IMAGINAL EXPOSURE FOR DISORDERED EATING RELATED FEARS: A PILOT RANDOMIZED CONTROLLED TRIAL

A Dissertation
Submitted to
the Temple University Graduate Board

In Partial Fulfillment
of the Requirements for the Degree
of Doctor of Philosophy

by
Rachel M. Butler, M.A.
August, 2022

Examining Committee Members:

Richard G. Heimberg, Ph.D., Advisory Chair, Department of Psychology
Michael McCloskey, Ph.D., Examining Chair, Department of Psychology
Eunice Chen, Ph.D., Department of Psychology
Tania Giovannetti, Ph.D., Department of Psychology
Thomas Olino, Ph.D., Department of Psychology
Philip C. Kendall, Ph.D., Department of Psychology

ABSTRACT

Exposure therapy has been investigated as a potential treatment for eating disorders, but prior research has largely neglected to target core fears driving the disorder. New research suggests that disordered eating behaviors may be driven by underlying feared consequences such as rejection, abandonment, disgust, and loss of control, among others. Targeting these core fears may be best achieved through imaginal exposure, a type of exposure that involves imagining the feared consequences to be true. To test imaginal exposure as an intervention for disordered eating related fears, we randomized participants (N = 47) with high scores on the Eating Disorder Examination - Self-Report Questionnaire to one of three conditions: imaginal exposure (IE), imaginal exposure preceded by a brief food exposure (IE + Food), or an assessment control (AC). Participants attended two in-person laboratory visits and completed pretreatment, posttreatment, and one-month follow-up questionnaires. Disordered eating symptoms, food and eating related fears, preoccupations, and rituals decreased following treatment, but no differences were found between conditions on the degree of change. Within- and between-session habituation occurred for subjective distress and believability of feared outcomes, suggesting that imaginal exposure effectively activates and targets disordered eating related fears. Distress tolerance and confidence in ability to change improved following the active interventions. Our study demonstrates that imaginal exposure is an acceptable intervention for disordered eating related fears, and future research must examine these questions within a longer course of treatment.

This dissertation is dedicated to Mom, Dad, and Jessica

for your endless support and love.

You instilled in me a deep appreciation for education

and a belief that I was capable of pursuing this Ph.D.

ACKNOWLEDGMENTS

First and foremost, I would like to thank my mentor, Rick Heimberg, for his endless support over my doctoral career. Rick, thank you sincerely for your unparalleled mentorship and for constantly pushing me to grow as a researcher. You graciously allowed me to pursue this dissertation project, largely outside of your area of interest, and your continued encouragement has meant so much to me. Thank you for creating such a warm, supportive environment in the lab so that each of us had the space and freedom to pursue our individualized career paths. We so appreciate you!

To my many incredible supervisors and mentors in undergraduate, postbacc research, and graduate school, thank you for imparting your research and clinical knowledge, which came together to form the idea for this dissertation.

Many thanks to my wonderful labmates who have been my colleagues and close friends over these past years. Thank you to my research assistants who volunteered their time to this project and improved it with their helpful feedback and careful running of participants (during a pandemic, no less!). It plainly would not have been possible without you all!

Lastly, the research described in this paper was supported in part by a grant to the author from the American Psychological Association.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure Page

CHAPTER 1
DISSERTATION IN THE FORM OF A JOURNAL ARTICLE

Introduction

Eating disorders (i.e., anorexia nervosa [AN], binge eating disorder [BED], bulimia nervosa [BN], and other-specified eating disorders) have physical and psychological repercussions and often result in impairments in functioning and quality of life (Berkman, Lohr, & Bulik, 2007; Jenkins, Hoste, Meyer, & Blisset, 2011). Current evidence-based treatments for eating disorders include cognitive behavioral therapy (CBT) or interpersonal psychotherapy for adults (Fairburn et al., 2015; Kass, Kolko, & Wilfley, 2013) and family-based treatment for adolescents (Lock, 2015). However, many individuals continue to suffer from eating disorders even after treatment (Wilson, Grilo, & Vitousek, 2007). Recovery rates from anorexia nervosa (AN) are low, and long-term recovery from physical and psychological symptoms of AN is uncommon (Murray, Quintana, Loeb, Griffiths, & Le Grange, 2019). As distress and impairment from eating disorders such as AN, bulimia nervosa (BN), binge-eating disorder (BED), and other specified or unspecified eating disorders are significant, it is imperative that we investigate new, specialized treatments for eating disorders. In particular, it may be useful to identify extensions to current treatment approaches that could bolster treatment outcomes (Reilly, Anderson, Gorrell, Schaumberg, & Anderson, 2017).

Transdiagnostically, eating disorders share core features, one of which is an over-emphasis on the importance of weight and shape (Fairburn, Cooper, & Shafran, 2003). This overvaluation of weight or shape can result in behaviors (e.g., food avoidance, restriction, binge episodes, compensatory behaviors) that maintain the eating disorder.

From a cognitive behavioral perspective, overvaluation of weight and shape may actually be fear-driven, such that individuals are experiencing significant fears related to violating the thin ideal that maintain the eating disorder. In this model, disordered eating behaviors serve the purpose of reducing anxiety related to fears of eating or weight gain. Ecological momentary assessment studies suggest this does occur (e.g., Lavender et al., 2013). As in anxiety disorders, significant avoidance behaviors emerge in eating disorders. For example, individuals restrict food intake, skip meals, limit eating to specific "safe" foods, or avoid seeing their bodies as a form of avoiding catastrophic feared outcomes of weight gain. Compulsive and/or safety behaviors such as body checking, calorie counting, or ritualized eating behaviors also serve as attempts to prevent feared outcomes. Compensatory behaviors after a binge episode serve an anxiety-reduction function for those with BN. Engaging in these avoidance, compulsive, or compensatory behaviors maintains the eating disorder by reducing distress in the short term and, as such, are reinforcing and prevent the introduction of new, non-threat information (for a comprehensive review, see Schaumberg et al., 2021).

A fear-driven conceptualization of eating disorders may require new or expanded approaches to treatment that directly target fear. The most widely researched and supported method for addressing conditioned fear is exposure therapy, which is often a component of CBT for anxiety and related disorders (e.g., Gloster et al., 2011; Kaplan, Swee, & Heimberg, 2018), obsessive compulsive disorder (Greist et al., 2003; Olatunji, Davis, Powers, & Smits, 2013), and posttraumatic stress disorder (Powers, Halpern, Ferenschak, Gillihan, & Foa, 2010). Stemming from behavioral learning theories, exposure therapy aims to target threat-based associations by inhibiting the association

between the conditioned stimulus and the conditioned fear response (Foa & Kozak, 1986). This is done by having the individual confront their feared stimulus without the occurrence of the feared outcome, thus introducing new evidence that violates expectancies and creates new non-threat associations (Craske, Treanor, Conway, Zbozinek, & Vervliet, 2014).

To apply exposure therapy to eating disorders, we must carefully identify the feared stimulus and feared outcomes on an individual basis in order to appropriately design exposures to target those fears. Some conceptualizations of fears in eating disorders suggest that food or the act of eating are the feared stimuli and weight gain or "fatness" are the feared outcomes. Following this, exposure would consist primarily of eating feared and avoided foods (Steinglass et al., 2011). New theory suggests that weight gain itself may be the feared stimulus, with feared consequences including rejection, abandonment, loss of control, or disgust at oneself (Murray, Loeb, & Le Grange, 2016; Reilly et al., 2017). Inhibiting associations between weight gain and these feared outcomes by demonstrating that these feared consequences do not accompany weight gain should lead to expectancy violation and result in inhibitory learning (Cardi et al., 2019) Other relevant fears have been identified and targeted in eating disorders such as fears of physical sensations (e.g., fullness and gastrointestinal sensitivity; Boswell et al., 2019; Plascencia, Sysko, Fink & Hildebrandt, 2019).

How can we directly target individuals with eating disorders' core fears? Core eating disorder related fears such as rejection, abandonment, feeling or appearing disgusting, or loss of control have not been directly targeted by exposure therapy in randomized controlled trials. One potential method of exposing individuals to these core

fears is through imaginal exposure, which is typically used in the treatment of obsessive-compulsive disorder or during prolonged exposure for posttraumatic stress disorder (Abramowitz, 1996; Powers et al., 2010). In imaginal exposure, the individual imagines their worst fears and learns to tolerate and approach rather than avoid these fears. Additionally, imaginal exposure can be used to develop tolerance of the uncertainty of a particular feared outcome that has not yet occurred (e.g., what if I gain weight?). Initially examined in a case study, imaginal exposure was used to target the core fear of loss of identity after becoming fat in a woman with AN. In this case, the CBT-based intervention comprised psychoeducation, script-writing, five sessions of imaginal exposure, and processing of thoughts related to the exposures. This imaginal exposure focused intervention led to clinically significant change in disordered eating and impairment and prompted weight gain (Levinson, Rapp, & Riley, 2014). Further, Levinson et al. (2020) found that four sessions of online imaginal exposure to a core eating disorder related fear resulted in decreases in eating disorder fears, fear and avoidance of food, and eating disorder symptoms more broadly. To our knowledge, no research has utilized a control group for comparison, so randomized controlled trials are needed.

Additionally, extinction theory suggests that exposure to multiple feared stimuli at the same time will make extinction more robust and enhance outcomes. Specifically, animal research shows that exposure to more than one conditioned stimulus results in deepened extinction (Rescorla, 2006). Further, in vivo exposure and imaginal exposure could promote the greatest generalization of learning through the combination of feared external and internal stimuli (Rescorla & Wagner, 1972). Thus, it may be useful to combine imaginal exposure to core eating disorder related fears with exposure to another

feared stimulus such as food. The current literature on in vivo exposure for eating disorders suggests that in vivo food exposure, in which the person is asked to consume feared foods, is a viable method of exposure therapy for eating disorders. In vivo food exposure has led to increases in body mass index (BMI) and decreases in state anxiety, eating disorder psychopathology, and food-related preoccupations (Cardi et al., 2019; Levinson et al., 2015; Steinglass et al., 2012). If combined with imaginal exposure, food exposure may increase negative thoughts, emotions, and fears surrounding eating. The enhanced accessibility of these thoughts and fears after eating a "fattening" food could allow for greater engagement in imaginal exposure by making the imaginal exposure script more evocative. To date, no research has been published on imaginal exposure combined with in vivo feared food exposures, so we believe our study would be the first to investigate this important question.

The current study set out to examine the feasibility, acceptability, and efficacy of a brief, two-session imaginal exposure intervention. We compared the efficacy of imaginal exposure only (IE), imaginal exposure plus food exposure (IE + Food), and an assessment control condition (AC) in addressing disordered eating related concerns. We expected that those in the IE + Food condition would experience greater decreases in disordered eating related symptoms, fears, and preoccupations than those in the IE condition, and that individuals in both treatment conditions would experience greater decreases than those in the AC condition. Additionally, we predicted that subjective distress and believability of feared consequences would decrease within and between imaginal exposure sessions and decreases would be more pronounced for those in the IE

+ Food condition. We expected that imaginal exposure interventions would lead to increases in confidence to change disordered eating and increases in tolerance of distress.

Methods

Participants

Participants (N = 47) were adult undergraduate students of any gender. Eligibility for participation in the study was determined solely based on scoring above a cut-off score on the Eating Disorders Examination - Self-Report Questionnaire Version (EDE-Q; Fairburn & Beglin, 1994; Fairburn & Beglin, 2008) global scale. Women were eligible if they scored above 2.5, based on the upper quartile of undergraduate women in a study published on the EDE-Q norms (Quick & Byrd-Bredbenner, 2013). Men were eligible to participate if they scored above 1.68 on the EDE-Q global scale, which was recommended as the cut-off score with the greatest sensitivity and specificity in a study on norms for male undergraduates (Schaefer et al., 2018). Because there was no research on norms for gender non-binary or transgender individuals at the time of study inception, they were eligible if they scored above 1.68 on the EDE-Q (i.e., the male cutoff score) to be most inclusive. Participants were not excluded if they were receiving concurrent treatment; five participants reported they were receiving psychotherapy with at least some focus on disordered eating. Participant demographic characteristics are presented in Table 1.

