Official Title: A web-based intuitive eating intervention for young women with disordered eating: A pilot randomized controlled trial

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Introduction

Over the past 20 years, average adult weight and BMI has risen in the United States (U.S.), sparking a rise in public and private efforts to improve health via weight loss and dietary change [17, 20, 21]. Though a great deal of time and money has been dedicated to this, average BMI has not decreased and health has not improved [2, 4, 27, 29, 33]. However, the fight against weight gain has been linked to severe unintended consequences including weight cycling, distraction from health goals, increased rates of weight stigmatization, body dissatisfaction, disordered eating, and even death from extreme diets, eating disorders, weight loss surgery complications, and suicide related to these issues [2, 4, 29, 33].

Particularly, increased rates of eating disorders and disordered eating (DE) resulting from this weight-centric paradigm warrant further attention. Eating disorders carry the highest mortality rate of any mental illness, and are associated with high morbidity and societal burden [11, 12, 18, 28]. In 2019, over 10,000 people died from an eating disorder, and from 2018 to 2019 eating disorders cost the U.S. healthcare system approximately $64.7 billion [12]. In the past 20 years, the lifetime prevalence of eating disorders in the U.S. has more-than doubled [19]. Parallel to the upsurge in eating disorders, the prevalence of DE, a subclinical pattern of maladaptive eating behavior, has also increased [30, 31]. DE is the greatest predictor for the development of an eating disorder [28]. DE disproportionately effects women, particularly young women [31, 41]. Currently, DE effects about 75% of U.S. women, most of whom will never receive treatment [7, 25, 31].

Concern for the lack of success and unintended consequences of a weight-centric paradigm has inspired calls for a shift in the promotion of healthy eating behavior. Given the high prevalence of DE, promotion of healthy eating ought to focus on this. At the forefront of this is Intuitive Eating (IE), a weight-neutral approach. The philosophy of IE posits that humans are born with the ability (an "intuition") to self-regulate appetite and make dietary choices based on internal hunger and fullness cues, but external messaging about food and body size undermines this ability and causes distress and disorder around food [35, 37]. IE is characterized by attending to internal bodily cues, and flexible thinking and behavior concerning food [35, 37]. The Intuitive Eating Scale (IES-2) provides a way to quantify IE as a construct by measuring respondents' ability to tune into various internal bodily cues [35]. In this scale, IE is broken down into 4 principles: Unconditional Permission to Eat (UPE), Reliance on Hunger and Fullness Cues (HFC), Eating for Physical Rather than Emotional Reasons (PRE), and Body-Food Choice Congruence (BFCC) [37]. Each principle is a measurable component of this style of eating; UPE is the absence of guilt or shame around eating, HFC is the ability to eat when hungry and stop when full, PRE is the ability to distinguish between physical and emotional hunger cues, and BFCC is the ability to eat in ways that are congruent with positive physical and emotional sensations and outcomes [35, 37]. These abilities are not static, though; several intervention studies have demonstrated individuals' ability to learn how to eat intuitively e.g. [7, 10, 40].

A systematic literature review of 16 IE interventions found consistent decreases in DE, depression, and increases in self-esteem [9]. While all interventions included in this review yielded improved relationship with food, mixed results were shown for weight loss, dietary changes, and physiological indicators of health [9]. Another review of 20 IE interventions demonstrated similar findings [34]. Across interventions, there were overall decreases in depression, anxiety, restriction, body dissatisfaction, and drive for thinness, and increases in self-esteem and quality of life [34]. Measures of improved physiological health including weight loss, lowered blood glucose, and lowered cholesterol levels had less data support [34].

Likewise, research examining correlates of IE reliably suggests that IE is associated with lower rates of DE, lower body preoccupation, internalized weight stigma, and rates of depression, and greater self-esteem, and quality of life [6, 7, 9, 10, 15, 34, 39, 40]. Moreover, some studies have linked IE to improved dietary quality, weight stability, and lower BMI [1, 3, 14, 16, 22, 24, 26, 32, 36, 39].

Recently, an eight-year study following 1,491 participants demonstrated strong and lasting effects of IE [15]. This study followed participants from early adolescence to young adulthood and found that both baseline levels of IE and change in IE over time predicted lower odds of depression, low self-esteem, body dissatisfaction, unhealthy weight control behaviors (fasting, skipping meals), extreme weight

control behaviors (diet pills, purging), and binge eating at follow-up [15]. The data seems to suggest that IE is a protective factor for developing DE.

