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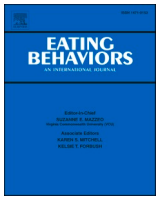

Preventing weight gain in adults who emotionally eat: An open pilot☆,☆☆

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ABSTRACT

Background: Weight gain prevention is a critical component of comprehensive obesity care. Emotional eating may contribute to unwanted weight gain, increasing cardiometabolic risk factors among adults with obesity. One way to help reduce emotional eating and reduce weight gain is to provide instruction in Appetite Awareness Training (AAT).

Purpose: The purpose of this open pilot study was to examine the feasibility and acceptability of the SATISFY intervention, a 12-week intervention consisting of AAT and training from the Diabetes Prevention Program in a sample of Black and White adults with obesity, and who report emotional eating.

Methods: Eligible adults participated in 12 virtual weekly 60–90-minute group sessions. The intervention included content from AAT and the Diabetes Prevention Program. Participants also received weekly feedback on weight and eating behavior trends via a digital health platform. Participants were assessed at 0, 3 (T1), and 6 months (T2).

Results: At baseline, participants ($N = 31$) had a mean (±SD) age of 47.55 ± 12.41 years, BMI of 36.6 ± 6.6 kg/m^2 and moderate levels of emotional eating. Participants attended approximately 50 % of sessions and 77 % of participants were retained at six months. Reductions in emotional eating subscales, disinhibition, and improvements in interoceptive awareness were observed, with participants also largely maintaining their weight from T1–T3. Finally, participants reported moderate to moderately high acceptability scores.

Conclusion: The results of this study provide evidence about the feasibility, acceptability, and potential of the SATISFY program to help participants with emotional eating maintain their weight.

1. Introduction

It is estimated that 42 % of the U.S. adult population has a body mass index (BMI) that would categorize them with overweight (BMI ≥ 25 kg/m^2) or obesity (BMI ≥ 30 kg/m^2) (Finkelstein et al., 2012; Hales et al., 2020; Ogden et al., 2020; Wang et al., 2020; Ward et al., 2019). As a leading contributor to morbidity and mortality, obesity is associated with numerous conditions including cardiovascular disease, diabetes, and various cancers (Boutelle et al., 2022; Carnethon et al., 2017; Ogden et al., 2020). Obesity also has psychological impacts and is associated with depression, anxiety, low self-esteem, and social isolation (Jebeile et al., 2024; Segal & Gunturu, 2024). Moreover, obesity disproportionately impacts medically vulnerable populations – those who are low-income, have racial and ethnic minority status, and live in rural communities (Ward et al., 2019; Warner, 2012; Wingo et al., 2014).

Increasing evidence is mounting for a paradigm shift from weight loss as the only pathway to health among those with a BMI ≥ 30 kg/m^2 (Mensinger et al., 2016; Tylka et al., 2014). Historically, long-term weight loss has been challenging, with most behavioral weight loss efforts resulting in weight loss at first, but the experience of weight regains

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over time (Nordmo et al., 2020). However, continued weight gain poses significant health risks. For example, in the ARIC study, which examined the effect of weight history on blood pressure, systolic and diastolic blood pressure were 2.6- and 1.9-mm Hg higher, in those who experienced a 10 % weight gain, compared to those who did not gain weight (Truesdale et al., 2008). Further, in the CARDIA study, weight gain over 15 years was associated with increased cardiovascular disease risk (Truesdale et al., 2005). Indeed, maintaining one's weight may stop, slightly improve, or slow the progression of cardiometabolic risk (Truesdale et al., 2005; Truesdale et al., 2008). Thus, weight gain prevention is a critical component of comprehensive healthcare.

Emotional eating (*EE*) (i.e., eating in response to negative emotions, rather than in response to physical hunger) may be one explanatory factor for unwanted weight gain (Smith et al., 2020; Van Strien, 2018). Nearly 60 % of adults in larger bodies report EE episodes (Péneau et al., 2013). Though emotional eating may be of some benefit in the short-term, it has not been associated with emotion regulation long-term (Haedt-Matt et al., 2014). Further, it is also associated with binge eating in adults with larger bodies (Nicholls et al., 2016), and with increased preoccupation about food and weight, and heightened psychological distress (Frayn et al., 2018; Masheb & Grilo, 2006). Individuals in larger bodies who emotionally eat may possess less effective coping skills for managing negative emotions, possibly leading to overeating (Van Strien, 2018). Further, EE may also be conceptualized as a form of disinhibition, where individuals may feel compelled to eat in response to negative affect or in the presence of highly palatable food, which is significantly associated with weight gain (Frayn & Knäuper, 2018; Hays & Roberts, 2008). Though EE may be curtailed during the weight loss intervention, the behavior may increase once the active program ends, thus impacting future weight gain (Risica et al., 2021).