Table 1. Participant Demographic Characteristics (N = 47)

	Imaginal + Food (*n* = 17)		Imaginal Only (*n* = 16)		Assessment Control (*n* = 14)		Test Statistics
	Mean or n	*SD or %*	*Mean or n*	*SD or %*	*Mean or n*	*SD or %*	
Age (*M, SD*)	20.24	2.82	19.81	2.26	19.71	2.46	F (2, 44) = 0.19, p = .83
Gender (*n*, %)							χ^2 = 6.05, p = .83
Female	12	70.6	14	87.5	13	92.9	
Male	2	11.8	2	12.5	1	7.1	
Transgender or Gender Non-binary	3	17.6	0	0	0	0	
Race (*n, %*)							χ^2 = 6.05, p = .42
Black	2	11.8	1	6.3	2	14.3	
Asian/Pacific Islander	0	0	1	6.3	2	14.3	
White	12	70.6	13	81.3	10	71.4	
Biracial or Multiracial	3	17.6	1	6.3	0	0	
Ethnicity (*n, %*)							χ^2 = 0.56, p = .76
Hispanic	2	11.8	3	18.8	3	21.4	
Non-Hispanic	15	88.2	13	81.2	11	78.6	
Student Status							χ^2 = 0.51, p = .77
Full Time	16	94.1	14	87.5	13	92.9	
Part Time	1	5.9	2	12.5	1	7.1	
Current mental health treatment							χ^2 = 1.01, p = .60
Yes	9	52.9	8	50	5	35.7	
No	8	47.1	8	50	9	64.3	
Current psychotropic medication							χ^2 = 1.56, p = .46
Yes	8	47.1	6	37.5	3	21.4	
No	9	52.9	10	62.5	11	78.6	
Body Mass Index (*M, SD*)	28.20	6.07	28.32	6.40	27.81	7.51	F (2, 44) = 0.02, p = .98

Measures

A demographic questionnaire was administered that asked participants to report their age, sex assigned at birth, gender identity, race, ethnicity, marital status, employment status, and level of education. We asked participants whether they were in treatment for any psychological difficulties, what the nature of the treatment was, and what the difficulties were. This questionnaire was administered at baseline only.

BMI (kg/m^2) was calculated from height and weight measurements taken in the lab during the baseline visit.

The EDE-Q (Fairburn & Beglin, 1994; Fairburn & Beglin, 2008) is a 28-item self-report measure derived from the Eating Disorders Examination interview (Cooper & Fairburn, 1987), which assesses eating disorder related attitudes, behaviors, and thoughts over the prior 28 days. The measure divides into subscales (i.e., restraint, eating concern, weight concern, and shape concern), and a global score can be calculated as well. The measure has been widely used as a screening tool for eating disorders. Items (e.g., "On how many of the past 28 days…have you had a definite fear of losing control over eating?") are rated on a 7-point Likert-type scale from 0 to 6 (0 = No days, 1 = 1-5 days, 2 = 6-12 days, 3 = 13-15 days, 4 = 16-22 days, 5 = 23-27 days, 6 = Every day). Internal consistency of the EDE-Q global score in undergraduate samples was excellent for males (α = .93; Lavender, Young, & Anderson, 2010) and for females (α = .91; Rose, Vaewsorn, Rosselli-Navarra, Wilson, & Weissman, 2013). Test re-test reliability of the EDE-Q global score over a 7-day period was excellent in a sample of undergraduate males and females (r = .92; Rose et al., 2013). Additionally, the EDE-Q global score shows excellent validity by discriminating between those with an eating disorder and

healthy controls (Area under the curve = .96; Aardoom, Dingemans, Op't Landt, & Van Furth, 2012). In the current sample, internal consistency of the EDE-Q global score was acceptable (EDE-Q total α = .69).

The Eating Disorder Fear Questionnaire (EFQ; Levinson, Vanzhula, & Christian, 2019) is a 20-item self-report questionnaire devised to measure current fears related to eating disorders. The EFQ comprises five subscales of eating disorder-related fears: personal consequences, physical sensations, weight gain, social consequences, and social eating. Items (e.g., "I am afraid others will look at me funny if I gain weight") are rated on a Likert-type scale from 1 (not at all) to 7 (very much so). The subscales have demonstrated excellent internal consistency (Cronbach's alphas ranged from .98 to .99) and good convergent validity through correlations with measures of eating disorder symptoms and fears of food (r = .35 to .73) in an undergraduate sample (Levinson et al., 2019). In the current sample, internal consistency of the EFQ subscales were acceptable to excellent (EFQ weight gain α = .82, EFQ social consequences α = .87, EFQ personal consequences α = .79, EFQ physical sensations α = .69, EFQ social eating α = .93).

The Fear of Food Measure (FOFM; Levinson & Byrne, 2015) evaluates the degree of fear and anxiety associated with food and eating. The 23-item measure divides into three subscales: anxiety about eating (e.g., "I feel tense when I am around food"), food avoidance behaviors (e.g., "I have rules about what I eat"), and feared concerns (e.g., "Eating makes me anxious because I am afraid I might get fat"). Prior research has shown that through mealtime exposure therapy, scores on the FOFM subscales decrease (Levinson & Byrne, 2015). Test-retest reliability of the subscales over a three-month period was excellent, with intraclass correlation coefficients ranging from .87 to .90

(Levinson & Byrne, 2015). In the current study, FOFM internal consistency was acceptable to excellent (Anxiety About Eating α = .96, Food Avoidance Behaviors α = .76, Feared Concerns α = .91).

The Yale-Brown-Cornell Eating Disorder Scale-Self-Report Questionnaire (YBC-EDS-SRQ; Bellace et al., 2012; Mazure et al., 1994) assesses preoccupations and rituals related to disordered eating. The measure comprises 65 checklist items and 19 questions. Four core questions are used to calculate the Preoccupations subscale, another four comprise the Rituals subscale, and a total score can be derived from these eight items. The YBC-EDS-SRQ demonstrated good discriminant validity (i.e., not correlated with measures of depression and anxiety) and test-retest reliability across one week (r = .65 to .94) in a female, eating disordered sample (Bellace et al., 2012). Internal consistency in the current study was good (Preoccupations α = .80, Rituals α = .88, Total α = .84).

The Treatment Acceptability/Adherence Scale (TAAS; Milosevic, Levy, Alcolado, & Radomsky, 2015) was administered to assess whether participants found the imaginal exposure intervention to be acceptable and whether they would expect to adhere to a full course of imaginal exposure if continued. The scale includes 10 items such as "This treatment would provide effective ways to help me cope with my fear/anxiety" rated from 1 (disagree strongly) to 7 (agree strongly). Higher scores on the scale signify greater adherence and acceptability of the intervention. In an exposure intervention for OCD, internal consistency of the TAAS was good, (α = .88) and the TAAS demonstrated convergent validity via positive correlation with other measures of treatment credibility and expectancy (Milosevic et al., 2015). Although the scale is relatively new, a scan of the literature suggests that in trials of CBT-based interventions tend to report moderate to

high TAAS scores (*M's* ranging from 36.78 to 63.57; e.g., Hebert & Dugas, 2019; Soucy, & Hadjistavropoulos, 2017). In the current study, TAAS scores at posttreatment had good internal consistency ($\alpha = .80$).

The ability to tolerate distress and anxiety during exposure sessions was assessed using the following item, adapted from Blakey et al. (2019): "Regardless of how intense your distress was, how well did you tolerate your distress? That is, how well were you able to manage whatever emotions and sensations came up during the exercise, regardless of how strong they were?" Participants rated how well they tolerated their distress from 0 (not able to tolerate my distress) to 100 (completely able to tolerate my distress).

Confidence in one's ability to change was measured using one item that asks participants, "How confident are you in your ability to change or lessen your fears related to eating?" Participants responded on a visual analog scale from 0 (not at all confident) to 100 (extremely confident). This one-item measure was adapted from Cardi et al. (2019).

The Subjective Units of Distress Scale (SUDS; Wolpe & Lazarus, 1966) is a widely used rating of current distress or anxiety during exposure therapy. Participants were asked to rate their current distress on a visual analog scale from 0 (none) to 100 (very severe) at five-minute intervals during the imaginal exposure sessions.

Believability of feared consequences (i.e., "How believable are these fears to you currently?") was rated using a visual analog scale from 0 (not at all believable) to 100 (extremely believable). Participants rated the believability of feared consequences at five-minute intervals during the imaginal exposure task. Ratings of believability of feared consequences were used to index expectancy violation through exposure.

Procedures

Participants were recruited through Temple University's SONA system and flyers posted at approved locations on campus. Interested potential participants were directed to complete a brief online screener comprising the EDE-Q. Participants recruited through SONA systems received 0.5 research credits for completing the screener. If eligible for the intervention, participants recruited through SONA systems were offered additional research credits (i.e., 1.5 credits for visit one, 1.5 credits for visit two, and 1.0 credit for online completion of follow-up questionnaires). Participants in the assessment control condition received the same number of credits as participants in the treatment conditions. All participants who completed the entirety of the study were entered into a raffle for one of two $100 gift cards. Upon admittance to the study, participants were randomized to one of three conditions using a random number generator: imaginal exposure (n = 16), imaginal exposure plus brief food exposure (n = 17), or assessment control (n = 14). Assessment control participants were offered the option to undergo the intervention following completion of the one-month follow-up questionnaires, but no participant chose to do so. Informed consent was provided by all participants prior to completing the baseline questionnaires.

At the beginning of session one, participants completed a battery of baseline questionnaires (Demographics, EFQ, FOFM, EDE-Q, YBC-EDS-SRQ, confidence to change). During exposure sessions one and two, within-session ratings of SUDS and believability of feared consequences were collected. At the end of each exposure session, participants rated their distress tolerance. At the end of the second session, participants completed the posttreatment battery of questionnaires (i.e., EFQ, FOFM, confidence to change, TAAS). At one-month following the second visit, participants completed the

follow-up questionnaire battery (i.e., EFQ, FOFM, EDE-Q, YBC-EDS-SRQ, confidence to change).

Experimenters (i.e., principal investigator and undergraduate research assistants) underwent extensive training using the experimental protocol. Research assistants were trained by the principal investigator and were required to successfully complete role plays of assisting participants in imaginal exposure script writing before beginning to run participants. Research assistants were trained in sensitivity and confidentiality due to the sensitive nature of the imaginal exposure scripts. Research assistants were not blind to participant condition or study aims.

Interventions

Imaginal Exposure

Participants were provided with a rationale for the imaginal exposure intervention. Specifically, the experimenter explained that fears related to disordered eating can maintain disordered eating behaviors and distress, and exposure allows them to confront those fears. In particular, imaginal exposure allows them to confront specific fears related to the consequences of eating or weight gain and to see how realistic the fears actually are. Exposure can also help them learn that they can tolerate the anxiety and distress surrounding eating or weight/shape related fears.