Though there is strong evidence suggesting that IE is associated with lower levels of DE, few studies have examined the effect of learning to eat intuitively for people with DE. One recent study tested an uncontrolled pilot feasibility trial of a brief IE intervention for college women with DE [7]. Seventy-one women with DE participated in this first-of-its-kind intervention, demonstrating that this population can learn to eat intuitively and benefit from it [7]. Participants had medium to large improvements in IE, body appreciation, and life satisfaction, as well as reductions in DE, body dissatisfaction, and weight-bias internalization [7].

This present study is the first randomized controlled trial (RCT) testing an IE intervention for DE. This study tested various health outcomes in a web-based intervention provided to a sample of young women with DE. Participants were assessed before (time 1/T1) and after (time 2/T2) completing the intervention. T1 to T2 changes in IE, DE, body appreciation, psychological flexibility, dichotomous thinking around food, and food intake were assessed.

Study Aims & Hypotheses

This study's aims were as follows: ***Aim 1:*** To introduce IE to a group of women with high levels of DE and assess associated outcomes. ***Hypothesis 1:*** When compared to the control group, the treatment group will experience the following changes from T1 to T2: ***(a)*** Increase in levels of IE, as measured by the Intuitive Eating Scale (IES-2), ***(b)*** Decrease in levels of DE, as measured by the Revised Three-Factor Eating Questionnaire (TFEQ-r18), ***(c)*** Increase in body appreciation, as measured by the Body Appreciation Scale (BAS-2), ***(d)*** Increase in psychological flexibility, as measured by the Acceptance and Action Questionnaire (AAQ-2), ***(e)*** Decrease in dichotomous thinking around food, as measured by the Dichotomous Thinking Scale (DT). ***Aim 2:*** To elucidate the effect of IE on food choice. ***Hypothesis 2:*** When compared to the control group, the treatment group's intake of fruits and vegetables, as measured by the NHANES Food Frequency Questionnaire, will increase from T1 to T2. ***Hypothesis 3:*** At baseline, IE will correlate with greater fruit and vegetable intake.

Method

Sample Characteristics

Participants were women ages 18-30 from the United States and Canada with high levels of DE, defined as higher-than-average scores (score > 25) on the TFEQ-r18, without a current eating disorder diagnosis, who have never previously participated in a formal intervention or course on IE (n=123). BMI at baseline ranged from 16.3 to 65. The sample was largely college-educated, white, and heterosexual (Table 1).

Potential participants were recruited via social media and online forums, including Facebook, Instagram, Tumblr, and Reddit. Recruited participants were asked to send the study screener to others who may be interested in participating, as well. Five-hundred-thirteen completed the screener, where 390 were excluded. Some met multiple criteria for exclusion, though none were excluded for having low TFEQ-r18 scores (Figure 1).

All participant information was deidentified, and contact information was kept in a separate secured file. Each participant was assigned a unique code used to connect data from different timepoints.

At Time 1 (T1), participants were randomly assigned to either a treatment (n=62) or waitlist control group (n=61). In most aspects, the groups were not significantly different at baseline (Table 1).

Procedures

IRB approval was granted from Western IRB on April 8th, 2020 (WIRB Tracking ID 20200516). After participants were recruited, the intervention began on April 29th, 2020 and concluded July 1st, 2020.

The intervention was a novel 10-week program aimed at promoting IE through pre-recorded videos, reading material, and bi-weekly discussion sessions. The intervention introduced the following

modules sequentially: Unconditional Permission to Eat, Reliance to Hunger and Fullness Cues, Body-Food Choice Congruence, Gentle Nutrition, and Joyful Movement.

Every other week, a new module was introduced. Participants were taught the concept of this module through video and reading, then prompted to practice it over the week. On opposite weeks, the module last introduced was discussed in greater detail through video, and participants were given the opportunity to discuss amongst one another and have all questions answered by the researchers. The intervention schedule included the following:

- *Week 1*: What is Intuitive Eating? A Program Overview and Introduction to Unconditional Permission to Eat (video + reading)
- *Week 2*: Discussion on Unconditional Permission to Eat, and Concerns about Eating Intuitively (video + discussion and questions/answer with researchers)
- *Week 3*: Reliance on Internal Cues: Eating when I'm Hungry & Stopping when I am Full (video + reading)
- *Week 4*: Discussion on Internal Cues, Concerns, and Questions Moving Forward -- It's OK to Make Mistakes (video + discussion and questions/answer with researchers)
- *Week 5*: Body-Food Choice Congruence: What Foods Make Me Feel Good? (video + reading)
- *Week 6*: Discussion on Food Choice -- How Do I Know if a Food Truly Makes Me Feel Good or if I Feel Good Because of Diet Culture Messages? (video + discussion and questions/answer with researchers)
- *Week 7*: Gentle Nutrition: Nourishing Yourself (video + reading)
- *Week 8*: Discussion on Nourishment, and Saying "NO" to the Food Police (video + discussion and questions/answer with researchers)
- *Week 9*: Joyful Movement: Find What Makes You Happy (video + reading)
- *Week 10*: Closing Discussion, and Final Questions (video + discussion and questions/answer with researchers)

Measures

Intuitive Eating Scale (IES-2)

The IES-2 was administered as a pre- and post-study measure of IE skills at T1 and T2. This 21-item scale measures the extent to which a respondent follows IE principles [37]. Response options are on a 5-point Likert-type scale, with 1=strongly disagree, 2 =disagree, 3=neutral, 4=agree, 5=strongly agree. There are four subscales on this questionnaire, each measuring a separate aspect of IE: Unconditional Permission to Eat (UPE), Reliance on Hunger and Fullness Cues (HFC), Eating for Physical Rather Than Emotional Reasons (PRE), and Body-Food Choice Congruence (BFCC). Means are calculated for overall and subscale scores. A sample item is *"I trust my body to tell me when to stop eating"* [37].

National Health and Nutrition Examination Survey Food Frequency Questionnaire (N-FFQ)

The National Health and Nutrition Examination Survey Food Frequency Questionnaire (N-FFQ) was administered as a pre- and post-study measure of diet. The N-FFQ is a standardized food frequency questionnaire in which respondents are asked to recall their food and beverage intake from the past three days. It measures consumption of whole grains, refined grains, vegetables, greens, whole fruits, total fruits, total protein, plant protein, dairy, fat, sodium, added sugar, and alcohol [13].

Three-Factor Eating Questionnaire (TFEQ-r18)

The TFEQ-r18 was initially used as a screening tool, then was administered post-study at T2. Higher scores on this measure indicate greater levels of pathology and distress around eating. This 18-item measure is divided into three sub-sections, each measuring a different aspect of eating distress and pathology: cognitive restraint/restriction, uncontrolled/binge eating, and emotional eating. There are six questions for cognitive restraint/restriction, nine for uncontrolled eating, and three for emotional eating. Response options are on a 4-point Likert-type scale, with 1=definitely false, 2=mostly false, 3=mostly

true, 4=definitely true. Overall and subscale scores are calculated by summing item responses. One sample item is *"When I feel lonely, I console myself by eating"* [23].

Body Appreciation Scale (BAS-2)

The BAS-2 was used as a pre- and post-study measure of participants' body appreciation. Body appreciation is an aspect of body image that specifically targets bodily respect and contentment. The BAS-2 is a 13-item questionnaire with 5-point Likert-type scale response options, 1=never, 2=seldom, 3=sometimes, 4=often, 5=always. One sample item is "*Despite its imperfections, I still like my body*" [38].

Acceptance and Action Questionnaire (AAQ-2)

The AAQ-2 was administered as a pre- and post-study measure of psychological flexibility. The AAQ-2 directly measures behavioral effectiveness as a proxy for psychological flexibility; this is one of the most common ways to measure psychological flexibility. There are seven items, with 7-point Likert-type scale response options, 1=never true, 2=very seldom true, 3=seldom true, 4=sometimes true, 5=frequently true, 6=almost always true, 7=always true. A sample item is "*I worry about not being able to control my worries and feelings*" [5].

Dichotomous Thinking Around Food Scale (DT)

The Dichotomous Thinking Around Food Scale (DT) was administered as a pre- and post-study measure of psychological flexibility specific to food. It is an 11-item measure of the extent to which respondents dichotomously categorize foods in an inflexible manner. Response options are on a 4-point Likert-type scale, 1=not at all true of me, 2=slightly true of me, 3=fairly true of me, and 4=very true of me. A sample item is "*I think of food as either 'good' or 'bad'*" [8].

Analyses

All analyses were completed using SPSS v.21. The data were visually inspected and cleaned prior to running analyses. Independent Sample T-Tests were used to test baseline group differences. Correlations were run for other baseline data. To test the effect of the intervention, a 2x2 analysis of variance (ANOVA) was used.

