to assess eating-related fear and avoidance. The measure included 23-items on a 7-point Likert scale (1 = not at all characteristics, 7 = very much so characteristics). The FOFM included three subscales: Anxiety about Eating (AE; e.g., "I feel anxious when I eat"), Feared Concerns (FC; e.g., "Eating makes me anxious because I worry I might get sick"), and Food Anxiety Behaviors (FAB; e.g., "There are certain foods I avoid because they make me anxious"). Levinson and Byrne (2015) tested convergent, discriminant, and incremental validity in community and clinical samples in four separate studies (adults recruited from the community, undergraduate students (2), and individuals from a community eating disorder facility). The researchers tested convergent and discriminant validity by examining the FOFM relationships with eating disorder outcomes (e.g., food intake, measures on the Eating Disorder Inventory-2), with other psychological measures (e.g., depression, negative affect, trait anxiety, and self-esteem), and with personality items (e.g., neuroticism and agreeableness). The researchers also ensured that the convergent relationships were stronger than the discriminant relationships and that the FOFM more strongly related to disordered eating than other related constructs. Lastly, the researchers

tested incremental validity by testing to see if the FOFM subscales predicted disordered eating over and above other related constructs (e.g., depression). Levinson & Byrne (2015) found that this three-factor model had good convergent, discriminant, and incremental validity across their clinical and community adult samples.

The Fear of Food Measure subscale scores were calculated as the total of the responses in that subscale (Anxiety about Eating: 8 items; Feared Concerns: 9 items; Food Anxiety Behaviors: 6 items). The internal consistency reliability of the subscales of the Fear of Food Measure was determined by conducting Cronbach alpha analysis on each of the subscales at pre- and post-treatment. An acceptable internal consistency was determined by a Cronbach alpha value of 0.70 or greater. The internal-consistency reliability of the Anxiety about Eating subscale was 0.93 at pre-treatment and 0.98 at post-treatment. The internal-consistency reliability of the Feared Concerns subscale was 0.84 at pre-treatment and 0.93 at post-treatment. The internal-consistency reliability of the Food Anxiety Behaviors subscale was 0.78 at pre-treatment and 0.90 at post-treatment.

EDI-3

The Eating Disorder Inventory-3 (EDI-3) (Garner, 2004) was used to assess ED symptoms and outcomes. The EDI-3 is a standardized, self-report measure that examines ED symptoms as well as other psychological characteristics. The scale consists of 91 items, on a 5-point Likert scale (0 to 4) organized into 12 primary scales, and contains three eating disorder specific primary scales (Drive for Thinness (DT), Bulimia (B), and Body Dissatisfaction (BD)) and 9 general psychological scales that are highly related to but not specific to EDs (Low Self-Esteem (LSE), Personal Alienation (PA), Interpersonal Insecurity (II), Interpersonal Alienation (IA), Interoceptive Deficits (ID), Emotional Dysregulation (ED), Perfectionism (P), and Maturity

Fears (MF)). The EDI-3 yields six composite scores: one that is ED specific (i.e., Eating Disorder Risk Composite (EDRC), which is a summed score of the DT, B, and BD subscales) and five that are general psychological constructs (i.e., Ineffectiveness Composite (IC), Interpersonal problems Composite (IPC), Affective Problems Composite (APC), Overcontrol Composite (OC), and General Psychological Maladjustment (GPMC)). The Eating Disorder Risk Composite reliability ranges from .90-.97 across four diagnostic groups and three normative groups. The three-eating disorder specific primary scales' reliabilities, (Drive for Thinness (DT), Bulimia (B), and Body Dissatisfaction (BD)), range from .80-.90 among normative groups. In this study, the three-eating disorder specific primary scales (Drive for Thinness (DT), Bulimia (B), and Body Dissatisfaction (BD)), the Eating Disorder Risk Composite score (EDRC), and the Perfectionism (P) primary scale (due to its prevalence in anorexia nervosa patients (Bastiani et al., 1995)), were used to measure eating disorder outcomes.

Weight Gain

Weight gain was measured as the difference between Body Mass Index (BMI) scores of the patients from pre- to post-treatment. Body Mass Index was measured as an individual's weight in kilograms divided by the square of height in meters (Center for Disease Control and Prevention, 2022). While it is acknowledged that weight gain is not a full picture of an individual's overall health, or total success in eating disorder treatment, weight gain (measured via BMI) has historically been measured as a primary predictor and outcome variable in eating disorder research and treatment, specifically in those with anorexia nervosa (Vall & Wade, 2015).

Data Analyses

The hypotheses concerned the comparison of the Fear of Food Measure subscale scores (Anxiety about Food, Feared Concerns, Food Anxiety Behaviors) from pre- to post-treatment, as well as the comparison of eating disorder outcomes on the EDI-3 (Drive for Thinness (DT), Bulimia (B), Body Dissatisfaction (BD), Perfectionism (P), and the Eating Disorder Risk Composite score (EDRC)) from pre- to post-treatment. Additionally, the hypotheses concerned the interactions between Fear of Food Measure subscale scores and EDI-3 eating disorder outcomes at pre- and post-treatment and from pre- to post-treatment. The hypotheses also concerned the interaction between the Fear of Food Measure subscale scores (Anxiety about Food, Feared Concerns, Food Anxiety Behaviors) from pre- to post-treatment and weight gain from pre- to post-treatment. Lastly, the hypotheses concerned the interaction between weight gain from pre- to post-treatment and eating disorder outcomes on the EDI-3 (Drive for Thinness (DT), Bulimia (B), Body Dissatisfaction (BD), Perfectionism (P), and the Eating Disorder Risk Composite score (EDRC)) at post-treatment.

To indicate whether the Fear of Food Measure subscales (Anxiety about Eating, Feared Concerns, Food Anxiety Behaviors) and eating disorder outcomes on the EDI-3 (Drive for Thinness (DT), Bulimia (B), Body Dissatisfaction (BD), Perfectionism (P), and the Eating Disorder Risk Composite score (EDRC)) decreased from pre- to post-treatment, multiple linear regressions were conducted and determined significant with p values $< .05$. Length of stay in treatment and pre-treatment Fear of Food Measure subscale scores and pre-treatment EDI-3 subscale scores were added as control variables.

To analyze whether a reduction in scores on the Fear of Food Measure subscales (Anxiety about Eating, Feared Concerns, Food Anxiety Behaviors) predicted a reduction in scores on the eating disorder outcomes on the EDI-3 (Drive for Thinness (DT), Bulimia (B),

Body Dissatisfaction (BD), Perfectionism (P), and the Eating Disorder Risk Composite score (EDRC)), from pre- to post-treatment, multiple linear regressions were conducted and were considered significant with p values $< .05$, while controlling for length of stay in treatment.

To determine whether higher scores on the Fear of Food Measure subscales (Anxiety about Eating, Feared Concerns, Food Anxiety Behaviors) predicted higher scores on the eating disorder outcomes on the EDI-3 (Drive for Thinness (DT), Bulimia (B), Body Dissatisfaction (BD), Perfectionism (P), and the Eating Disorder Risk Composite score (EDRC)) at pre-treatment, multiple linear regressions were conducted and were considered significant with p values $< .05$ as done in Levinson and Byrne (2015). This same analysis was conducted at post-treatment, controlling for the Fear of Food Measure subscale scores and the EDI-3 subscale scores at pre-treatment, as well as length of stay in treatment.