Participants wrote out an imaginal exposure script based on a prompt, using first person, present tense language. The prompt asked participants to describe their worst fears related to eating or weight gain, and it included cues to focus on themes such as fear of "fatness" and what weight gain means about them or what it would lead to (e.g., rejection following weight gain, loss of identity, loss of control, etc.). Instructions urged

participants to really imagine themselves in the situation, for example, how they would feel and what they would be thinking in that moment. Participants were encouraged to write approximately one page, but script word counts were highly variable (exposure one: M = 342.39, SD = 138.22, exposure two: M = 312.60, SD = 135.29). Then, participants audio recorded themselves reading their imaginal exposure script aloud. Participants listened to their recorded script repeatedly for 30 minutes. At 5-minute intervals during the exposure, participants were prompted by the experimenter to rate their SUDS and belief in feared consequences. When participants returned to the lab one week later, they wrote a new script and underwent a second 30-minute session of imaginal exposure identical in procedure to the first session. A new script was written to keep procedure and time engaged in the imaginal exposure process (script writing and listening) consistent between session one and two. After the second session of imaginal exposure, participants were given a 10-minute break (e.g., use their phone, restroom, etc.) before completing the posttreatment assessment. Finally, participants completed online questionnaires one-month following the second exposure session.

Imaginal Exposure Plus Brief Food Exposure

Participants were given the same rationale as in the imaginal exposure only condition. In addition, they were told that eating a high energy dense food prior to the imaginal exposure could allow them to gain the most benefit from imaginal exposure by increasing their ability to imagine their feared consequences. Prior to each of the two imaginal exposure sessions, participants in this condition were asked to consume a standardized energy dense food item (i.e., one package of Tastykakes Chocolate or Butterscotch Cupcakes). Participants rated their SUDS immediately before, during, and

after eating the food item. Participants then completed the imaginal exposure protocol, described above.

Assessment Control

Participants in the assessment control condition completed the same battery of measures as the treatment conditions at session one (baseline), session two (posttreatment), and at the one-month follow-up.

Data Analytic Plan

All analyses were conducted using SPSS Version 24 (International Business Machines Corporation, 2016). Linear mixed-effects models (LMMs) were used to test changes in outcome measures from pre- to posttreatment and follow-up. LMMs were also employed to test moderators of change as a function of treatment. Random intercepts were included in the models, and maximum likelihood estimation was used to address missing data, so the intent-to-treat sample was included. For LMMs, the random effect covariance structure was declared using a scaled identity matrix. LMM effect sizes were calculated as Cohen's *d* (Cohen, 1988), using the differences in estimated marginal means divided by the pooled within-group standard deviation (Dunlap, Cortina, Vaslow, & Burke, 1996). Repeated measures analyses of variance (ANOVAs) were conducted to test changes in SUDS, believability, and distress tolerance between sessions, and to test within-session changes in SUDS and believability of feared outcomes. For repeated measures ANOVAs, we calculated partial eta squared as the measure of effect size, considering $\geq$ .01 as small, $\geq$.06 as medium, and $\geq$ .14 as large effects.

Results

Demographic Characteristics and Baseline Correlations

We ran chi-square tests to determine whether participants in the three conditions differed on race, ethnicity, gender identity, marital status, or employment status. We ran one-way ANOVAs to test differences between conditions on age, BMI, and baseline outcome variables. There were no differences between conditions on any baseline characteristics (see Table 1) or outcome variables, p's > .05 (see Table 2). Baseline correlations between outcome variables are presented in Table 3.

Table 2. Descriptive Statistics and Pretreatment Comparisons of Outcome Variables by Condition

	Imaginal + Food (*n* = 17)	Imaginal Only (*n* = 16)	Assessment Control (*n* = 14)	Statistic
	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	
EDE-Q Global				
Pretreatment	3.88 (0.89)	3.73 (0.94)	3.66 (1.00)	$F(2, 44) = 0.21$, $p = .81$
Follow-up	3.55 (1.02)	3.21 (1.51)	3.08 (1.44)	
YBC-EDS-SRQ Rituals				
Pretreatment	9.29 (3.69)	9.94 (3.45)	9.93 (3.47)	$F(2, 44) = 0.18$, $p = .84$
Follow-up	9.07 (3.77)	7.86 (3.90)	8.82 (2.86)	
YBC-EDS-SRQ Preoccupations				
Pretreatment	11.06 (2.84)	11.94 (2.49)	11.86 (3.13)	$F(2, 44) = 0.49$, $p = .62$
Follow-up	11.20 (3.03)	10.21 (2.78)	10.91 (2.81)	
FOFM Anxiety About Eating				
Pretreatment	3.35 (1.67)	3.38 (1.95)	3.47 (1.56)	$F(2, 44) = 0.02$, $p = .98$
Posttreatment	3.16 (1.81)	3.11 (2.00)	3.33 (1.62)	
Follow-up	3.10 (1.86)	2.79 (1.89)	3.07 (1.51)	
FOFM Food Avoidance Behaviors				
Pretreatment	3.61 (1.94)	3.60 (1.11)	3.62 (1.24)	$F(2, 44) < 0.01$, $p = 1.00$
Posttreatment	3.45 (1.91)	3.41 (1.25)	3.09 (1.08)	
Follow-up	3.58 (2.00)	2.77 (1.29)	2.67 (1.00)	
FOFM Feared Concerns				
Pretreatment	3.88 (1.76)	3.54 (1.36)	4.02 (1.55)	$F(2, 44) = 0.37$, $p = .69$
Posttreatment	3.90 (1.62)	3.60 (1.60)	3.50 (1.39)	
Follow-up	3.90 (1.62)	3.17 (1.75)	3.43 (1.36)	
EFQ Physical				
Pretreatment	6.41 (0.73)	6.65 (0.66)	6.64 (0.82)	$F(2, 44) = 0.54$, $p = .59$
Posttreatment	6.04 (0.74)	6.47 (0.96)	5.85 (1.37)	
Follow-up	5.60 (1.38)	6.21 (1.62)	6.27 (1.21)	
EFQ Social Eating				
Pretreatment	4.12 (2.00)	5.13 (1.22)	3.39 (1.71)	$F(2, 44) = 1.94$, $p = .16$
Posttreatment	4.19 (2.06)	3.00 (1.68)	3.08 (1.64)	
Follow-up	4.03 (2.02)	2.61 (1.90)	3.59 (1.81)	
EFQ Personal				
Pretreatment	5.04 (1.37)	4.84 (1.17)	5.01 (1.81)	$F(2, 44) = 0.09$, $p = .91$
Posttreatment	4.85 (1.71)	4.93 (1.41)	4.40 (1.69)	
Follow-up	4.43 (1.67)	4.50 (1.84)	4.47 (1.58)	
EFQ Weight				
Pretreatment	6.35 (0.79)	6.03 (1.43)	6.25 (1.16)	$F(2, 44) = 0.33$, $p = .71$
Posttreatment	6.16 (0.85)	6.10 (1.47)	5.73 (1.74)	
Follow-up	6.10 (1.14)	6.11 (1.73)	5.68 (1.95)	
EFQ Social				
Pretreatment	5.47 (1.08)	5.13 (1.22)	4.92 (1.51)	$F(2, 44) = 0.76$, $p = .48$
Posttreatment	5.30 (1.33)	5.08 (1.48)	4.51 (1.64)	
Follow-up	4.98 (1.54)	5.04 (1.63)	4.34 (1.86)	

Note. *F*-tests refer to one-way ANOVAs examining the main effect of condition at pretreatment. EDE-Q = Eating Disorders Examination - Self Report Questionnaire Version; YBC-EDS-SRQ = Yale-Brown-Cornell Eating Disorder Scale-Self-Report Questionnaire; EFQ = Eating Fear Questionnaire; FOFM = Fear of Food Measure

Table 3. Baseline Correlations Between Outcome Variables

	EDE-Q Global	YBC-EDS-SRQ Rituals	YBC-EDS-SRQ Preocc.	FOFM AE	FOFM FAB	FOFM FC	EFQ Physical	EFQ Social Eating	EFQ Personal	EFQ Weight
EDE-Q Global	--									
YBC-EDS-SRQ Rituals	.26	--								
YBC-EDS-SRQ Preoccupations	.46**	.38**	--							
FOFM AE	.56**	.49**	.60**	--						
FOFM FAB	.48**	.40**	.31*	.68**	--					
FOFM FC	.52**	.57**	.58**	.81**	.70**	--				
EFQ Physical	.33*	.18	.29*	.28	.04	.26	--			
EFQ Social Eating	.36*	.55**	.43**	.66**	.50**	.74**	.11	--		
EFQ Personal	.53**	.48**	.64**	.59**	.44**	.60**	.38**	.47**	--	
EFQ Weight	.37**	.13	.24	.26	.03	.28	.36*	.20	.42**	--
EFQ Social	.30*	.28	.45**	.35*	.07	.39**	.47**	.42**	.45**	.35*

Note. EDE-Q = Eating Disorders Examination - Self Report Questionnaire Version; YBC-EDS-SRQ = Yale-Brown-Cornell Eating Disorder Scale-Self-Report Questionnaire; EFQ = Eating Fear Questionnaire; FOFM AE= Fear of Food Measure Anxiety About Eating; FOFM FAB = Fear of Food Measure Food Avoidance Behaviors; FOFM FC = Fear of Food Measure Feared Concerns; *$p < .05$, **$p < .01$.

Acceptability and Retention

Overall, the treatment acceptability and adherence rating (M = 39.28, SD = 9.45) suggested a neutral rating of treatment acceptability on average. We conducted an independent-samples t-test to compare posttreatment scores on the TAAS between the two intervention conditions. Imaginal exposure (M = 43.27, SD = 11.22) was rated significantly more acceptable than imaginal exposure plus food (M = 35.63, SD = 6.06), t (29) = 2.38, p = .024. Only three patients dropped out following the baseline session (one in IE + Food condition, one in IE condition, and one in AC), and we retained 85% of the sample at the one-month follow-up assessment. There was an equivalent rate of drop out among the conditions, χ^2 = 0.68, p = .71.

Disordered Eating Fears Across Pretreatment, Posttreatment, and Follow-up Assessments

We examined whether participants in the IE + Food and IE conditions demonstrated differential changes compared to the those in the AC condition on the FOFM, EFQ, and confidence in ability to change from pre- to posttreatment and pretreatment to follow-up. To examine within- and between-group changes across time points, we ran LMMs with Time (pretreatment, posttreatment, and follow-up) and Condition (IE + Food, IE, AC) as the predictors. A second LMM was conducted with Time (pretreatment, posttreatment, and follow-up) and Condition (Interventions, AC) as the predictors to compare effects of the interventions to the control condition.

FOFM Anxiety about Eating subscale scores did not decrease significantly from pretreatment to posttreatment, B = -0.24, SE = 0.14, p = .09, d = 0.25, but decreased significantly from pretreatment to follow-up, B = -.49, SE = 0.15, p = .001, d = 0.48. The

IE condition FOFM anxiety about eating scores were not significantly different than the IE + Food condition's scores, $B = 0.03$, $SE = 0.59$, $p = .96$, $d = 0.009$. Pooled intervention condition scores were not significantly different than the AC condition's scores, $B = -0.11$, $SE = 0.54$, $p = .84$, $d = 0.03$. The Time x Condition (Interventions vs. AC) interactions were not significant, p's $> .05$.

FOFM Food Avoidance Behaviors subscale scores decreased significantly from pretreatment to posttreatment, $B = -0.29$, $SE = 0.14$, $p = .03$, $d = 0.30$, and from pretreatment to follow-up, $B = -0.58$, $SE = 0.14$, $p < .001$, $d = 0.60$. The IE condition FOFM Food Avoidance Behaviors scores were not significantly different than the IE + Food condition's scores, $B = -0.004$, $SE = 0.50$, $p = .99$, $d = 0.001$. Scores in the pooled intervention conditions were not significantly different than in the AC condition, $B = 0.013$, $SE = 0.46$, $p = .98$, $d = 0.004$. The Time x Condition (Interventions vs. AC) interactions were not significant, p's $> .05$.