Regulating one's appetite and response to appetitive drivers is essential to successful weight management. The key to appetite self-regulation is the ability to perceive and adhere to bodily signals, particularly signals of biological hunger and satiety. Interoceptive awareness and processing of bodily signals are critical to that ability. Individuals with higher levels of interoceptive awareness may be better able to recognize their biological signals of hunger and satiety, leading them to be more conscious of their eating behavior and in turn, help them maintain a healthier weight/BMI. Cross-sectionally, lower interoceptive awareness has been associated with higher emotional eating (Bullock & Goldbacher, 2023). Indeed, the inability to self-regulate one's appetite has been linked to an increased BMI, weight gain, and emotional eating (Brewer et al., 2003; Goode et al., 2018; Willig et al., 2014).

One way to help individuals reduce emotional eating, improve interoceptive awareness, and reduce weight gain is to provide instruction in adhering to biological signals of hunger and satiety and relevant training in lifestyle modification. Recent evidence suggests that receiving this training may help individuals reduce emotional eating (Anand et al., 2023; Goode, Alexander, & Burke, 2023). A tool to provide this instruction may be a combined Appetite Awareness Training (AAT) and lifestyle modification intervention. AAT is a cognitive-behavioral intervention that has helped those with disordered and emotional eating reduce binge eating, overeating, and prevent weight gain (Allen & Craighead, 1999; Craighead, 2006; Goode et al., 2018). Recently, AAT has been combined with lifestyle modification to help reduce disordered eating and to prevent weight gain (Goode, Bardone-Cone, et al., 2023). With this evidence, examining the feasibility of a combined AAT + lifestyle intervention in adults with emotional eating may be a critical step in preventing weight gain for those at risk.

Thus, the purpose of this study is to examine the proof of concept of an AAT + lifestyle modification (SATISFY) intervention's feasibility and acceptability in adults with a BMI $\geq$ 25 kg/m^{2,} who report emotional eating, and who were at risk for weight gain. This single-center, non-randomized 12-week intervention consisted of AAT and training from the Diabetes Prevention Program (DPP). In addition to examining feasibility measures, we examined whether the treatment could obtain a clinically significant signal on interoceptive awareness, emotional eating, disinhibition, and weight management to strengthen the intervention for future effectiveness trials.

2. Materials and methods

2.1. Inclusion and exclusion criteria

Participants were eligible if they were 18–65 years of age, had a BMI between 25 and 45 kg/m^2, reported emotional eating, and regularly used a smartphone. Participants were excluded from participation if they were currently pregnant, in substance use treatment, involved in a weight reduction program, or had received prior or planned bariatric surgery. If women became pregnant during the study, they were withdrawn.

2.2. Procedure

Study approval was provided by the Institutional Review Board from the University of North Carolina at Chapel Hill. Recruitment occurred between February–June 2022 through a university listserv, utilizing mass emails. Potential participants were also recruited through snowball recruitment efforts from the research staff. Interested individuals completed an eligibility screener via Qualtrics, which included the Emotional Eater Questionnaire (EEQ) (Garaulet et al., 2012) to verify the presence and severity of emotional eating. Eligible individuals were scheduled for an in-person baseline assessment. During the baseline assessment, anthropometric measures were taken via a stadiometer and Seca Model 876 Digital Scale. Blood pressure measures were taken via an Omron 10 Series Upper Arm Blood Pressure Monitor. Participants also completed several self-report measures. Participants completed two additional assessments: one immediate post-treatment (four months after baseline assessment) and one six months after baseline assessment. All assessments took approximately 30–45 min per participant. Following the intervention, research staff conducted optional exit interviews to assess the acceptability of the intervention, the digital health tool, and to receive suggestions for how to strengthen the program in the future. Participants were compensated with a $35 gift card for completing each of the three assessments at each time point. If participants chose to participate in the exit interview, they received an additional $35.