Lastly, to examine whether a reduction in scores on the Fear of Food Measure subscales (Anxiety about Eating, Feared Concerns, Food Anxiety Behaviors) predicted an increase in weight gain (change in BMI) from pre- to post-treatment, a multiple linear regression was conducted and was considered significant with p values $< .05$, while controlling for length of stay in treatment. In addition, to examine whether an increase in weight gain from pre- to post-treatment (change in BMI) predicted lower scores on the eating disorder outcomes on the EDI-3 at post-treatment (Drive for Thinness (DT), Bulimia (B), Body Dissatisfaction (BD), Perfectionism (P), and the Eating Disorder Risk Composite score (EDRC)), multiple linear regressions were conducted and were considered significant with p values $< .05$, while controlling for length of stay in treatment.

Data Management

Outliers were first examined and were determined present if any values exceeded + or - three standard deviations from the mean. Four responses were identified to be outliers but three were determined to be a formula error. These three responses were corrected and were no longer determined to be outliers. The additional outlier response was not a formula error and was removed from the data set.

Correlations were also conducted between pre- and post-treatment scores on the FOFM subscales (AE, FC, FAB) to ensure they were correlated at the two time points. The correlations showed moderate positive Pearson correlations among the pre- and post-treatment subscale scores. The correlations between pre- and post-treatment subscales were also all significant (Anxiety about Eating, $r(88) = .46, p < .001$; Feared Concerns, $r(90) = .49, p < .001$; Food Anxiety Behaviors, $r(90) = .43, p < .001$).

Lastly, heteroscedasticity was conducted on the models using the Breusch-Pagan Test (Breusch & Pagan, 1979). Seven models exhibited heteroscedasticity p values $< .05$. Therefore, robust standard errors were calculated using Huber-White sandwich estimators via the sandwich package (Zeileis, 2004). The robust covariance matrix estimator HC3 was used to give valid standard errors as HC3 is often preferred for small-sample sizes (MacKinnon & White, 1985).

RESULTS

Descriptive Data

All 100 participants were diagnosed with Anorexia Nervosa. 63 of the 100 participants (63%) met diagnostic criteria for AN restricting type, while 33 (33%) met criteria for AN binge-eating/purging type, and 4 (4%) for other specified feeding or eating disorder (atypical AN). 67 of the 100 participants (67%) had a comorbid diagnosis of generalized anxiety disorder. Seventy of the participants had a history of previous eating disorder treatment. Participant's length of stay in treatment ranged from 17-613 days. On average, participants spent 107.8 days ($SD = 67.52$) in program.

Average scores on the Fear of Food measures pre-treatment were the following: Anxiety about Eating ($M = 43.68$, $SD = 11.06$), Feared Concerns ($M = 46.67$, $SD = 11.90$), and Food Anxiety Behaviors ($M = 26.65$, $SD = 9.42$). Average scores on the Fear of Food measures post-treatment were the following: Anxiety about Eating ($M = 30.53$, $SD = 16.75$), Feared Concerns ($M = 32.89$, $SD = 17.40$), and Food Anxiety Behaviors ($M = 19.74$, $SD = 11.56$).

Average scores on the EDI-3 subscales pre-treatment were the following: Drive for Thinness ($M = 20.23$, $SD = 7.41$), Bulimia ($M = 6.59$, $SD = 6.76$), Body Dissatisfaction ($M = 26.79$, $SD = 10.09$), Perfectionism ($M = 14.23$, $SD = 6.29$), and the Eating Disorder Risk Composite score ($M = 149.20$, $SD = 21.92$). Average scores on the EDI-3 subscales post-treatment were the following: Drive for Thinness ($M = 13.00$, $SD = 9.98$), Bulimia ($M = 3.78$, $SD = 5.33$), Body Dissatisfaction ($M = 19.84$, $SD = 12.66$), Perfectionism ($M = 12.70$, $SD = 6.12$), and the Eating Disorder Risk Composite score ($M = 129.80$, $SD = 27.24$).

The average differences on the Fear of Food measure subscales from pre- to post-treatment were the following: Anxiety about Eating ($M = -13.65$, $SD = 15.05$), Feared Concerns ($M = -13.66$, $SD = 15.57$), and Food Anxiety Behaviors ($M = -6.88$, $SD = 11.08$). The average differences on the EDI-3 subscales from pre- to post-treatment were the following: Drive for Thinness ($M = -7.47$, $SD = 8.97$), Bulimia ($M = -3.21$, $SD = 4.82$), Body Dissatisfaction ($M = -6.82$, $SD = 12.14$), Perfectionism ($M = -1.34$, $SD = 4.98$), and the Eating Disorder Risk Composite score ($M = -20.14$, $SD = 27.83$).

Average BMI was 19.46 (scores ranged from 14.16- 42.29) ($SD = 4.32$) at pre-treatment and 21.83 (scores ranged from 15.22- 42.46) ($SD = 4.60$) at post-treatment. Average weight gain during a treatment stay (difference in BMI from pre- to post-treatment) was 2.23 (scores ranged from -1.71 to 8.15) ($SD = 2.27$).

Hypothesis 1

To test the hypothesis that the Fear of Food subscales (Anxiety about Eating, Feared Concerns, Food Anxiety Behaviors) would decrease from pre- to post-treatment, multiple linear regressions were conducted for each subscale as opposed to t-tests to control for covariates. A change in Fear of Food subscale scores (from pre- to post-treatment) were regressed onto pre-treatment Fear of Food subscale scores and length of stay in treatment, which were centered at their mean to make the models' intercepts more meaningful and bolster interpretation. Pre-treatment Fear of Food subscale scores and length of stay in treatment were included as control variables in these models. A change of Fear of Food subscale scores (post-treatment scores minus pre-treatment scores) were used as the outcome variables in these models to measure the overall change in Fear of Food subscales from pre- to post-treatment. The intercept was the primary focus of these models to examine this overall effect. Anxiety about Eating ($F(2, 87) =$

4.17, $p = .019$, $R^2 = .087$), Feared Concerns ($F(2, 89) = 3.79$, $p = .026$, $R^2 = .079$), and Food Anxiety Behaviors ($F(2, 89) = 9.36$, $p < .001$, $R^2 = .174$) significantly decreased from pre- to post-treatment as the intercept was significant for each of these models. Results for these models can be seen in Table 1.

Table 1

Regression Coefficients for Pre- to Post-Treatment Differences for Fear of Food Subscales, Controlling for Pre-Treatment Subscale Scores and Length of Stay in Treatment

	<i>b</i>	<i>t</i>	<i>p</i>
Model 1: Anxiety about Eating			
(Intercept)	-13.64	-9.70	< .001
Pre-AE	-0.33	-2.75	.007
Days in Treatment	-0.02	-0.51	.609
Model 2: Feared Concerns			
(Intercept)	-13.78	-9.61	< .001
Pre-FC	-0.34	-3.14	.002
Days in Treatment	<0.01	0.13	.898
Model 3: Food Anxiety Behaviors			
(Intercept)	-6.90	-7.21	< .001
Pre-FAB	-0.48	-4.14	< .001
Days in Treatment	-0.01	-0.98	.331

Note. Table 1 displays three multiple linear regressions. The outcome variables in these models are the change in Fear of Food Measure subscale scores from pre-treatment to post-treatment (e.g., for Model 1 the outcome variable is the change in scores for Anxiety about Eating from pre- to post-treatment). Pre-AE (Pre-treatment Anxiety about Eating), Pre-FC (Pre-treatment Feared Concerns), Pre-FAB (Pre-treatment Food Anxiety Behaviors), and Days in Treatment were added as control variables and were centered at the mean. Model 1 and Model 2 values were computed using robust standard errors. Bold denotes significance.