FOFM Feared Concerns subscale scores did not decrease significantly from pretreatment to posttreatment, $B = -0.19$, $SE = 0.14$, $p = .18$, $d = 0.20$, but decreased significantly from pretreatment to follow-up, $B = -0.35$, $SE = 0.14$, $p = .02$, $d = 0.36$. The IE condition FOFM Feared Concerns scores were not significantly different than the IE + Food condition's scores, $B = -0.34$, $SE = 0.53$, $p = .52$, $d = 0.12$. Pooled intervention condition scores were not significantly different than the AC condition's scores, $B = -0.30$, $SE = 0.49$, $p = .54$, $d = 0.09$. The Time x Condition (Interventions vs. AC) interactions were not significant, p's $> .05$.

EFQ Weight subscale scores did not decrease significantly from pretreatment to posttreatment, $B = -0.23$, $SE = 0.17$, $p = .17$, $d = 0.20$, or from pretreatment to follow-up,

B = -0.26, *SE* = 0.17, *p* = .14, *d* = 0.22. The IE condition EFQ Weight scores were not significantly different than the IE + Food condition's scores, *B* = -0.32, *SE* = 0.47, *p* = .49, *d* = 0.12. Pooled intervention condition scores were not significantly different than the AC condition's scores, *B* = -0.05, *SE* = 0.43, *p* = .90, *d* = 0.02. The Time x Condition (Interventions vs. AC) interactions were not significant, *p*'s > .05.

EFQ Social subscale scores did not change significantly from pre- to posttreatment, *B* = -0.17, *SE* = 0.15, *p* = .26, *d* = 0.17, but decreased significantly from pretreatment to follow-up, *B* = -0.36, *SE* = 0.16, *p* = .03, *d* = 0.33. The IE condition EFQ Social scores were not significantly different than the IE + Food condition's scores, *B* = -0.35, *SE* = 0.50, *p* = .49, *d* = 0.13. Pooled intervention condition scores were not significantly different than the AC condition's scores, *B* = 0.38, *SE* = 0.45, *p* = .40, *d* = 0.12. The Time x Condition (Interventions vs. AC) interactions were not significant, *p*'s > .05.

EFQ Personal subscale scores did not change significantly from pre- to posttreatment, *B* = -0.22, *SE* = 0.17, *p* = .20, *d* = 0.19, but decreased significantly from pretreatment to follow-up, *B* = -0.55, *SE* = 0.18, *p* = .002, *d* = 0.45. The IE condition EFQ Personal scores were not significantly different than the IE + Food condition's scores, *B* = -0.20, *SE* = 0.53, *p* = .71, *d* = 0.07. Pooled intervention condition scores were not significantly different than the AC condition's scores, *B* = 0.07, *SE* = 0.49, *p* = .88, *d* = 0.02. The Time x Condition (Interventions vs. AC) interactions were not significant, *p*'s > .05.

EFQ Physical subscale scores decreased significantly from pre- to posttreatment, *B* = -0.42, *SE* = 0.15, *p* = .005, *d* = 0.41, and from pretreatment to follow-up, *B* = -0.58,

SE = 0.15, *p* < .001, *d* = 0.56. The IE condition EFQ Physical scores were not significantly different than the IE + Food condition's scores, *B* = 0.23, *SE* = 0.36, *p* = .52, *d* = 0.11. Pooled intervention condition scores were not significantly different than the AC condition's scores, *B* = -0.12, *SE* = 0.33, *p* = .73, *d* = 0.05. The Time x Condition (Interventions vs. AC) interactions were not significant, *p*'s > .05.

EFQ Social Eating subscale scores did not change from pre- to posttreatment, *B* = -0.04, *SE* = 0.21, *p* = .86, *d* = 0.03, or from pretreatment to follow-up, *B* = -0.10, *SE* = 0.22, *p* = .65, *d* = 0.07. The IE condition EFQ Social Eating scores were marginally significantly lower than the IE + Food condition's scores, *B* = -1.24, *SE* = 0.63, *p* = .05, *d* = 0.35. Pooled intervention condition scores were not significantly different than the AC condition's scores, *B* = -0.12, *SE* = 0.59, *p* = .84, *d* = 0.03. The Time x Condition (Interventions vs. AC) interactions were not significant, *p*'s > .05.

Confidence to Change Across Pretreatment, Posttreatment, and Follow-up Assessments

Confidence to change significantly increased from pre- to posttreatment, *B* = 13.52, *SE* = 4.85, *p* = .007, *d* = 0.41, and from pretreatment to follow-up, *B* = 10.33, *SE* = 4.96, *p* = .04, *d* = 0.30. The IE condition confidence to change scores were higher than the IE + Food condition's scores at marginal significance, *B* = 12.96, *SE* = 6.58, *p* = .052, *d* = 0.35. Pooled intervention condition scores were not significantly different than the AC condition's scores, *B* = -2.41, *SE* = 6.31, *p* = .70, *d* = 0.06. The Time x Condition (Interventions vs. AC) interactions were not significant, *p*'s > .05.

Changes in Disordered Eating from Pretreatment to Follow-up Assessments

We examined whether changes occurred in eating disorder symptoms, rituals, and preoccupations following treatment and whether these were greater in the intervention

conditions compared to the AC condition. Given that these measures assess the past 28-days, they were administered only at pretreatment and follow-up, so we examined change from only for that interval. We also tested outcomes in the IE + Food condition compared to IE. To examine within- and between-group changes across time points, we ran LMMs with Time (pretreatment, follow-up) and Condition (IE + Food, IE, AC) as the predictors. A second LMM was conducted with Time (pretreatment, follow-up) and Condition (Interventions, AC) as the predictors to compare effects of the interventions to the control condition.

EDE-Q global scores decreased significantly from pretreatment to follow-up, B = -0.49, SE = 0.15, p = .002, d = 0.48. There were no differences in EDEQ global scores between the IE and IE + Food conditions, B = -0.14, SE = 0.38, p = .71, d = 0.07, and no differences when comparing the pooled intervention conditions' scores to the AC condition's scores, B = -0.14, SE = 0.35, p = .68, d = 0.06. The Time x Condition (Interventions vs. AC) interaction was not significant, $p > .05$.

YBC-EDS-SRQ total scores decreased significantly from pretreatment to follow-up, B = -2.02, SE = 0.78, p = .01, d = 0.38. There were no differences in YBC-EDS-SRQ total scores between the IE and IE + Food conditions, B = -1.47, SE = 1.93, p = .45, d = 0.14, and no differences when comparing the pooled intervention conditions' scores to the AC condition's scores, B = -1.10, SE = 1.84, p = .55, d = 0.09. The Time x Condition (Interventions vs. AC) interaction was not significant, $p > .05$.

YBC-EDS-SRQ Preoccupation scores decreased significantly from pretreatment to follow-up, B = -0.79, SE = 0.36, p = .03, d = 0.32. There were no differences in YBC-EDS-SRQ Preoccupation scores between the IE and IE + Food conditions, B = -0.70, SE

= 1.00, p = .49, d = 0.13, and no differences when comparing the pooled intervention condition's scores to the AC condition's scores, B = -0.78, SE = 0.95, p = .42, d = 0.12. The Time x Condition (Interventions vs. AC) interaction was not significant, $p > .05$.

YBC-EDS-SRQ Rituals scores decreased significantly from pretreatment to follow-up, B = -1.22, SE = 0.51, p = .02, d = 0.35. There were no differences in YBC-EDS-SRQ Rituals scores between the IE and IE + Food conditions, B = -0.73, SE = 1.25, p = .56, d = 0.10, and no differences when comparing the pooled intervention conditions' scores to the AC condition's scores, B = 0.42, SE = 1.19, p = .73, d = 0.05. The Time x Condition (Interventions vs. AC) interaction was not significant, $p > .05$.

Brief Food Exposures

During the session one brief food exposure, SUDS ratings were provided before eating the cupcake package (pre), after finishing the first cupcake in the package (mid) and after finishing both cupcakes (post). SUDS ratings significantly increased from pre (M = 31.47, SD = 17.12) to mid (M = 42.65, SD = 16.87; t (16) = 3.41, $p < .01$, d = 0.66) and from mid to post (M = 48.41, SD = 20.18; t (16) = 2.62, p = .02, d = 0.31).

During the session two brief food exposure, SUDS ratings significantly increased from pre (M = 18.67, SD = 17.47) to mid (M = 30.47, SD = 22.13; t (14) = 3.10, $p < .01$, d = 0.59). The change from mid to post (M = 34.13, SD = 27.40) was not significant, t (14) = 1.43, p = .18, d = 0.15.

Imaginal Exposures

We examined changes in SUDS ratings and believability of feared consequences within-session. We conducted 2 (Condition: IE, IE + Food) x 7 (Time: 0, 5, 10, 15, 20, 25, 30 minutes) between- and within-subjects repeated measures ANOVA with

believability of feared consequences and SUDS as the outcome variables. Planned paired samples *t*-tests were used to probe changes between time points (e.g., between 0 and 5 minutes).

In the session one imaginal exposure, there was a significant effect of Time, F (6, 186) = 14.97, $p < .001$, $\eta_p^2 = .33$, on SUDS scores. We found the effect of Time to have both linear ($F(6, 31) = 17.36$, $p < .001$) and quadratic ($F(6, 31) = 18.82$, $p < .001$) components, such that SUDS scores initially increased and then decreased within-session. Pairwise comparisons revealed that there was a significant increase in SUDS ratings from 0 to 5 minutes ($M_{diff} = 2.98$, $SE = 1.45$, $p = .049$, $d = 0.36$) and a significant decrease between 15 and 20 minutes ($M_{diff} = -3.68$, $SE = 1.21$, $p < .01$, $d = 0.53$), 20 and 25 minutes ($M_{diff} = -6.54$, $SE = 1.54$, $p < .001$, $d = 0.74$), and 25 to 30 minutes ($M_{diff} = -4.96$, $SE = 1.48$, $p < .01$, $d = 0.58$). The main effect of Condition was not significant, F (1, 31) = 2.51, $p = .12$, $\eta_p^2 = .075$. There was no Time x Condition interaction, F (6, 31) = .11, $p = .995$, $\eta_p^2 = .02$. In the session two imaginal exposure, there was a significant effect of Time, F (6, 174) = 14.78, $p < .001$, $\eta_p^2 = .34$, such that SUDS scores decreased within-session. Pairwise comparisons revealed that there was a significant a significant decrease in SUDS between 10 and 15 minutes ($M_{diff} = -5.72$, $SE = 2.04$, $p < .01$, $d = 0.50$) and 15 and 20 minutes ($M_{diff} = -3.14$, $SE = 1.45$, $p = .04$, $d = 0.39$). The main effect of Condition was not significant, F (1, 29) = 0.19, $p = .67$, $\eta_p^2 = .007$. The Time x Condition interaction was not significant, F (6, 29) = 0.26, $p = .96$, $\eta_p^2 = .05$. Figure 1 depicts SUDS by condition during the exposure sessions.