Data Analysis Plan

Baseline correlations and pre- to post-study between groups analyses will be completed to test effects of IE. Correlation analyses will also be run testing associations between IE, body appreciation, psychological flexibility, dichotomous thinking around food, DE, subtypes of DE, BMI, and food choice broken down by food group. These analyses will utilize responses from all 123 participants.

At T2, 58.5% of the overall sample completed testing (n=72), including 51.6% of the treatment group (n=32), and 65.6% of the control group (n=40). Independent sample t-tests were run to compare treatment participants who completed the intervention to those who dropped out. At baseline, participants who completed treatment had higher levels of IE (t=-2.11, p=.039) and body appreciation (t=-2.39, p=.02), and lower levels of DE (t=3.5, p=.001) and dichotomous thinking (t=2.68, p=.009). There were no differences in treatment completion for participant age, race, nationality, sexual orientation, marital status, education, BMI, eating disorder history, or psychological flexibility.

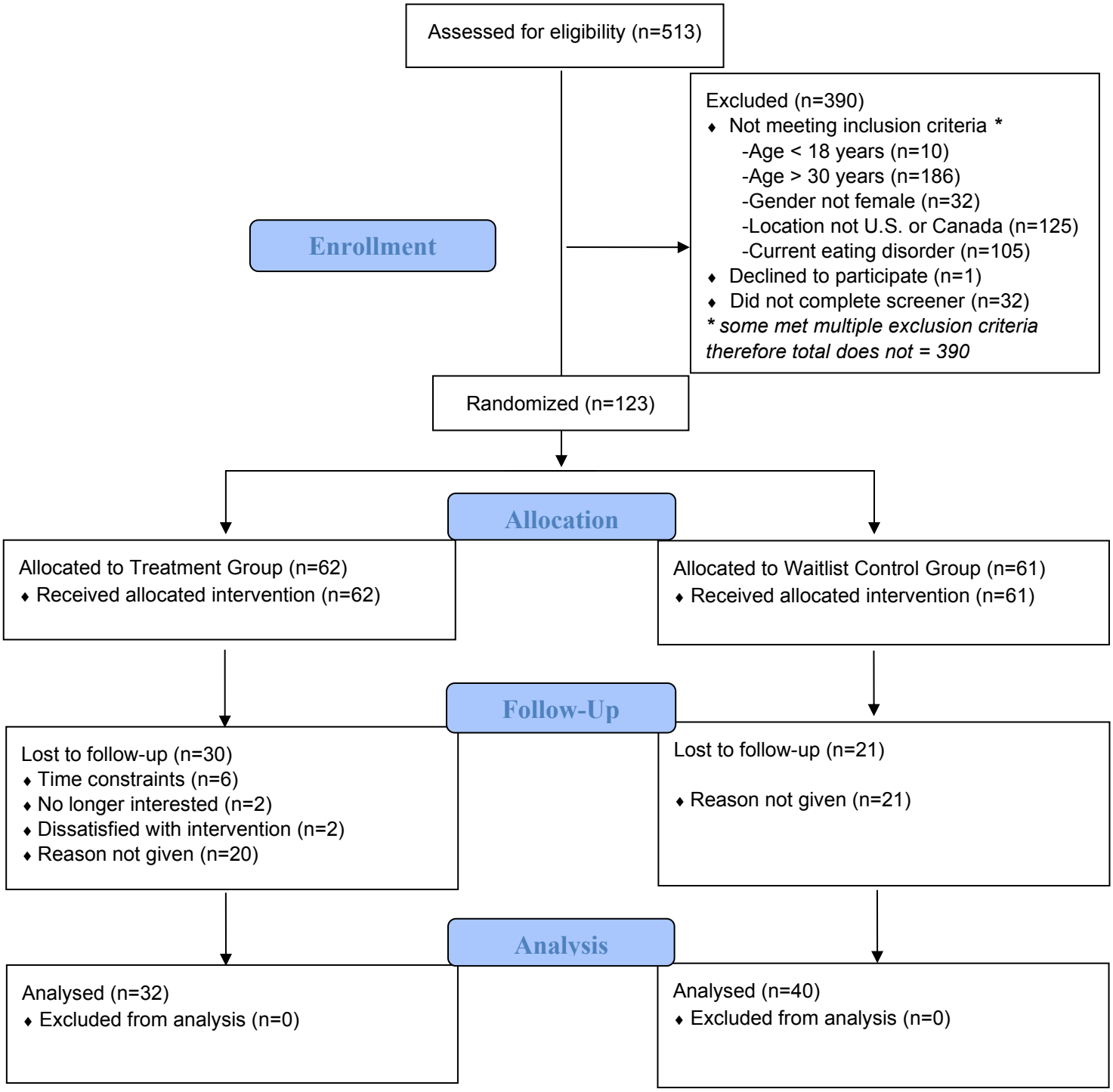
To test the effect of participating in the intervention, a 2x2 ANOVA will be completed. Group x Time comparisons will examine T1 to T2 differences in the treatment and control groups.