To test the hypothesis that the EDI-3 subscales (Drive for Thinness, Bulimia, Body Dissatisfaction, Perfectionism, and the Eating Disorder Risk Composite score) would decrease from pre- to post-treatment, multiple linear regressions were conducted in a similar fashion as the Fear of Food subscales. A change in EDI-3 subscale scores (post-treatment scores minus pre-treatment scores) were regressed onto pre-treatment EDI-3 subscale scores and length of stay in treatment which were both centered at the mean. Pre-treatment EDI-3 subscale scores and length of stay in treatment were included as control variables in these models. The intercepts were

primarily examined to view overall effect and change in these subscales over time. All EDI-3 subscales, Drive for Thinness ($F(2, 88) = 5.97, p = .004, R^2 = .119$), Bulimia ($F(2, 88) = 20.16, p < .001, R^2 = .314$), Body Dissatisfaction ($F(2, 88) = 10.73, p < .001, R^2 = .196$), Perfectionism ($F(2, 86) = 10.82, p < .001, R^2 = .201$), and the Eating Disorder Risk Composite score ($F(2, 88) = 14.68, p < .001, R^2 = .250$), significantly decreased from pre- to post-treatment as the intercept was significant for each of these models. Results for these models can be seen in Table 2.

Table 2

Regression Coefficients for Pre- to Post-Treatment Differences for EDI-3 Subscales, Controlling for Pre-Treatment Subscale Scores and Length of Stay in Treatment

	<i>b</i>	<i>t</i>	<i>p</i>
Model 1: Drive for Thinness			
(Intercept)	-7.43	-9.30	< .001
Pre-DT	-0.40	-3.45	.001
Days in Treatment	<.01	-0.18	.856
Model 2: Bulimia			
(Intercept)	-3.16	-8.12	< .001
Pre-B	-0.37	-3.75	<.001
Days in Treatment	<0.01	-0.40	.694
Model 3: Body Dissatisfaction			
(Intercept)	-7.01	-6.66	< .001
Pre-BD	-0.54	-4.59	< .001
Days in Treatment	-0.01	-0.82	.413
Model 4: Perfectionism			
(Intercept)	-1.39	-3.16	.002
Pre-P	-0.37	-4.50	<.001
Days in Treatment	<0.01	-1.03	.304
Model 5: Eating Disorder Risk Composite			
(Intercept)	-20.05	-8.56	< .001
Pre-EDRC	-0.61	-5.18	< .001
Days in Treatment	-0.02	-0.40	.693

Note. Table 2 displays five multiple linear regressions. The outcome variables in these models are the change in EDI-3 subscale scores from pre-treatment to post-treatment (e.g., for Model 1 the outcome variable is the change in scores for Drive for Thinness from pre- to post-treatment). Pre-DT (Pre-treatment Drive for Thinness), Pre-B (Pre-treatment Bulimia), Pre-BD (Pre-treatment Body Dissatisfaction), Pre-P (Pre-treatment Perfectionism), Pre-EDRC (Pre-treatment Eating Disorder Risk Composite score),

and Days in Treatment were added as control variables and were centered at the mean. Model 2 and Model 5 values were computed using robust standard errors. Bold denotes significance.

Hypothesis 2

It was hypothesized that a reduction in scores on the Fear of Food Measure subscales (Anxiety about Eating, Feared Concerns, Food Anxiety Behaviors) would predict a reduction in scores on the EDI-3 subscales (Drive for Thinness, Bulimia, Body Dissatisfaction, Perfectionism, and the Eating Disorder Risk Composite score), from pre- to post-treatment. Multiple linear regressions were conducted to examine these relationships. A change in each individual EDI-3 subscale scores (post-treatment scores minus pre-treatment scores) were regressed onto all three of the change in Fear of Food Measure subscale scores (post-treatment scores minus pre-treatment scores) (e.g., the difference in Drive for Thinness from pre- to post-treatment was regressed onto the difference in Anxiety about Eating, Feared Concerns, and Food Anxiety Behaviors from pre- to post-treatment). Length of stay in treatment was also included as a control variable in these models. A reduction in Anxiety about Eating and Feared Concerns significantly predicted a reduction in Drive for Thinness ($F(4, 80) = 31.02, p < .001, R^2 = .608$), but Food Anxiety Behaviors was not a significant predictor. A reduction in Feared Concerns significantly predicted a reduction in Bulimia scores ($F(4, 80) = 7.08, p < .001, R^2 = .261$); however, neither a reduction in Anxiety about Eating nor Food Anxiety Behaviors predicted a reduction in Bulimia scores. A reduction in Anxiety about Eating and Feared Concerns predicted a reduction in Body Dissatisfaction ($F(4, 80) = 36.90, p < .001, R^2 = .649$), but Food Anxiety Behaviors did not. Lastly, a reduction in Feared Concerns predicted a reduction in Perfectionism ($F(4, 79) = 4.673, p = .002, R^2 = .191$) and the Eating Disorder Risk Composite ($F(4, 80) = 27.85, p < .001, R^2 = .582$), while a reduction in Anxiety about Eating and Food Anxiety Behaviors did not. See Table 3 for results.

Table 3

Regression Coefficients for a Reduction in Fear of Food subscales predicting a Reduction in EDI-3 subscales, Controlling for Length of Stay in Treatment

	<i>b</i>	<i>t</i>	<i>p</i>
Model 1: Drive for Thinness			
Anxiety about Eating	0.27	3.17	.002
Feared Concerns	0.21	2.92	.005
Food Anxiety Behaviors	0.03	0.32	.747
Days in Treatment	0.01	1.31	.194
Model 2: Bulimia			
Anxiety about Eating	-0.04	-0.64	.526
Feared Concerns	0.19	3.67	<.001
Food Anxiety Behaviors	-0.02	-0.24	.813
Days in Treatment	-0.01	-1.27	.208
Model 3: Body Dissatisfaction			
Anxiety about Eating	0.40	3.54	.001
Feared Concerns	0.24	2.51	.014
Food Anxiety Behaviors	0.13	0.93	.356
Days in Treatment	.01	0.45	.654
Model 4: Perfectionism			
Anxiety about Eating	0.02	0.23	.820
Feared Concerns	0.13	2.04	.045
Food Anxiety Behaviors	0.01	0.12	.908
Days in Treatment	-0.01	-0.99	.324
Model 5: Eating Disorder Risk Composite			
Anxiety about Eating	0.46	1.71	.091
Feared Concerns	0.95	4.15	<.001
Food Anxiety Behaviors	0.10	0.29	.773
Days in Treatment	0.01	0.33	.744

Note. Table 3 displays five multiple linear regressions. The outcome variables in these models are change scores for the EDI-3 subscales (post-treatment scores minus pre-treatment scores). The predictor variables are the change scores for the Fear of Food subscales (post-treatment scores minus pre-treatment scores). Days in Treatment was added as a control variable. Bold denotes significance.