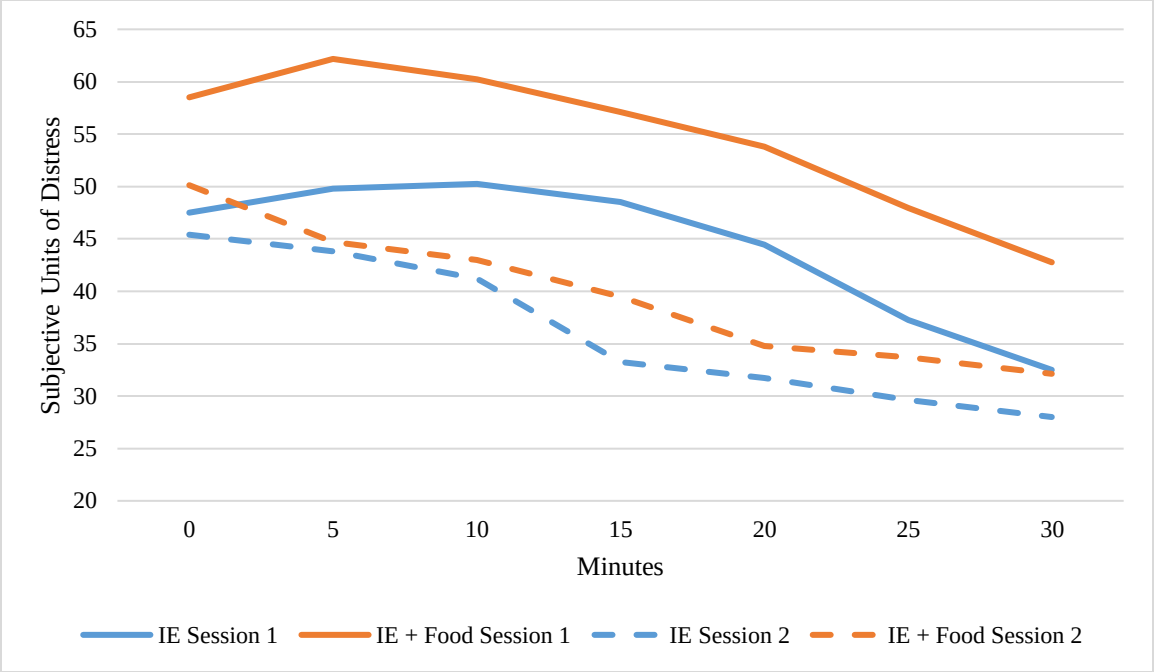

Figure 1. Subjective units of distress during imaginal exposure.

In the session one exposure, there was a significant effect of Time such that believability of feared outcomes decreased within-session, F (6, 186) = 14.51, p < .001, η_p^2 = .32. Pairwise comparisons revealed that there was a significant decrease in believability from 5 to 10 minutes (M_{diff} = -3.01, SE = 1.21, p = .02, d = 0.43), 20 and 25 minutes (M_{diff} = -3.73, SE = 0.99, p < .001, d = 0.66), and 25 to 30 minutes (M_{diff} = -2.55, SE = 1.01, p = .02, d = 0.44). The main effect of Condition was not significant, F (1, 31) = 0.91, p = .35, η_p^2 = .03. There was no Time x Condition interaction, F (6, 31) = 0.96, p = .45, η_p^2 = .16. In the session two exposure, there was a significant effect of Time, F (6, 174) = 22.73, p < .001, η_p^2 = .44, such that believability decreased within-session. Pairwise comparisons revealed that there was a significant decrease in believability from 0 to 5 minutes (M_{diff} = -3.18, SE = 0.82, p < .001, d = 0.70), 5 to 10 minutes (M_{diff} = -4.65, SE = 1.09, p < .001, d = 0.77), 10 and 15 minutes (M_{diff} = -3.78, SE = 0.93, p <

.001, d = 0.73), and 15 to 20 minutes (M_{diff} = -3.73, SE = 1.30, p < .01, d = 0.51). The main effect of Condition was not significant, F (1, 29) = 0.003, p = .96, η_p^2 < .001. There was no Time x Condition interaction, F (6, 29) = 0.20, p = .98, η_p^2 = .04. Figure 2 depicts the believability scores in sessions one and two of imaginal exposure.

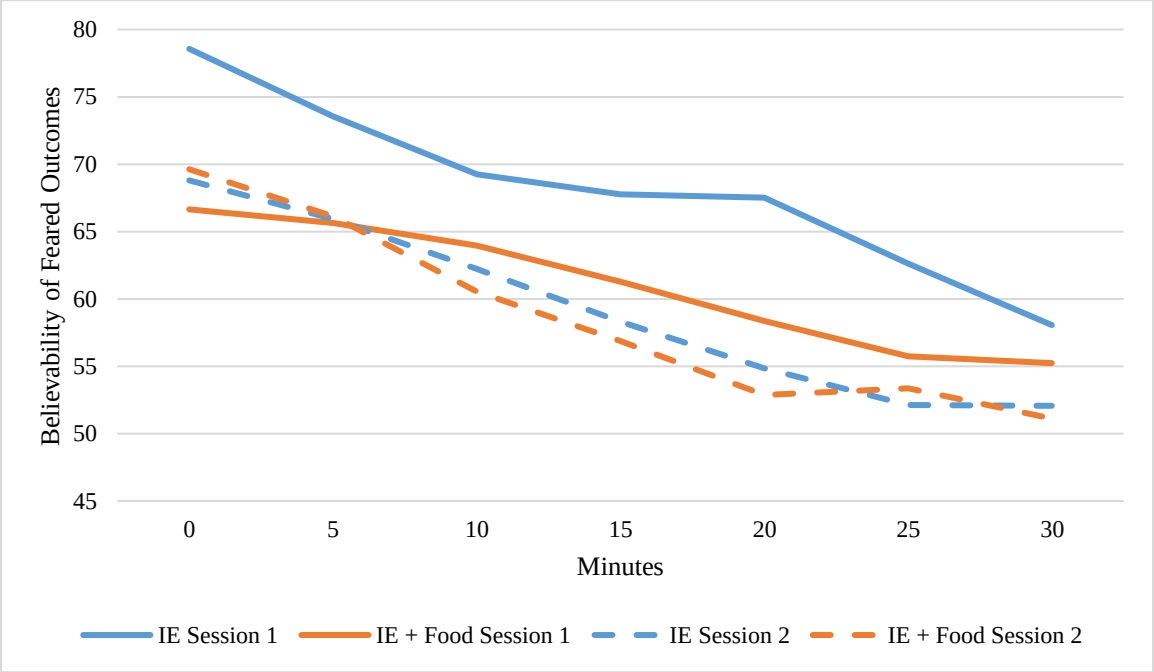

Figure 2. Believability of feared outcomes during imaginal exposure.

We examined between-session effects of exposure condition on SUDS ratings and believability of feared outcomes. To do this, we conducted 2 (Condition: IE, IE + Food) x 2 (Time: session one, session two) repeated measures ANOVAs with first rating, final rating, and mean rating as dependent variables.

Initial SUDS ratings (0 minutes) did not decrease significantly between-session, F (1, 29) = 2.01, p = .17, η_p^2 = .06. There was no main effect of Condition, F (1, 29) = 0.92, p = .35, η_p^2 = .03. There was no Time x Condition interaction, F (1, 29) = 0.32, p = .58, η_p^2 = .01.

Final SUDS ratings (30 minutes) marginally decreased between-session, F (1, 29) = 3.32, p = .079, η_p^2 = .10. There was no main effect of Condition, F (1, 29) = 0.79, p = .38, η_p^2 = .03. There was no Time x Condition interaction, F (1, 29) = 0.25, p = .62, η_p^2 = .01.

Mean SUDS ratings significantly decreased between-session, F (1, 29) = 7.33, p = .01, η_p^2 = .20. There was no main effect of Condition, F (1, 29) = 1.09, p = .30, η_p^2 = .04. There was no Time x Condition interaction, F (1, 29) = 0.41, p = .53, η_p^2 = .01.

There was no main effect of Time, such that initial believability ratings (0 minutes) did not change between-session, F (1, 29) = 2.08, p = .16, η_p^2 = .07. There was no main effect of Condition, F (1, 29) = 0.63, p = .43, η_p^2 = .02. There was a significant Time x Condition interaction, F (1, 29) = 4.97, p = .03, η_p^2 = .15. Pairwise comparisons revealed that IE condition initial believability scores decreased significantly from session 1 to session 2, M_{diff} = -11.93, SE = 4.99, p = .03, d = 0.62, whereas initial IE + Food condition believability scores did not change, p > .05. See Figure 2 for a depiction of initial believability ratings by condition.

Final believability ratings (30 minutes) decreased between-session, F (1, 29) = 5.03, p = .03, η_p^2 = .15. There was no main effect of Condition, F (1, 29) = 0.12, p = .74, η_p^2 = .004. There was no Time x Condition interaction, F (1, 29) = 0.77, p = .39, η_p^2 = .03.

Mean believability ratings decreased between-session, F (1, 29) = 5.75, p = .02, η_p^2 =.17. There was no main effect of Condition, F (1, 29) = 0.36, p = .56, η_p^2 = .01. There was no Time x Condition interaction, F (1, 29) = 2.48, p = .13, η_p^2 = .08.

We examined between-session effects of exposure condition on changes in distress tolerance. We conducted a 2 (Condition: IE, IE + Food) x 2 (Time: session one, session two) repeated measures ANOVA with distress tolerance ratings as the dependent variable. Distress tolerance significantly increased between-session, F (1, 29) = 8.77, p = .006, η_p^2 = .23. There was no main effect of Condition, F (1, 29) = 1.48, p = .23, η_p^2 = .05. There was no Time x Condition interaction, F (1, 29) = 1.10, p = .30, η_p^2 = .04.

Discussion

The current study was the first to examine the use of imaginal exposure for eating disorders utilizing a randomized controlled design. Overall, the imaginal exposure intervention was feasible and found to be moderately acceptable by participants. There was minimal drop out (4%) between sessions one and two of the intervention. Participants found the brief food exposure plus imaginal exposure condition to be less acceptable than imaginal exposure alone.

Overall, disordered eating symptoms, eating related rituals, and preoccupations decreased from baseline to one-month follow-up. Additionally, scores on nearly all fear of food and fear of eating measures decreased from pre- to posttreatment and pretreatment to follow-up. However, we did not find differences between the conditions (IE, IE + Food, or AC) in the degree of change demonstrated. Participants experienced an increase in confidence in their ability to lessen fears related to eating from pre- to posttreatment and from pretreatment to follow-up, and those in the IE condition had greater confidence in their ability to change compared to those in the IE + Food condition. Although the decrease in disordered eating symptoms and fears is encouraging, the lack of difference in changes between the intervention conditions and

control condition implies that the interventions were not necessarily responsible for the improvements detected. A few explanations may account for this; perhaps the two-session intervention was not a high enough dose of imaginal exposure to produce measurable changes in disordered eating symptoms as compared to the control condition. Large decreases in disordered eating symptoms and fears of food were found after four sessions of online imaginal exposure (Levinson et al., 2020), so it is possible that two sessions were not enough to produce tangible change in symptoms above and beyond the control. Additionally, due to the small size of our sample in each condition, it is possible that existing effects have gone undetected. Future randomized controlled trials on imaginal exposure for disordered eating related fears should increase the dose of imaginal exposure and recruit larger sample sizes in order to detect treatment effects.

Subjective distress during the imaginal exposure sessions decreased within sessions one and two. As expected, in session one, there was an initial peak in distress followed by subsequent decreases in distress in both intervention conditions, suggesting that within-session habituation to fears occurred. Between sessions, there was a large decrease in mean subjective distress ratings and a moderate decrease in final ratings. Between-session habituation in SUDS has been shown to predict better treatment response (Maples-Keller & Rauch, 2020), for example, for those with posttraumatic stress disorder undergoing prolonged exposure therapy (Badour et al., 2017; van Minnen & Hagenaars, 2002). Our findings suggest that within- and between-session habituation of distress related to fears driving disordered eating is occurring during imaginal exposure in our sample, indicating that eating-related fears are activated by imaginal exposure.