Table 1. Participant Demographics x Group

	Overall (n=123)	Intervention (n=62)	Control (n=61)	*p*
Median Age (years)	25 ± 5	25 ± 4	25 ± 6	.917
Nationality				
United States	106 (86.2%)	51 (82.3%)	55 (90.2%)	.011*
Canada	17 (13.8%)	11 (17.7%)	6 (9.8%)	.011*
Race				
White	86 (69.9%)	48 (77.4%)	38 (62.3%)	.089
Asian	10 (8.2%)	6 (9.7%)	4 (6.6%)	.400
Latina	7 (5.7%)	1 (1.6%)	6 (9.8%)	.021*
Black	4 (3.3%)	1 (1.6%)	3 (4.9%)	.454
Other	2 (1.6%)	0 (0%)	2 (3.3%)	.153
2 or more races	14 (11.3%)	6 (9.7%)	8 (13.1%)	.454
Sexual Orientation				
Heterosexual	86 (69.9%)	47 (75.8%)	39 (63.9%)	.154
Homosexual	0 (0%)	0 (0%)	0 (0%)	1
Bisexual	33 (26.8%)	13 (21%)	20 (32.8%)	.141
Other	3 (2.4%)	2 (3.2%)	1 (1.6%)	.572
Prefer Not to Say	1 (0.8%)	0 (0%)	1 (1.6%)	.315
Marital Status				
Never married	87 (70.7%)	43 (69.4%)	44 (72.1%)	.738
Married	34 (27.6%)	18 (29%)	16 (26.2%)	.731
Divorced	1 (0.8%)	0 (0%)	1 (1.6%)	.315
Prefer Not to Say	1 (0.8%)	1 (1.6%)	0 (0%)	.323
Education				
High School or Equivalent	8 (6.5%)	3 (4.8%)	5 (8.2%)	.454
Trade School	1 (0.8%)	1 (1.6%)	0 (0%)	.323
Some College	19 (15.4%)	9 (14.5%)	10 (16.4%)	.776
Associate Degree	7 (5.7%)	2 (3.2%)	5 (8.2%)	.238
Bachelor's Degree	57 (46.3%)	32 (51.6%)	25 (41%)	.241
Master's Degree	28 (22.8%)	15 (24.2%)	13 (31.3%)	.706
Doctoral Degree	3 (2.4%)	0 (0%)	3 (4.9%)	.078
BMI (median)	27.8 ± 10.8	26.8 ± 9.6	29.9 ± 11.8	.044*
Underweight (>18.5)	3 (2.4%)	2 (3.2%)	1 (1.6%)	.572
Normal weight (18.5-24.9)	40 (32.5%)	22 (35.5%)	18 (29.5%)	.483
Overweight (25-30)	32 (26%)	19 (29%)	14 (23%)	.446
Obese (30+)	48 (39%)	20 (32.3%)	28 (45.9%)	.123
Eating Disorder History^	18 (14.6%)	9 (14.5%)	9 (14.8%)	.974
Anorexia Nervosa	3 (2.4%)	1 (1.6%)	2 (3.3%)	.234
Bulimia Nervosa	4 (3.3%)	2 (3.2%)	2 (3.3%)	.974
Binge Eating Disorder	1 (0.8%)	1 (1.6%)	0 (0%)	.046*
Other Specified Feeding/Eating Disorder	6 (4.9%)	3 (4.8%)	3 (4.9%)	.968
Unspecified Feeding/Eating Disorder	1 (0.8%)	1 (1.6%)	0 (0%)	.046*
Multiple	3 (2.4%)	1 (1.6%)	2 (3.3%)	.234

** Group difference at the 0.05 level*
^ No participants had current eating disorders

Figure 1. CONSORT Flow Diagram



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