Hypothesis 3

To test the hypothesis that higher scores on the Fear of Food Measure subscales (Anxiety about Eating, Feared Concerns, Food Anxiety Behaviors) predicted higher scores on the EDI-3

subscales (Drive for Thinness, Bulimia, Body Dissatisfaction, Perfectionism, and the Eating Disorder Risk Composite score) at pre-treatment, multiple linear regressions were conducted. Pre-treatment EDI-3 subscales were regressed onto all three of the Fear of Food Measure subscales. Higher scores on Anxiety about Eating and Feared Concerns subscales significantly predicted higher scores on Drive for Thinness subscales at pre-treatment ($F(3, 91) = 49.77, p < .001, R^2 = .621$); however, Food Anxiety Behaviors did not. Higher scores on the Feared Concerns subscale significantly predicted higher scores on Bulimia ($F(3, 91) = 4.39, p = .006, R^2 = .126$), and Body Dissatisfaction ($F(3, 91) = 17.61, p < .001, R^2 = .367$), while Anxiety about Eating and Food Anxiety Behaviors did not. None of the Fear of Food Measure subscales significantly predicted the Perfectionism subscale ($F(3, 91) = 2.79, p = .045, R^2 = .084$). Lastly, higher scores on Anxiety about Eating and Feared Concerns subscales significantly predicted higher scores on the Eating Disorder Risk Composite score ($F(3, 91) = 31.22, p < .001, R^2 = .507$), but Food Anxiety Behaviors did not. See Table 4 for results.

To test whether higher scores on the Fear of Food measure subscales (Anxiety about Eating, Feared Concerns, Food Anxiety Behaviors) predicted higher scores on the EDI-3 subscales (Drive for Thinness, Bulimia, Body Dissatisfaction, Perfectionism, and the Eating Disorder Risk Composite score) at post-treatment, multiple linear regressions were conducted as above. However, pre-treatment Fear of Food measure subscale scores, pre-treatment EDI-3 subscale scores, and length of stay in treatment were added to each model as controls (e.g., Drive for Thinness post-treatment score was regressed onto Anxiety about Eating post-treatment and pre-treatment scores, Feared Concerns post-treatment and pre-treatment scores, Food Anxiety behaviors post-treatment and pre-treatment scores, Drive for Thinness pre-treatment score and length of stay in treatment). Higher scores on Anxiety about Eating and Feared Concerns

subscales at post-treatment significantly predicted higher scores on Drive for Thinness ($F(8, 76) = 23.40, p < .001, R^2 = .711$) and Body Dissatisfaction ($F(8, 76) = 20.34, p < .001, R^2 = .682$) subscales at post-treatment. However, higher scores on Food Anxiety Behaviors subscale at post-treatment did not predict higher scores for Drive for Thinness nor Body Dissatisfaction. None of the Fear of Food measure subscale scores significantly predicted Bulimia outcomes ($F(8, 76) = 20.35, p < .001, R^2 = .682$). Additionally, higher scores on the Feared Concerns subscale score at post-treatment significantly predicted higher scores on the Perfectionism ($F(8, 75) = 15.54, p < .001, R^2 = .624$) and Eating Disorder Risk Composite ($F(8, 76) = 18.56, p < .001, R^2 = .661$) subscale scores at post-treatment, but neither Anxiety about Eating nor Food Anxiety Behaviors had a significant impact. See Table 4 for results.

Table 4

Regression Coefficients for Higher Scores on Fear of Food subscales Predicting Higher Scores on EDI-3 subscales at Pre-treatment and Post-treatment, Controlling for Length of Stay at Post-treatment

Pre-treatment	<i>b</i>	<i>t</i>	<i>p</i>	Post-treatment	<i>b</i>	<i>t</i>	<i>p</i>
Model 1: Drive for Thinness							
Anxiety about Eating	0.18	2.24	.027	Anxiety about Eating	0.18	2.01	.048
Feared Concerns	0.31	4.33	<.001	Feared Concerns	0.21	2.26	.027
Food Anxiety Behaviors	0.10	1.44	.155	Food Anxiety Behaviors	0.17	1.30	.198
				Days in Treatment	0.01	0.76	.450
Model 2: Bulimia							
Anxiety about Eating	<0.01	0.03	.977	Anxiety about Eating	-0.01	-0.19	.851
Feared Concerns	0.21	2.67	.009	Feared Concerns	0.10	1.55	.125
Food Anxiety Behaviors	-0.01	-0.12	.903	Food Anxiety Behaviors	0.07	0.60	.547
				Days in Treatment	-0.01	-1.09	.279
Model 3: Body Dissatisfaction							
Anxiety about Eating	0.16	1.41	.164	Anxiety about Eating	0.27	2.29	.025
Feared Concerns	0.31	3.28	.001	Feared Concerns	0.30	2.53	.013
Food Anxiety Behaviors	0.14	1.14	.256	Food Anxiety Behaviors	0.16	0.90	.371
				Days in Treatment	<0.01	-0.04	.971
Model 4: Perfectionism							
Anxiety about Eating	0.12	1.41	.163	Anxiety about Eating	0.03	0.43	.670
Feared Concerns	0.05	0.69	.492	Feared Concerns	0.23	3.50	.001
Food Anxiety Behaviors	<0.01	0.04	.972	Food Anxiety Behaviors	-0.10	-1.04	.302

Model 5: Eating Disorder Risk Composite				Days in Treatment	-0.01	-1.28	.206
Anxiety about Eating	0.47	2.10	.038	Anxiety about Eating	0.17	0.69	.492
Feared Concerns	0.86	4.64	< .001	Feared Concerns	0.73	2.85	.006
Food Anxiety Behaviors	0.21	0.87	.385	Food Anxiety Behaviors	0.60	1.57	.120
				Days in Treatment	-0.02	-0.92	.360

Note. Table 4 displays ten multiple linear regressions. The outcome variables in the pre-treatment models are EDI-3 subscale scores at pre-treatment. The outcome variables in the post-treatment models are EDI-3 subscale scores at post-treatment. The predictor variables for pre-treatment models are the Fear of Food subscale scores at pre-treatment. The predictor variables for post-treatment models are the Fear of Food subscale scores at post-treatment. Days in Treatment was added as a control variable in addition to pre-treatment Fear of Food and EDI-3 subscale scores (not depicted here) for post-treatment models. Values for Model 1 for pre-treatment analysis and Model 2 for post-treatment analysis were computed using robust standard errors. Bold denotes significance.

Hypothesis 4

It was hypothesized that a reduction in scores on the Fear of Food Measure subscales (Anxiety about Eating, Feared Concerns, Food Anxiety Behaviors) would predict an increase in weight gain (change in BMI) from pre-treatment to post-treatment. One multiple linear regression was conducted to examine this relationship. A change in scores for BMI from pre-treatment to post-treatment (post-treatment scores minus pre-treatment scores) was regressed onto a change in scores for the Fear of Food Measure subscales from pre-treatment to post-treatment (post-treatment scores minus pre-treatment scores) (e.g., the difference in BMI from pre- to post-treatment was regressed onto the difference in Anxiety about Eating, Feared Concerns, and Food Anxiety Behaviors from pre- to post-treatment). Length of stay in treatment was also included as a control variable in this model. None of the Fear of Food Measure subscale change in scores significantly predicted a change in scores for BMI ($F(4, 83) = 1.578, p = .188, R^2 = .071$). See Table 5 for results.