Based on an inhibitory learning approach, one of the main goals of exposure therapy is to introduce new evidence that undermines the believability of the feared outcome (i.e., "violates expectancies"; Craske et al., 2014). We found that believability of feared outcomes decreased within session one and two of imaginal exposure. Importantly, between-session decreases in expectancy also occurred for mean and final ratings. In other words, fears were less believable the longer participants engaged in the imaginal exposure and less believable in the second session. In light of prior research suggesting that between-session habituation is most predictive of treatment outcomes (Sripada & Rauch, 2015), these findings are promising. The addition of the brief food exposure prior to the imaginal exposure seems to have affected initial believability scores at the beginning of the imaginal exposure such that those in the IE + Food condition entered the imaginal exposure with similar believability in sessions one and two, whereas those in the IE only condition experienced a decrease in their initial believability scores. This may be explained by the fact that the brief food exposure was intended to heighten believability of fears prior to the imaginal exposure. Overall, our findings suggest that imaginal exposure serves to undermine believability of fears related to eating or weight gain for those with disordered eating.

Distress tolerance also increased between session one and two of imaginal exposure. Craske et al. (2008) posit that distress tolerance (e.g., fear tolerance) may be a critical aim of exposure therapy. Our results suggest that imaginal exposure may enhance individuals' willingness or ability to tolerate distress related to eating disorder fears. Additionally, self-efficacy enhancement may be another mechanism through which exposure therapy promotes change, as individuals are confronting feared situations and

learning about their own competence through this process (Breuninger, Tuschen-Caffier & Svaldi, 2019). Participants in both conditions experienced an increase in their confidence to change which aligns with findings of Cardi et al. (2019), who demonstrated that feared food exposures increased confidence to change for those with anorexia nervosa. Those in the IE condition experienced greater increase in confidence in their ability to change following the intervention compared to those in the IE + Food condition. It is possible that the IE condition was the appropriate level of challenging to promote both inhibitory learning and feelings of self-efficacy.

The current study has a number of limitations. Primarily, the sample size is smaller than intended due to disruption of recruitment during the COVID-19 pandemic, which prevented us from detecting small to moderate effect sizes that may otherwise be significant. Secondly, participants underwent only two sessions of the imaginal exposure intervention. Although this allowed us to determine feasibility, acceptability, and within and between-session changes in distress and believability of feared outcomes, it was likely not a strong enough dose of imaginal exposure to demonstrate its potential effects on disordered eating symptoms and psychopathology. Future research should investigate imaginal exposure compared to in vivo exposure using a higher dose of treatment with larger samples of participants. Finally, we examined the utility of imaginal exposure in a non-clinical sample, but the effects of the intervention could be different in a clinical sample and should be explored.

Future research is needed to determine whether imaginal exposure is an efficacious intervention for fears driving eating disorders. Research should seek to examine this intervention in larger, clinical samples with a randomized controlled design.

It remains uncertain whether in vivo feared food exposures augment imaginal exposure or whether imaginal exposure is sufficient on its own; future studies should explore this and other methods of bolstering the robustness of fear inhibition. Finally, it will be clinically important to determine whether specific types of eating disorder related fears are best targeted using imaginal exposure versus in vivo exposure. Future research on this topic would assist clinicians in determining whether imaginal exposure or in vivo exposure would best inhibit a patient's eating disorder related fears and promote symptom reduction.

Overall, we found little difference between imaginal exposure and imaginal exposure combined with brief food exposure, which suggests that imaginal exposure may be able to stand alone as an intervention for eating disorder related fears. Low rates of drop out between session one and session two indicate that participants found imaginal exposure acceptable. Participants found IE more acceptable than IE + Food and experienced greater confidence to change from IE alone, suggesting that IE may be a more tolerable intervention and may be appropriately targeting fears without the addition of in vivo exposure. Decreases in subjective distress and believability of feared outcomes within and between imaginal exposure sessions suggest that imaginal exposure inhibits disordered eating related fears. Research in larger, clinical samples is needed to determine whether imaginal exposure is a supported intervention for eating disorder related fears.

CHAPTER 2
SUPPLEMENTARY ANALYSES

Introduction

There are several factors that may affect who benefits most from imaginal exposure. First, the ability to visualize more vividly could allow fear associations to be activated to a greater degree during imaginal exposure. Vividness of mental imagery during exposures related to outcome in one study of prolonged exposure for posttraumatic stress disorder (i.e., imaginal exposure to the traumatic memory; Mota et al., 2015) but not in another (Rauch, Foa, Furr, & Filip, 2004), suggesting that more research is needed to assess this relationship. A second factor worth exploring is whether the use of mental rituals during imaginal exposure may impact the learning of new, non-threat associations. If the individual attributes the absence of the feared outcome to their engagement in mental rituals (e.g., counting calories, repeating a phrase to oneself), then the importance of avoiding the feared outcome is reinforced (Abramowitz, 2006). Understanding which factors affect who benefits from imaginal exposure is crucial to determining whether the intervention may be useful to specific individuals.

In the current study, we examined whether vividness of mental imagery at baseline would differentially predict outcomes from imaginal exposure. We expected that those with more vivid mental imagery ability would experience a greater change in outcomes following imaginal exposure. We also examined whether rituals would predict outcomes from imaginal exposure, and we expected that those who reported engaging in more rituals at baseline would experience relatively poorer outcomes from imaginal exposure.

Methods

Refer to Chapter 1 for study participants, procedures, and measures.

Measures

Visual imagery ability was assessed using the Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973). This 16-item measure asks participants to visualize four different scenes, which are each accompanied by four specific items related to that scene. Participants are asked to rate the vividness of the mental image from 1 ("perfectly clear and as vivid as normal vision") to 5 ("no image at all, you only 'know' that you are thinking of the object"). The VVIQ has demonstrated good criterion validity; those with lower scores more accurately recalled information from pictures (Marks, 1973). Over a three-week interval, test-retest reliability was .71 (McKelvie, 1986). The VVIQ was administered at baseline only and had good internal consistency ($\alpha = .88$).

Data Analytic Plan

Analyses were conducted using SPSS Version 24 (International Business Machines Corporation, 2016). Linear Mixed Models (LMMs) were employed to test moderators of change (VVIQ, YBC-EDS-SRQ Rituals) as a function of treatment. Random intercepts were included in the models, and maximum likelihood estimation was used to address missing data, so the intent-to-treat sample was included. The random effect covariance structure was declared using a scaled identity matrix. Effect sizes were calculated as Cohen's *d* (Cohen, 1988), using the differences in estimated marginal means divided by the pooled within-group standard deviation (Dunlap et al., 1996).

Results

Moderating Effects of Rituals and Visual Imagery

We examined whether tendency to engage in rituals moderated the effects of treatment on changes in EDE-Q global score, FOFM subscale scores, and EFQ subscale scores. We conducted LMMs with baseline YBC-EDS-SRQ Rituals, treatment condition, and the interaction between treatment condition and YBC-EDS-SRQ Rituals as predictors. The LMM for EDE-Q global score included pretreatment and follow-up time points. The LMMs for EFQ and FOFM subscale scores included pretreatment, posttreatment, and follow-up time points. These analyses were conducted using only participants in the intervention conditions (IE and IE + Food).

The effect of YBC-EDS-SRQ Rituals on EDE-Q scores was not significant, B = 0.08, SE = 0.06, p = .22, d = 0.24. The effect of Condition was not significant, B = -0.13, SE = 0.96, p = .89, d = 0.02. The interaction between YBC-EDS-SRQ Rituals and Condition was not significant, B = -0.01, SE = 0.09, p = .88, d = 0.02.

The effect of YBC-EDS-SRQ Rituals on FOFM Anxiety about Eating scores was significant, B = 0.25, SE = 0.10, p = .02, d = 0.44, such that higher use of rituals predicted higher FOFM Anxiety about Eating scores at follow-up. The effect of Condition was not significant, B = 0.45, SE = 1.56, p = .78, d = 0.05. The interaction between YBC-EDS-SRQ Rituals and Condition was not significant, B = -0.07, SE = 0.15, p = .65, d = 0.08.

The effect of YBC-EDS-SRQ Rituals on FOFM Food Avoidance Behaviors scores was significant, B = 0.36, SE = 0.08, p < .001, d = 0.78, such that higher use of rituals predicted higher FOFM Food Avoidance Behaviors scores at follow-up. The effect of Condition was not significant, B = 1.88, SE = 1.18, p = .12, d = 0.28. The interaction between YBC-EDS-SRQ Rituals and Condition was marginally significant, B = -0.23, SE = 0.12, p = .05, d = 0.33, such that higher rituals were associated with higher FOFM Food

Avoidance Behaviors for those in the IE condition, whereas the effect was reversed in the IE + Food condition.

The effect of YBC-EDS-SRQ Rituals on FOFM Feared Concerns scores was significant, $B = 0.25$, $SE = 0.09$, $p < .01$, $d = 0.48$, such that higher use of rituals predicted higher FOFM Feared Concerns scores at follow-up. The effect of Condition was not significant, $B = 0.43$, $SE = 1.36$, $p = .76$, $d = 0.06$. The interaction between YBC-EDS-SRQ Rituals and Condition was not significant, $B = -0.10$, $SE = 0.13$, $p = .46$, $d = 0.13$.

The effect of YBC-EDS-SRQ Rituals on EFQ Weight scores was not significant, $B = 0.02$, $SE = 0.07$, $p = .80$, $d = 0.05$. The effect of Condition was not significant, $B = -0.67$, $SE = 1.13$, $p = .56$, $d = 0.10$. The interaction between YBC-EDS-SRQ Rituals and Condition was not significant, $B = 0.04$, $SE = 0.11$, $p = .69$, $d = 0.06$.

The effect of YBC-EDS-SRQ Rituals on EFQ Social scores was not significant, $B = 0.10$, $SE = 0.08$, $p = .21$, $d = 0.22$. The effect of Condition was not significant, $B = -0.44$, $SE = 1.18$, $p = .71$, $d = 0.06$. The interaction between YBC-EDS-SRQ Rituals and Condition was not significant, $B = 0.03$, $SE = 0.11$, $p = .82$, $d = 0.05$.

The effect of YBC-EDS-SRQ Rituals on EFQ Personal scores was not significant, $B = 0.15$, $SE = 0.09$, $p = .09$, $d = 0.29$. The effect of Condition was not significant, $B = -0.07$, $SE = 1.31$, $p = .96$, $d = 0.009$. The interaction between YBC-EDS-SRQ Rituals and Condition was not significant, $B = -0.004$, $SE = 0.13$, $p = .97$, $d < 0.01$.

The effect of YBC-EDS-SRQ Rituals on EFQ Physical scores was not significant, $B < 0.001$, $SE = 0.06$, $p = .99$, $d = 0.002$. The effect of Condition was not significant, $B = -0.23$, $SE = 0.87$, $p = .79$, $d = 0.05$. The interaction between YBC-EDS-SRQ Rituals and Condition was not significant, $B = 0.06$, $SE = 0.08$, $p = .46$, $d = 0.13$.

The effect of YBC-EDS-SRQ Rituals on EFQ Social Eating scores was significant, $B = 0.28$, $SE = 0.10$, $p < .01$, $d = 0.49$, such that higher use of rituals at baseline predicted higher scores on EFQ Social Eating at follow-up. The effect of Condition was not significant, $B = -1.26$, $SE = 1.46$, $p = .40$, $d = 0.15$. The interaction between YBC-EDS-SRQ Rituals and Condition was not significant, $B < -0.001$, $SE = 0.14$, $p = .99$, $d < .001$.

Next, we examined whether visual imagery ability predicted treatment changes in EDE-Q global score, FOFM subscale scores, and EFQ subscale scores, and whether this was moderated by treatment condition. We conducted LMMs with baseline VVIQ score, treatment condition, and the interaction between treatment condition and VVIQ score as predictors. The LMM for EDE-Q global score included pretreatment and follow-up time points. The LMMs for EFQ and FOFM subscales included pretreatment, posttreatment, and follow-up time points. These analyses were conducted only in the intervention conditions (IE and IE + Food).

The effect of baseline VVIQ scores on EDE-Q total was not significant, $B = 0.10$, $SE = 0.40$, $p = .80$, $d = 0.04$. The effect of Condition was not significant, $B = -1.15$, $SE = 1.11$, $p = .31$, $d = 0.19$. The Condition by VVIQ interaction was not significant, $B = 0.51$, $SE = 0.50$, $p = .31$, $d = 0.18$.

The effect of baseline VVIQ scores on FOFM Anxiety about Eating scores was not significant, $B = 0.34$, $SE = 0.74$, $p = .65$, $d = 0.08$. The effect of Condition was not significant, $B = 1.48$, $SE = 2.08$, $p = .48$, $d = 0.12$. The Condition by VVIQ interaction was not significant, $B = -0.76$, $SE = 0.93$, $p = .42$, $d = 0.14$.

The effect of VVIQ scores on FOFM Food Avoidance Behaviors scores was not significant, $B = 0.60$, $SE = 0.65$, $p = .37$, $d = 0.16$. The effect of Condition was not significant, $B = 1.94$, $SE = 1.82$, $p = .30$, $d = 0.19$. The interaction between VVIQ scores and Condition was not significant, $B = -1.01$, $SE = 0.81$, $p = .22$, $d = 0.22$.

The effect of VVIQ scores on FOFM Feared Concerns scores was not significant, $B = 0.21$, $SE = 0.66$, $p = .75$, $d = 0.06$. The effect of Condition was not significant, $B = 0.32$, $SE = 1.86$, $p = .87$, $d = 0.03$. The interaction between VVIQ scores and Condition was not significant, $B = -0.34$, $SE = 0.83$, $p = .68$, $d = 0.07$.

The effect of VVIQ scores on EFQ Weight scores was not significant, $B = 0.54$, $SE = 0.45$, $p = .24$, $d = 0.21$. The effect of Condition was not significant, $B = -0.12$, $SE = 1.27$, $p = .92$, $d = 0.02$. The interaction between VVIQ scores and Condition was not significant, $B = 0.07$, $SE = 0.56$, $p = .90$, $d = 0.02$.

The effect of VVIQ scores on EFQ Personal scores was not significant, $B = -0.44$, $SE = 0.59$, $p = .46$, $d = 0.13$. The effect of Condition was not significant, $B = -1.62$, $SE = 1.67$, $p = .34$, $d = 0.17$. The interaction between VVIQ scores and Condition was not significant, $B = 0.75$, $SE = 0.74$, $p = .32$, $d = 0.18$.

The effect of VVIQ scores on EFQ Social scores was not significant, $B = 0.12$, $SE = 0.53$, $p = .82$, $d = 0.04$. The effect of Condition was not significant, $B = -0.05$, $SE = 1.48$, $p = .97$, $d = 0.005$. The interaction between VVIQ scores and Condition was not significant, $B = -0.01$, $SE = 0.66$, $p = .98$, $d < 0.01$.

The effect of VVIQ scores on EFQ Physical scores was not significant, $B = -0.11$, $SE = 0.36$, $p = .77$, $d = 0.05$. The effect of Condition was not significant, $B = -0.65$, $SE =$

1.02, p = .53, d = 0.11. The interaction between VVIQ scores and Condition was not significant, B = 0.53, SE = 0.45, p = .25, d = 0.21.

The effect of VVIQ scores on EFQ Social Eating scores was not significant, B = 0.50, SE = 0.74, p = .50, d = 0.12. The effect of Condition was not significant, B = 1.09, SE = 2.06, p = .60, d = 0.09. The interaction between VVIQ scores and Condition was not significant, B = -1.05, SE = 0.92, p = .26, d = .20.

Discussion

We did not find any evidence to suggest that visual imagery ability moderated treatment outcome. In fact, we found no effects at all of visual imagery ability on outcomes from imaginal exposure. This aligns with findings by Rauch et al. (2004) which suggested that vividness during imaginal exposure sessions in a course of prolonged exposure for PTSD did not predict outcomes. Perhaps individual differences in visual mental imagery do not affect ability to engage in and benefit from imaginal exposure.

Similarly, we found that baseline tendency to engage in rituals did not moderate treatment outcomes between the two imaginal exposure conditions. However, we did find that greater use of rituals at baseline predicted higher levels of food avoidance behaviors, anxiety about eating, and feared concerns related to food at follow-up. Those engaging in high levels of ritualized behaviors around food and eating may be prevented from learning that food and eating do not result in their feared outcomes, thus maintaining anxiety, fear, and avoidance behaviors around eating (Schaumberg et al., 2021). Future research must examine whether interventions targeting ritualized eating behaviors could improve outcomes.

REFERENCES CITED

Abramowitz, J. S. (1996). Variants of exposure and response prevention in the treatment of obsessive-compulsive disorder: A meta-analysis. *Behavior Therapy, 27*, 583-600. https://doi.org/10.1016/S0005-7894(96)80045-1

Abramowitz, J. S. (2006). *Understanding and treating obsessive-compulsive disorder: A cognitive behavioral approach*. Mahwah NJ: Lawrence Erlbaum. https://doi.org/10.4324/9781410615718

Aardoom, J. J., Dingemans, A. E., Op't Landt, M. C. S., & Van Furth, E. F. (2012). Norms and discriminative validity of the Eating Disorder Examination Questionnaire (EDE-Q). *Eating Behaviors, 13*, 305-309. https://doi.org/10.1016/j.eatbeh.2012.09.002

Badour, C. L., Flanagan, J. C., Gros, D. F., Killeen, T., Pericot-Valverde, I., Korte, K. J., ... & Back, S. E. (2017). Habituation of distress and craving during treatment as predictors of change in PTSD symptoms and substance use severity. *Journal of Consulting and Clinical Psychology, 85*, 274-281. https://doi.org/10.1037/ccp0000180

Bellace, D. L., Tesser, R., Berthod, S., Wisotzke, K., Crosby, R. D., Crow, S. J., ... & Simonich, H. K. (2012). The Yale-Brown-Cornell Eating Disorders Scale Self-report questionnaire: A new, efficient tool for clinicians and researchers. *International Journal of Eating Disorders, 45*, 856-860. https://doi.org/10.1002/eat.22023

Berkman, N. D., Lohr, K. N., & Bulik, C. M. (2007). Outcomes of eating disorders: A systematic review of the literature. *International Journal of Eating Disorders, 40*, 293-309. https://doi.org/10.1002/eat.20369

Blakey, S. M., Abramowitz, J. S., Buchholz, J. L., Jessup, S. C., Jacoby, R. J., Reuman, L., & Pentel, K. Z. (2019). A randomized controlled trial of the judicious use of safety behaviors during exposure therapy. *Behaviour Research and Therapy, 112*, 28-35. https://doi.org/10.1016/j.brat.2018.11.010

Boswell, J. F., Anderson, L. M., Oswald, J. M., Reilly, E. E., Gorrell, S., & Anderson, D. A. (2019). A preliminary naturalistic clinical case series study of the feasibility and impact of interoceptive exposure for eating disorders. *Behaviour Research and Therapy, 117*, 54-64. https://doi.org/10.1016/j.brat.2019.02.004

Breuninger, C., Tuschen-Caffier, B., & Svaldi, J. (2019). Dysfunctional cognition and self-efficacy as mediators of symptom change in exposure therapy for agoraphobia: Systematic review and meta-analysis. *Behaviour Research and Therapy, 120*, 103443. https://doi.org/10.1016/j.brat.2019.103443

Cardi, V., Leppanen, J., Mataix-Cols, D., Campbell, I. C., & Treasure, J. (2019). A case series to investigate food-related fear learning and extinction using in vivo food exposure in anorexia nervosa: A clinical application of the inhibitory learning framework. *European Eating Disorders Review, 27*, 173-181. https://doi.org/10.1002/erv.2639

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Earlbaum Associates, Inc.

Cooper, Z., & Fairburn, C. (1987). The Eating Disorder Examination: A semi-structured interview for the assessment of the specific psychopathology of eating disorders. *International Journal of Eating Disorders*, *6*, 1-8. https://doi.org/10.1002/1098-108X(198701)6:1<1::AID-EAT2260060102>3.0.CO;2-9

Craske, M. G., Kircanski, K., Zelikowsky, M., Mystkowski, J., Chowdhury, N., & Baker, A. (2008). Optimizing inhibitory learning during exposure therapy. *Behaviour Research and Therapy, 46,* 5-27. https://doi.org/10.1016/j.brat.2007.10.003

Craske, M. G., Treanor, M., Conway, C. C., Zbozinek, T., & Vervliet, B. (2014). Maximizing exposure therapy: An inhibitory learning approach. *Behaviour Research and Therapy, 58,* 10-23. https://doi.org/10.1016/j.brat.2014.04.006

Dunlap, W. P., Cortina, J. M., Vaslow, J. B., & Burke, M. J. (1996). Meta-analysis of experiments with matched groups or repeated measures designs. *Psychological Methods, 1,* 170–177. https://doi.org/10.1037/1082-989X.1.2.170

Fairburn, C. G., Bailey-Straebler, S., Basden, S., Doll, H. A., Jones, R., Murphy, R., ... & Cooper, Z. (2015). A transdiagnostic comparison of enhanced cognitive behaviour therapy (CBT-E) and interpersonal psychotherapy in the treatment of eating disorders. *Behaviour Research and Therapy, 70*, 64-71. https://doi.org/10.1016/j.brat.2015.04.010

Fairburn, C. G., & Beglin, S. J. (1994). Assessment of eating disorders: Interview or self-report questionnaire? *International Journal of Eating Disorders, 16*, 363-370. https://doi.org/10.1002/1098-108X(199412)16:4<363::AID-EAT2260160405>3.0.CO;2-%23

Fairburn, C. G., & Beglin, S. J. (2008). Eating Disorder Examination Questionnaire (EDE-Q 6.0). In C. G. Fairburn (Ed.), *Cognitive behavior therapy and eating disorders* (pp. 309–314). New York: Guilford Press.

Fairburn, C. G., Cooper, Z., & Shafran, R. (2003). Cognitive behaviour therapy for eating disorders: A "transdiagnostic" theory and treatment. *Behaviour Research and Therapy, 41*, 509-528. https://doi.org/10.1016/S0005-7967(02)00088-8

Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: Exposure to corrective information. *Psychological Bulletin, 99*, 20-35. https://doi.org/10.1037/0033-2909.99.1.20

Gloster, A. T., Wittchen, H. U., Einsle, F., Lang, T., Helbig-Lang, S., Fydrich, T., ... & Gerlach, A. L. (2011). Psychological treatment for panic disorder with agoraphobia: A randomized controlled trial to examine the role of therapist-guided exposure in situ in CBT. *Journal of Consulting and Clinical Psychology, 79*, 406-420. https://doi.org/10.1037/a0023584

Greist, J. H., Bandelow, B., Hollander, E., Marazziti, D., Montgomery, S. A., Nutt, D. J., ... & Zohar, J. (2003). WCA recommendations for the long-term treatment of obsessive-compulsive disorder in adults. *CNS Spectrums, 8*, 7-16. https://doi.org/10.1017/S1092852900006908

Hebert, E. A., & Dugas, M. J. (2019). Behavioral experiments for intolerance of uncertainty: challenging the unknown in the treatment of generalized anxiety disorder. *Cognitive and Behavioral Practice, 26*, 421-436. https://doi.org/10.1016/j.cbpra.2018.07.007

IBM Corporation (2016). *IBM SPSS Statistics for Windows, Version 24.0*. Armonk, NY: IBM Corporation.