Table 5

Regression Coefficients for a Reduction in Fear of Food subscales Predicting an Increase in Weight Gain, Controlling for Length of Stay in Treatment

	<i>b</i>	<i>t</i>	<i>p</i>
Model 1: Weight Gain			

Anxiety about Eating	-0.02	-0.58	.566
Feared Concerns	0.02	0.85	.397
Food Anxiety Behaviors	-0.02	-0.33	.745
Days in Treatment	<0.01	0.56	.576

Note. Table 5 displays one multiple linear regression. The outcome variable in this model is the change score for BMI (post-treatment scores minus pre-treatment scores). The predictor variable is the change scores for the Fear of Food subscales (post-treatment scores minus pre-treatment scores). Days in Treatment was added as a control variable. This model's values were computed using robust standard errors.

It was also hypothesized that an increase in weight gain from pre- to post-treatment would predict lower scores on the EDI-3 subscales (Drive for Thinness, Bulimia, Body Dissatisfaction, Perfectionism, and the Eating Disorder Risk Composite score) at post-treatment. Multiple linear regressions were conducted to examine these relationships. EDI-3 subscale scores at post-treatment were regressed onto a change in scores for BMI from pre-treatment to post-treatment (post-treatment scores minus pre-treatment scores). Length of stay in treatment was also included as a control variable in these models. An increase in weight gain significantly predicted a reduction in scores on the Drive for Thinness subscale of the EDI-3 at post-treatment ($F(2, 88) = 2.38, p = .099, R^2 = .051$). However, an increase in weight gain did not significantly predict a reduction in scores on the remaining EDI-3 subscales at post-treatment: Bulimia ($F(2, 88) = 2.12, p = .127, R^2 = .046$), Body Dissatisfaction ($F(2, 88) = 1.01, p = .368, R^2 = .022$), Perfectionism ($F(2, 87) = 1.48, p = .233, R^2 = .033$), and the Eating Disorder Risk Composite ($F(2, 88) = 1.17, p = .316, R^2 = .026$). See Table 6 for results.

Table 6
Regression Coefficients for a Reduction in Fear of Food subscales predicting a Reduction in EDI-3 subscales, Controlling for Length of Stay in Treatment

	<i>b</i>	<i>t</i>	<i>p</i>
Model 1: Drive for Thinness			
Weight Gain	-0.91	-2.00	.049
Days in Treatment	<0.01	-0.28	.783
Model 2: Bulimia			
Weight Gain	-0.59	-1.98	.051
Days in Treatment	<0.01	0.02	.987

Model 3: Body Dissatisfaction			
Weight Gain	-0.64	-1.07	.289
Days in Treatment	-0.01	-0.60	.548
Model 4: Perfectionism			
Weight Gain	-0.45	-1.55	.125
Days in Treatment	<0.01	-0.23	.781
Model 5: Eating Disorder Risk Composite			
Weight Gain	-0.90	-0.71	.479
Days in Treatment	-0.04	-1.10	.275

Note. Table 6 displays five multiple linear regressions. The outcome variables in these models are the EDI-3 subscale scores at post-treatment. The predictor variables are the change scores for weight gain (post-treatment BMI minus pre-treatment BMI). Days in Treatment was added as a control variable. Bold denotes significance.

While not hypothesized, due to insignificant results between weight gain and the Fear of Food Measure and the EDI-3, an analysis of change in BMI from pre -to post-treatment was conducted post hoc to determine efficacy in exposure therapy interventions in weight gain for AN patients. A multiple linear regression was conducted as opposed to a t-test to control for covariates. A change in BMI from pre- to post-treatment (from pre- to post-treatment) was regressed onto pre-treatment BMI scores and length of stay in treatment, which were centered at their mean to make the model’s intercept more meaningful and bolster interpretation. Pre-treatment BMI and length of stay in treatment were included as control variables for this model. A change in BMI (post-treatment scores minus pre-treatment scores) was used as the outcome variable in this model to measure the overall change in BMI from pre- to post-treatment. The intercept was the primary focus of this model, as in hypothesis 1, to examine the overall effect. The model was significant ($F(2, 95) = 7.21, p = .001, R^2 = .132$) and BMI, while controlling for pre-treatment BMI and length of stay in treatment, significantly increased from pre- to post-treatment due to the significance of the intercept. See Table 7 for results.

Table 7

Regression Coefficients for Pre- to Post-Treatment Differences for BMIs, Controlling for Pre-Treatment BMI and Length of Stay in Treatment

	<i>b</i>	<i>t</i>	<i>p</i>
Model 1: Weight Gain			
(Intercept)	2.24	10.63	< .001
Pre-BMI	-0.11	-2.55	.012
Days in Treatment	0.01	0.74	.461

Note. Table 7 displays one multiple linear regression. The outcome variable in this model is the change score for BMI (post-treatment scores minus pre-treatment scores). Pre-BMI (Pre-treatment BMI) and Days in Treatment were added as control variables and were centered at the mean. This model's values were computed using robust standard errors. Bold denotes significance.

DISCUSSION

The current study tested several hypotheses aimed at examining the efficacy of exposure therapy in Anorexia Nervosa, due to its significant overlap with anxiety, by identifying outcomes on the Fear of Food Measure and on the EDI-3. Additionally, this study aimed to examine the validity of fear of food, using the Fear of Food Measure, as a central motivator/component to AN, by examining relationships between the Fear of Food Measure and eating disorder outcomes on the EDI-3. Lastly, this study aimed to examine relationships between the Fear of Food Measure and weight gain in addition to eating disorder outcomes (measured via the EDI-3) and weight gain.

It was hypothesized that scores on the Fear of Food Measure and on the EDI-3 would significantly decrease from pre- to post-treatment after the implementation of exposure therapy. Secondly, a reduction in Fear of Food Measure scores was hypothesized to predict a significant reduction in eating disorder outcomes from pre- to post-treatment on the EDI-3, due to the proposed connection between measures on the Fear of Food Measure and eating disorder outcomes. It was hypothesized that higher scores on the Fear of Food Measure would predict significantly higher scores in eating disorder outcomes on the EDI-3 at pre- and post-treatment. It was also hypothesized that a reduction in scores on the Fear of Food Measure from pre- to post-treatment would predict a significant increase in weight gain from pre- to post-treatment. Lastly, it was hypothesized that an increase in weight gain from pre- to post-treatment would predict lower scores on the eating disorder outcomes on the EDI-3 at post-treatment. Overall, the hypotheses were partially supported. Findings are discussed below.