Jenkins, P. E., Hoste, R. R., Meyer, C., & Blissett, J. M. (2011). Eating disorders and quality of life: A review of the literature. *Clinical Psychology Review, 31*, 113-121. https://doi.org/10.1016/j.cpr.2010.08.003

Kaplan, S. C., Swee, M., & Heimberg, R. G. (2018). Psychological treatments for social anxiety disorder. In O. Braddick (Ed.), *The Oxford research encyclopedia of psychology*. New York: Oxford University Press. doi:10.1093/acrefore/9780190236557.013.98. Retrieved from https://psychology.oxfordre.com/view/10.1093/acrefore/9780190236557.001.0001/acrefore-9780190236557-e-98

Kass, A. E., Kolko, R. P., & Wilfley, D. E. (2013). Psychological treatments for eating disorders. *Current Opinion in Psychiatry, 26*, 549-555. https://doi.org/10.1097/YCO.0b013e328365a30e

Lavender, J. M., De Young, K. P., & Anderson, D. A. (2010). Eating Disorder Examination Questionnaire (EDE-Q): Norms for undergraduate men. *Eating Behaviors, 11*, 119-121. https://doi.org/10.1016/j.eatbeh.2009.09.005

Lavender, J. M., De Young, K., Wonderlich, S. A., Crosby, R. D., Engel, S. G., Mitchell, J. E., … & Le Grange, D. (2013). Daily patterns of anxiety in anorexia nervosa: Associations with eating disorder behaviors in the natural environment. *Journal of Abnormal Psychology, 122*, 672-683. https://dx.doi.org/10.1037/a0031823.

Levinson, C. A., & Byrne, M. (2015). The Fear of Food Measure: A novel measure for use in exposure therapy for eating disorders. *International Journal of Eating Disorders, 48*, 271-283. https://doi.org/10.1002/eat.22344

Levinson, C. A., Christian, C., Ram, S. S., Vanzhula, I., Brosof, L. C., Michelson, L. P., & Williams, B. M. (2020). Eating disorder symptoms and core eating disorder fears decrease during online imaginal exposure therapy for eating disorders. *Journal of Affective Disorders, 276*, 585-591. https://doi.org/10.1016/j.jad.2020.07.075

Levinson, C. A., Rapp, J., & Riley, E. N. (2014). Addressing the fear of fat: Extending imaginal exposure therapy for anxiety disorders to anorexia nervosa. *Eating and Weight Disorders: Studies on Anorexia, Bulimia and Obesity, 19*, 521-524. https://doi.org/10.1007/s40519-014-0115-6

Levinson, C. A., Rodebaugh, T. L., Fewell, L., Kass, A. E., Riley, E. N., Stark, L., ... & Lenze, E. J. (2015). D-Cycloserine facilitation of exposure therapy improves weight regain in patients with anorexia nervosa: A pilot randomized controlled trial. *Journal of Clinical Psychiatry, 76*, 787-793. https://doi.org/10.4088/JCP.14m09299

Levinson, C. A., Vanzhula, I. A., & Christian, C. (2019). Development and validation of the Eating Disorder Fear Questionnaire and interview: Preliminary investigation of eating disorder fears. *Eating Behaviors, 35*, 101320. https://doi.org/10.1016/j.eatbeh.2019.101320

Lock, J. (2015). An update on evidence-based psychosocial treatments for eating disorders in children and adolescents. *Journal of Clinical Child & Adolescent Psychology, 44,* 707-721. https://doi.org/10.1080/15374416.2014.971458.

Lovibond, P. F. (2004). Cognitive processes in extinction. *Learning & Memory, 11,* 495-500. https://doi.org/10.1101/lm.37401.

Maples-Keller, J. L., & Rauch, S. A. (2020). Habituation. In J.S. Abramowitz & S.M. Blakey (Eds.), *Clinical handbook of fear and anxiety: Maintenance processes and treatment mechanisms*. (p. 249-263). American Psychological Association. https://doi.org/10.1037/0000150-014

Marks, D. F. (1973). Visual imagery differences in the recall of pictures. *British Journal of Psychology, 64,* 17-24. https://doi.org/10.1111/j.2044-8295.1973.tb01322.x

Mazure, C. M., Halmi, K. A., Sunday, S. R., Romano, S. J., & Einhorn, A. M. (1994). The Yale-Brown-Cornell Eating Disorder Scale: Development, use, reliability and validity. *Journal of Psychiatric Research, 28,* 425-445. https://doi.org/10.1016/0022-3956(94)90002-7

McKelvie, S. J. (1986). Effects of format of the Vividness of Visual Imagery Questionnaire on content validity, split-half reliability, and the role of memory in test-retest reliability. *British Journal of Psychology, 77,* 229-236. https://doi.org/10.1111/j.2044-8295.1986.tb01997.x

Milosevic, I., Levy, H.C., Alcoado, G.M., & Radomsky, A.S. (2015). The Treatment Acceptability/Adherence Scale: Moving beyond the assessment of treatment effectiveness. *Cognitive Behaviour Therapy*, *44,* 456-469. https://doi.org/10.1080/16506073.2015.1053407

Mota, N. P., Schaumberg, K., Vinci, C., Sippel, L. M., Jackson, M., Schumacher, J. A., & Coffey, S. F. (2015). Imagery vividness ratings during exposure treatment for posttraumatic stress disorder as a predictor of treatment outcome. *Behaviour Research and Therapy*, *69*, 22-28. https://doi.org/10.1016/j.brat.2015.03.003

Murray, S. B., Loeb, K. L., & Le Grange, D. (2016). Dissecting the core fear in anorexia nervosa: Can we optimize treatment mechanisms? *JAMA Psychiatry, 73*, 891-892. https://doi.org/10.1001/jamapsychiatry.2016.1623

Murray, S. B., Quintana, D. S., Loeb, K. L., Griffiths, S., & Le Grange, D. (2019). Treatment outcomes for anorexia nervosa: A systematic review and meta-analysis of randomized-controlled trials–CORRIGENDUM. *Psychological Medicine*, *49*, 701-704. https://doi.org/10.1017/S0033291718003185

Olatunji, B. O., Davis, M. L., Powers, M. B., & Smits, J. A. (2013). Cognitive-behavioral therapy for obsessive-compulsive disorder: A meta-analysis of treatment outcome and moderators. *Journal of Psychiatric Research, 47*, 33-41. https://doi.org/10.1016/j.jpsychires.2012.08.020

Plasencia, M., Sysko, R., Fink, K., & Hildebrandt, T. (2019). Applying the disgust conditioning model of food avoidance: A case study of acceptance-based interoceptive exposure. *International Journal of Eating Disorders*, *52*, 473-477. https://doi.org/10.1002/eat.23045

Powers, M. B., Halpern, J. M., Ferenschak, M. P., Gillihan, S. J., & Foa, E. B. (2010). A meta-analytic review of prolonged exposure for posttraumatic stress disorder. *Clinical Psychology Review*, *30*, 635-641. https://doi.org/10.1016/j.cpr.2010.04.007

Quick, V. M., & Byrd-Bredbenner, C. (2013). Eating Disorders Examination Questionnaire (EDE-Q): Norms for US college students. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 18*, 29-35. https://doi.org/10.1007/s40519-013-0015-1

Rauch, S. A., Foa, E. B., Furr, J. M., & Filip, J. C. (2004). Imagery vividness and perceived anxious arousal in prolonged exposure treatment for PTSD. *Journal of Traumatic Stress*, *17*, 461-465. https://doi.org /10.1007/s10960-004-5794-8

Reilly, E. E., Anderson, L. M., Gorrell, S., Schaumberg, K., & Anderson, D. A. (2017). Expanding exposure-based interventions for eating disorders. *International Journal of Eating Disorders, 50*, 1137-1141. https://doi.org/10.1002/eat.22761

Rescorla, R. A. (2006). Deepened extinction from compound stimulus presentation. *Journal of Experimental Psychology: Animal Behavior Processes*, *32*, 135-144. https://doi.org/10.1037/0097-7403.32.2.135

Rescorla, R. A., & Wagner, A. R. (1972). A theory of Pavlovian conditioning: Variations in the effectiveness of reinforcement and nonreinforcement. In A.H. Black & W.F. Prokasy (eds.). *Classical conditioning II: Current research and theory* (pp. 64-99) New York: Appleton-Century-Crofts.

Rose, J. S., Vaewsorn, A., Rosselli-Navarra, F., Wilson, G. T., & Weissman, R. S. (2013). Test-retest reliability of the Eating Disorder Examination-Questionnaire (EDE-Q) in a college sample. *Journal of Eating Disorders, 1*, 1-10. https://doi.org/10.1186/2050-2974-1-42

Schaefer, L. M., Smith, K. E., Leonard, R., Wetterneck, C., Smith, B., Farrell, N., ... & Anderson, D. A. (2018). Identifying a male clinical cutoff on the Eating Disorder

Examination-Questionnaire (EDE-Q). *International Journal of Eating Disorders, 51*, 1357-1360. https://doi.org/10.1002/eat.22972

Schaumberg, K., Reilly, E. E., Gorrell, S., Levinson, C. A., Farrell, N. R., Brown, T. A., ... & Anderson, L. M. (2021). Conceptualizing eating disorder psychopathology using an anxiety disorders framework: Evidence and implications for exposure-based clinical research. *Clinical Psychology Review*, *83*, 101952. https://doi.org/10.1016/j.cpr.2020.101952

Soucy, J. N., & Hadjistavropoulos, H. D. (2017). Treatment acceptability and preferences for managing severe health anxiety: Perceptions of internet-delivered cognitive behaviour therapy among primary care patients. *Journal of Behavior Therapy and Experimental Psychiatry*, *57*, 14-24. https://doi.org/10.1016/j.jbtep.2017.02.002

Sripada, R. K., & Rauch, S. A. (2015). Between-session and within-session habituation in prolonged exposure therapy for posttraumatic stress disorder: a hierarchical linear modeling approach. *Journal of Anxiety Disorders, 30*, 81-87. https://doi.org/10.1016/j.janxdis.2015.01.002

Steinglass, J., Albano, A. M., Simpson, H. B., Carpenter, K., Schebendach, J., & Attia, E. (2012). Fear of food as a treatment target: Exposure and response prevention for anorexia nervosa in an open series. *International Journal of Eating Disorders, 45*, 615-621. https://doi.org/10.1002/eat.20936

Steinglass, J., Eisen, J.L., Attia, E., Mayer, L., & Walsh, B.T. (2007). Is anorexia nervosa a delusional disorder? An assessment of eating beliefs in anorexia nervosa. *Journal of Psychiatric Practice, 13*, 65-71. https://doi.org/10.1097/01.pra.0000265762.79753.88

Steinglass, J. E., Sysko, R., Glasofer, D., Albano, A. M., Simpson, H. B., & Walsh, B. T. (2011). Rationale for the application of exposure and response prevention to the treatment of anorexia nervosa. *International Journal of Eating Disorders*, *44*, 134–141. https://doi.org/ 10.1002/eat.20784.

van Minnen, A., & Hagenaars, M. (2002). Fear activation and habituation patterns as early process predictors of response to prolonged exposure treatment in PTSD. *Journal of Traumatic Stress*, *15*, 359-367.

Wilson, G. T., Grilo, C. M., & Vitousek, K. M. (2007). Psychological treatment of eating disorders. *American Psychologist, 62*, 199-216. https://doi.org /10.1037/0003-066X.62.3.199

Wolpe, J., & Lazarus, A. A. (1966). *Behavior therapy techniques: A guide to the treatment of neuroses*. Oxford: Pergamon.