Pre- to Post-Treatment Differences

Subscale scores on the Fear of Food Measure, including Anxiety about Eating, Feared Concerns, and Food Anxiety Behaviors, in addition to all subscale scores on the EDI-3, including Drive for Thinness, Bulimia, Body Dissatisfaction, Perfectionism, and the Eating Disorder Risk Composite (a global measure of eating concerns), significantly decreased from pre- to post-treatment while controlling for length of stay and pre-treatment subscale scores. This finding demonstrates the efficacy of exposure therapy in reducing fear-based concerns in eating disorders, specifically fear of food, in addition to eating disorder outcomes. This finding is consistent with the existing literature that examines the efficacy of exposure therapy in treating eating disorders, specifically that exposure therapy for EDs shows reductions in fear-based concerns (Boutelle, 1998; Cardi et al., 2019; Glasofer et al., 2016; Key et al., 2002; Levinson et al., 2014; Rushford & Ostermeyer, 1997; Steinglass et al., 2014) and that exposure therapy lends itself to an alleviation of ED symptoms (Cardi et al., 2019; Glasofer et al., 2016; Key et al., 2002; Levinson et al., 2014; Levinson et al., 2020; Morgan et al., 2014). However, this finding also extends the existing literature in that fear of food, specifically, reduces after the implementation of exposure therapy interventions (Boutelle, 1998; Glasofer et al., 2016; Steinglass et al., 2014). Specifically, this finding extends the existing literature by showing reductions on all subscales (Anxiety about Eating, Feared Concerns, and Food Anxiety Behaviors) of the Fear of Food Measure after exposure therapy (Butler et al., 2024; Farrell, Bowie, et al., 2019; Farrell, Brosf, et al., 2019; Levinson & Byrne, 2015; Levinson et al., 2020). It also supports the finding that exposure therapy interventions for individuals with AN, specifically meal therapy, is effective at reducing fear of food in hospital-based studies. Only two studies prior have been able to do so (Farrell, Bowie, et al., 2019; Farrell, Brosf, et al., 2019). Lastly, these findings reinforce the relationship between anxiety disorders and AN (due to the

efficacy of exposure-based therapy interventions in AN) and validates the use of exposure therapy interventions, specifically meal therapy, in the treatment of those with anorexia nervosa.

Fear of Food Measure and the EDI-3

When examining the connection between the Fear of Food Measure and eating disorder outcomes measured by the EDI-3, reductions on subscales of the Fear of Food Measure from pre- to post-treatment were compared to reductions on subscales on the EDI-3 from pre- to post-treatment, while controlling for length of stay in treatment. Additionally, higher scores on the Fear of Food Measure subscales were compared against higher scores on the subscales of the EDI-3 at pre-treatment and post-treatment (controlling for length of stay in treatment and pre-treatment scores).

Reductions on the Feared Concerns subscale from the Fear of Food Measure significantly predicted a reduction in scores on all subscales of the EDI-3 (Drive for Thinness, Bulimia, Body Dissatisfaction, Perfectionism, and the Eating Disorder Risk Composite) from pre- to post-treatment. Higher scores on the Feared Concerns subscale also predicted higher scores on EDI-3 subscales, including the Eating Disorder Risk Composite, at pre- and post-treatment aside from Perfectionism at pre-treatment and Bulimia at post-treatment.

When exploring the relationship between the Anxiety about Eating subscale on the Fear of Food Measure and the subscales on the EDI-3, reductions in the Anxiety about Eating subscale from pre- to post-treatment predicted reductions in the Drive for Thinness and Body Dissatisfaction subscales on the EDI-3. Further, higher scores on the Anxiety about Eating subscale predicted higher scores on the Drive for Thinness at both pre- and post-treatment, in addition to Body Dissatisfaction at post-treatment, and The Eating Disorder Risk Composite score at pre-treatment.

Lastly, when examining the influence of the Food Anxiety Behaviors subscale on eating disorder outcomes measured by the EDI-3, reductions on the Food Anxiety Behaviors from pre- to post-treatment did not significantly predict reductions on any of the EDI-3 subscales. Furthermore, higher scores on the Food Anxiety Behaviors subscale did not predict higher scores on any of the EDI-3 subscales at pre- or post-treatment.

These findings suggest that Feared Concerns (feared concerns, beliefs, or maladaptive thoughts that may drive underlying anxiety) have the most efficacious link to eating disorder outcomes, as measured on the EDI-3. These findings also suggest a poor link between Food Anxiety Behaviors (anxiety related avoidance behaviors) and eating disorder outcomes as well as a moderate link between Anxiety about Eating (trait level fear of food or anxiety surrounding eating) and eating disorder outcomes. The Fear of Food Measure was created to address all components of a cognitive-behavioral model of anxiety due to the proposed link between anxiety and eating disorders, specifically anorexia nervosa: (1) feelings (anxiety), (2) beliefs or thoughts (core fears/feared concerns/maladaptive thoughts that underlie anxiety), and (3) behaviors (avoidance) (Beck et al., 2005; Levinson & Byrne, 2015). While previous studies have shown reductions in scores on all subscales of the Fear of Food Measure and other eating disorder outcome measures (measured primarily by the EDE-Q) from pre- to post-treatment (Butler et al., 2024; Farrell, Bowie, et al., 2019; Farrell, Brosf, et al., 2019; Levinson & Byrne, 2015; Levinson et al., 2020), and other studies have shown that those with ED's have on average higher scores on the Fear of Food Measure (Levinson & Byrne, 2015; Melles & Jansen, 2023), only two studies examined how the Fear of Food Measure predicted eating disorder symptomology (Farrell, Brosf, et al., 2019; Levinson & Byrne, 2015), and only one study examined the specific link between the Fear of Food Measure subscales and eating disorder symptomology,

measured by the EDE-Q (Farrell, Brosf, et al., 2019). The findings from the current study are consistent with the findings from Farrell, Brosf, et al. (2019), in that the Feared Concerns subscale was a significant predictor of global eating disorder outcomes at pre- and post-treatment and Anxiety about Eating was a significant predictor of global eating disorder outcomes at pre-treatment. However, Farrell, Brosf, et al. (2019) did not examine how the Fear of Food Measure subscales predicted eating disorder outcomes at both pre- and post-treatment. The researchers examined how lower scores on the Anxiety about Eating and Feared Concerns subscales at the 2-week time point was predictive of decreased global eating disorder severity at discharge. Additionally, this study's finding that Food Anxiety Behaviors was not predictive of eating disorder outcomes is consistent with the findings of Farrell, Brosf, et al. (2019) as the researchers did not find a significant relationship between Food Anxiety Behaviors and eating disorder outcomes on the EDE-Q.

This is the first study to examine how reductions on the Fear of Food Measures subscales from pre- to post-treatment predict reductions on eating disorder outcomes from pre- to post-treatment. This relationship was proposed due to the presumed link between scores on the Fear of Food and eating disorder outcomes in that those with EDs have been found to have higher Fear of Food Measure scores (Levinson & Byrne, 2015; Melles & Jansen, 2023) and due to previous studies that have found a reduction in measures on the Fear of Food Measure and eating disorder outcomes from pre- to post-treatment (Butler et al., 2024; Farrell, Bowie, et al., 2019; Farrell, Brosf, et al., 2019; Levinson & Byrne, 2015; Levinson et al., 2020). Furthermore, this is the first study to examine how the subscales on the Fear of Food Measure predict specific eating disorder outcome subscales. The only study to examine this link (Farrell, Brosf, et al., 2019) used global eating disorder outcome scores measured by the EDE-Q. This study found

significant relationships between Feared Concerns and all subscales, including Drive for Thinness, Bulimia, Body Dissatisfaction, and Perfectionism. This study also found significant relationships between Anxiety about Eating and Drive for Thinness and Body Dissatisfaction. It is hypothesized that Feared Concerns was a strong predictor of all EDI-3 outcomes due to the significance of beliefs/thoughts, as opposed to feelings or behaviors, being the driving force in CBT. For example, CBT often begins with addressing and modifying maladaptive thoughts patterns which then improves emotional and behavioral responses (Beck, 1970). Thoughts/beliefs are often at the center of CBT treatment and therapeutic change among individuals and could explain the significance of the Feared Concerns subscale in predicting EDI-3 subscales in this study.

Further, the Anxiety about Eating subscale may be a significant factor in Drive for Thinness and Body Dissatisfaction due to a connection between anxiety and body-related core components of AN. Jérolon et al. (2022) and Marzola et al. (2020) found that those with an anxious temperament tend to have more body-related core components of AN (e.g., concerns about their body weight/shape) (which Drive for Thinness and Body Dissatisfaction both measure). Specifically, Jérolon et al. (2022) found that an anxious temperament (individuals with an anxious tendency) led to increases on scores for Drive for Thinness. The researchers also found a close relationship with those with anxious temperaments and Body Dissatisfaction, although this was not statistically significant. These findings point to the important connection between anxious traits, measured by the Fear of Food, and core AN body-related psychopathology such as eating, shape, and weight concerns in addition to a preoccupation with wanting to be thinner. These findings also support the key role that anxiety plays in those with AN, and validates the use of exposure-based therapy interventions in those with AN.

The lack of significance of the Food Anxiety Behaviors subscale could be for several reasons. As this study and Farrell, Brosnoff, et al. (2019) have been the only studies to examine the relationship between measures on the FOFM and eating disorder outcomes, and both have found that the Food Anxiety Behaviors subscale was not a significant predictor of eating disorder outcomes, it could be that the FOFM Food Anxiety Behaviors subscale does not adequately measure or map onto all eating disorder behaviors. Further, this sample was comprised of AN participants with various subtypes. It is possible that those with AN restricting type, AN binge-eating/purging type, and other specified feeding or eating disorder (atypical AN) differ in their report and engagement in Food Anxiety Behaviors. For example, those with AN restricting type may engage more heavily in food avoidance behaviors as opposed to their counterparts. Lastly, it is possible that the lack of findings with the Food Anxiety Behaviors subscale could be a result of underreporting of behaviors as those with EDs are found to often conceal or hide their illness (Smink et al., 2012).

Overall, these findings provide support for the validity of fear of food, measured using the FOFM, in those with AN in a hospital-based setting due to the significant relationships between measures on the FOFM subscales and measures on the EDI-3 subscales at both pre- and post-treatment in addition to reductions on the FOFM subscales predicting reductions on the EDI-3 subscales from pre- to post-treatment. While this study did not compare the FOFM's predictive validity to that of scores from other fear of food measures, the relationships between the FOFM and the EDI-3 show support for the validity of fear of food, measured by the FOFM, in those with AN. This finding reinforces previous findings that the FOFM has good convergent, discriminant, and incremental validity in community and clinical samples (Levinson & Byrne, 2015).

Weight Gain

Reductions on the Fear of Food Measure subscales did not significantly predict an increase in weight gain (change in BMI) from pre- to post-treatment. This means that fear of food may not be a driving factor for weight gain in ED treatment for those with AN. This finding is not in line with previous studies who find that fear of food is an obstacle for weight restoration (McFarlane et al., 2008; Steinglass et al., 2010) and that underweight individuals frequently endorse a fear of food as opposed to those with normal weight/over-weight/obesity BMIs (Brown & Levinson, 2022). However, the relationship between fear of food and weight gain is still unclear as some studies find that the association between food and the outcome of weight gain creates anxiety for those with AN (Murray, Loeb, et al., 2016; Murray, Treanor, et al., 2016). Therefore, it is unclear if weight gain would lead to reductions of fear of food or increases in fear of food due to their increased weight gain. While this study did not find a relationship between the Fear of Food Measure and weight gain, this relationship warrants future study in order to sufficiently rule out fear of food's impact on weight gain during ED treatment for those with AN.

Additionally, weight gain from pre- to post-treatment predicted lower scores on the Drive for Thinness subscale at post-treatment but did not predict lower scores on the remaining EDI-3 subscales at post-treatment. The finding that weight gain predicted lower scores on the Drive for Thinness subscale is in line with previous studies that find increases in weight among AN patients predict a decrease in disorder pathology later in treatment (Accurso et al., 2014). Further, this finding makes sense in that the Drive for Thinness subscale measures desires to be thinner, concerns with dieting, and preoccupation with weight and an intense fear of weight gain (Garner, 2004). If individuals gained weight during treatment, therefore individuals were

exposed to weight gain, it would make sense why fears surrounding weight gain would also decrease. However, other studies have shown no connection between weight gain and improvement in psychological (i.e., depression, anxiety) and ED symptoms (Coulon et al., 2009; Kawai et al., 2008; Laessle et al., 1988; Mattar et al., 2012), which may explain the lack of support for the remainder of these hypotheses. These mixed results are reflective of the mixed literature surrounding weight gain and ED outcomes. Additionally, these mixed findings convolute the connection between weight gain and ED symptoms. While weight gain may decrease an individual's Drive for Thinness, it may have no impact on an individual's other eating disorder outcomes, including measures of bulimia (thinking about and engaging in bouts of uncontrollable overeating, body dissatisfaction (discontentment with the overall shape and size of body regions), perfectionism (achieving high goals and standards of personal achievement), and their global measure of eating concerns. While it is a positive finding that weight gain did not increase eating disorder outcomes, a lack of impact may mean that weight gain is not sufficient in describing an individual's overall ED improvement. This is congruent with previous studies that find that weight restoration on its own is not sufficient in reducing eating disorder symptomology (Channon et al., 1989; Eckert et al., 1995; Pike, 1998; Steinglass et al., 2011) and confirms that treatments like exposure therapy (as opposed to just behavioral therapy) are more effective at targeting the underpinnings of AN eating disorder symptomology.

Post hoc analysis did show a significant increase in BMI (a mean increase of 2.24 on the BMI scale) from pre- to post treatment when controlling for pre-treatment BMI and length of stay in program. While weight gain is not the full picture of an individual's overall health, or total success in eating disorder treatment, it has been shown to be a primary outcome variable in eating disorder research, particularly with those with anorexia nervosa (Vall & Wade, 2015). The

finding from this study supports previous literature that connects the implementation of exposure therapy for individuals with anorexia nervosa with increases in BMI (Butler et al., 2024; Cardi et al., 2012; Channon et al., 1989; Levinson et al., 2014). This finding provides support for the use of exposure-based interventions for the treatment of AN, particularly for those in need of weight restoration as pre-treatment BMI (centered at the mean) was significant in this model. This means that individuals with lower pre-treatment BMI gained significantly more weight than those with higher pre-treatment BMIs. This is an important finding due to the lack of current evidence-based outpatient treatment for underweight individuals with AN (Murray et al., 2019).

While this study did not find significant relationships between the FOFM and eating disorder outcomes and BMI but found a significant increase in BMI from pre- to post-treatment, it is important to recognize the constraints in using BMI to measure weight. It is possible that the insignificant results related to BMI in this study, specifically when examining the relationships BMI has with other variables, are a result of the lack of efficacy in using BMI as a measure of weight. For example, BMI is an indirect measure of body fat and does not integrate differences related to age/sex/ethnic background, proportion of body fat or muscle mass. Measures of BMI have also shown poor sensitivity and specificity in measuring body composition (Kok et al., 2004; Rothman, 2008). Therefore, BMI may not be the most efficacious measure of weight and could have influenced the findings in this study.

Days in Treatment

Days in Treatment (length of stay in treatment) was added as a control variable in several models in this study in order to control for this variable when examining reductions in subscales on the Fear of Food Measure, EDI-3, and in BMI from pre- to post-treatment. However, Days in Treatment did not show significance as a predictor in the reduction of Fear of Food subscales,

EDI-3 subscales, or weight gain from pre- to post-treatment, meaning an individual's length of stay in treatment had no impact. This finding indicates that other factors, aside from length of stay in treatment, have a more significant impact on reducing measures of fear of food and eating disorder outcomes, and increases in weight gain for those with AN in ED treatment. It also means that individuals with AN who participate in ED treatment with various stay lengths may benefit equally from exposure-based interventions.

Limitations and Future Research

Limitations of this study include a small sample size in addition to a lack of comparison or control group, which limits the ability to make conclusions about the efficacy of exposure-based interventions alone in addition to comparisons to individuals who received no treatment/non-exposure-based treatment. Further, this sample was not transdiagnostic, and had limited demographic diversity (age, gender, race) and therefore limits the ability to generalize these findings. This study also did not differentiate treatment outcomes for those with AN restricting type versus AN binge-eating/purging type. Since studies like Brown and Levinson (2022) highlight significant differences in endorsed fears among eating disorder diagnoses, future research with more diverse samples would be important to determine which fears exposure-based therapy interventions should address in the treatment of divergent eating disorders. Additionally, it may be beneficial for future studies to examine how treatment outcomes differ for those with various AN subtypes given the potential differences between fears and eating disorder symptomology for those with restricting type versus AN binge-eating/purging type. Future studies may include subtypes as a moderator in their analyses in order to examine differences between these eating disorder diagnoses.

Second, 67 of the 100 participants in this sample had a comorbid diagnosis of generalized anxiety disorder. However, group differences between those with generalized anxiety disorders, and other comorbid disorders/no comorbid disorders, was not analyzed. Therefore, findings from this study are not able to conclude whether some patients benefited from exposure-based interventions due to their anxiety diagnosis or their AN diagnosis. Future studies should address this gap and explore differences between those with AN and those with AN and anxiety.

Third, this study did not examine differences in scores on the Fear of Food Measure, EDI-3, or BMI after discharge. It would be important to identify if reductions on the Fear of Food Measure and EDI-3, and increases in BMI, persist past treatment stay due to the significant relapse rates of those with EDs. Since previous studies have identified high relapse rates with CBT treatment alone in patients with AN (57% after one year) (Walsh et al., 2006), it would be meaningful to compare relapse rates to individuals with AN who have received exposure-based interventions.

Lastly, it is important to recognize that this is an observational study as opposed to a clinical trial. While this study aimed to examine the efficacy of exposure-based therapy interventions in those with AN, this study did not include a manipulation of the intervention nor random assignment to the intervention. Therefore, conclusions made by this study are observational and not causal and should be interpreted accordingly. Additionally, while exposure therapy was a central component to the program structure, and this study, participants did receive other therapeutic interventions (e.g., individual therapy, family therapy, skills groups) during their treatment stay. Further, while meal therapy was conducted for the same amount of time at the same time of day (e.g., lunch at noon for one hour), deviations in the ways in which participants experienced meal therapy could have been present due to several uncontrollable

variables (e.g., different staff members, different encouragements/supports throughout meal therapy, different challenges with different foods). PHP and IOP participants also received different amounts of exposure therapy and had differences in treatment team and treatment modalities outside of the exposure therapy (e.g., some therapists more heavily utilizing Cognitive Behavioral Therapy and others more heavily utilizing Acceptance and Commitment Therapy). While it is a positive finding that treatment that primarily utilized exposure therapy was efficacious despite individual treatment differences, it is difficult to rule out other variables' (e.g., therapists, other treatment modalities) influence on the positive treatment outcome findings.

Conclusion

This study aimed to examine the utility of exposure-based therapy interventions in individuals with AN by measuring reductions on the Fear of Food Measure and the EDI-3 from pre- to post-treatment. This study also aimed to determine the validity of fear of food, using the Fear of Food Measure, by comparing its scores against eating disorder outcomes on the EDI-3. Lastly, this study examined the relationship between weight gain and the Fear of Food Measure and the EDI-3, in addition to determining whether exposure-based therapy interventions led to increases in weight gain from pre- to post-treatment. This study found significant reductions in scores on the Fear of Food Measure and the EDI-3 from pre- to post-treatment. Additionally, this study found that subscales on the Fear of Food Measure significantly predicted subscales on the EDI-3, specifically the Feared Concerns subscale. However, the Food Anxiety Behaviors subscale was found to not be a significant predictor of eating disorder outcomes. Lastly, this study did not find a significant relationship between weight gain and subscales on the Fear of Food Measure and the EDI-3. However, this study did find that exposure-based therapy

interventions led to a significant increase in weight gain from pre- to post-treatment. Future research is required to generalize these findings, in addition to isolate the effects of exposure-based therapy interventions, and to determine the efficacy of exposure-based therapy interventions for individuals with AN, and individuals with AN and anxiety. Further, future research should examine fear of food and its efficacy in divergent eating disorders and across AN subtypes. Lastly, future studies should determine if these outcomes from exposure-based therapy interventions persist past treatment discharge to determine overall treatment efficacy.

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2. I have specific patterns and behaviors that I engage in when I eat. ① ② ③ ④ ⑤ ⑥ ⑦
3. I have to eat my food in a certain order. ① ② ③ ④ ⑤ ⑥ ⑦
4. There are foods that I will not touch because I don't like how they feel. ① ② ③ ④ ⑤ ⑥ ⑦
5. I try and avoid eating when I can. ① ② ③ ④ ⑤ ⑥ ⑦
6. I have rules about what I eat. ① ② ③ ④ ⑤ ⑥ ⑦

FC

1. Eating makes me anxious because I am afraid I might get fat. ① ② ③ ④ ⑤ ⑥ ⑦
2. Eating makes me anxious because I worry I might get sick. ① ② ③ ④ ⑤ ⑥ ⑦
3. I don't like eating because of the way my stomach feels after I eat. ① ② ③ ④ ⑤ ⑥ ⑦
4. I worry that eating will make me dissatisfied with my body. ① ② ③ ④ ⑤ ⑥ ⑦
5. I feel anxious when eating around other people. ① ② ③ ④ ⑤ ⑥ ⑦
6. I don't like to eat around other people because they might judge me. ① ② ③ ④ ⑤ ⑥ ⑦
7. I don't like to eat in social situation. ① ② ③ ④ ⑤ ⑥ ⑦
8. If I don't eat much because I am worried about my weight. ① ② ③ ④ ⑤ ⑥ ⑦
9. I don't like the physical sensations I feel when eating. ① ② ③ ④ ⑤ ⑥ ⑦