2.3. Intervention

The SATISFY intervention consisted of 12 weekly group sessions, each 60 to 90 min long, and conducted via Zoom. All sessions were led by licensed mental health clinicians trained in behavioral treatment for obesity. The intervention took place across two cohorts. Intervention content was comprised of content from the Appetite Awareness Training (AAT) program, a Cognitive Behavioral Treatment (CBT)-focused intervention for binge eating that emphasizes appetite self-regulation, and the Diabetes Prevention Program (DPP), a lifestyle intervention that resulted in 58 % reduction in the incidence of diabetes (Craighead, 2006; Goode et al., 2018; Wing et al., 2017). AAT + DPP is informed by Cognitive Behavioral Theory and Affect Regulation Model (Deaver et al., 2003), positing that those who overeat do so in response to negative emotions and to alleviate aversive mood states (Spoor et al., 2007). Session content included discussions of emotional hunger vs. physical hunger, food awareness, setting SMART (i.e., specific, measurable, action-oriented, realistic, and time-bound) goals, information about nutrients and types of food (e.g., protein, vegetables, carbohydrates, and heart-healthy fats), urge surfing, and long-term planning (see Table 2). Participants were given a digital scale, an activity tracker, and were encouraged to complete 30 min of physical activity per day. Participants also were instructed to self-monitor their eating episodes daily, and their

adherence to their signals of hunger and fullness through a digital health platform, which also provided weekly lessons reinforcing AAT content, and weekly feedback on weight and eating behavior trends.

2.4. Measures

2.4.1. Emotional Eating Scale (EES)

Participants completed the Emotional Eating Scale (EES), a 25-item self-report questionnaire with three factor-derived subscales: anger, anxiety, and depression (Arnow et al., 1995). The questionnaire utilized a Likert scale, with scoring for each response ranging from 0 to 4. Lower scores indicated "no desire to eat" and higher scores indicated an "overwhelming urge to eat." The instrument classifies each score into each of the three subscales. Scores range from 0 to 44 on EES-anger; from 0 to 36 on EES-anxiety; and from 0 to 20 on EES-depression. The EES has a documented reliability factor, as measured by Cronbach's alpha, ranging from 0.81 to 0.94, and an average validity factor of 0.67 (Arnow et al., 1995).

2.4.2. Multidimensional Assessment of Interoceptive Awareness Assessment, Version 2 (MAIA-2)

This 37-item self-report questionnaire measures multiple dimensions of interoception (awareness of bodily sensations) (Mehling et al., 2018). The questionnaire uses a Likert scale, with scoring for each response ranging from 0 to 5. Each of the dimensions are grouped with a series of questions that represent concepts related to eight measurements: noticing (i.e., awareness of uncomfortable, comfortable, and neutral body sensations), not-distracting (i.e., tendency not to ignore or distract oneself from sensations of pain or discomfort), not-worrying (i.e., tendency not to worry or experience emotional distress with sensations of pain or discomfort), attention regulation (i.e., ability to sustain and control attention to body sensations), emotional awareness (i.e., awareness of the connection between body sensations and emotional states), self-regulation (i.e., ability to regulate distress by attention to body sensations), body listening (i.e., active listening to the body for insight), and trusting (i.e., experience of one's body as safe and trustworthy). The Cronbach's alpha for the MAIA-2 ranged from 0.64 to 0.83, and a validity factor of 0.9 on average (Mehling et al., 2018).

2.4.3. The Three Factor Eating Questionnaire (TFEQ)

The TFEQ is a 51-item self-report scale designed to measure 3 dimensions of eating behaviors: 1) cognitive restraint of eating (20 items), 2) disinhibition (16 items), and perceived hunger (15 items) (De Lauzon et al., 2004; Stunkard & Messick, 1985). The disinhibition scale measures the tendency to lose control while eating or overeating due to external stimuli or emotional states, and it has been associated with weight gain and obesity (Hays & Roberts, 2008). The disinhibition scores can range from 0 to 16, with high scores indicating a high tendency to overeat.

2.4.4. Body mass index (BMI)

Weight was measured to the nearest 0.1 kg on a Seca Model 876 Digital Scale and height on a portable stadiometer. BMI was calculated as weight in kilograms divided by height in meters squared (kg/m^2).

2.4.5. Sociodemographic characteristics

This self-report questionnaire collected data on the following: age, race/ethnicity, gender, marital status, education, employment status, and income.

2.4.6. Treatment acceptability

All participants completed the Client Satisfaction Questionnaire (CSQ-8), an 8-item questionnaire to assess satisfaction with the intervention sessions as part of their 4-month assessment (Attkisson & Zwick, 1982). The CSQ-8 has high reliability, as measured by Cronbach's alpha, ranging from 0.83 to 0.94, and an average validity of 0.8 (De Wilde & Hendriks, 2005). Total scores range from 8 to 32, with higher scores indicating more satisfaction. Participants were also asked to complete an optional exit interview. Interview questions were developed by the PI, and participants were asked to provide feedback on the intervention sessions, satisfaction, and suggestions for improvement. On average, interviews lasted approximately 30 to 45 min. Interviews were recorded via a digital recorder.

2.4.7. Statistical analysis

This proof-of-concept study aimed to determine feasibility, acceptability, effect sizes, and examine a clinically relevant signal on key outcomes (e.g., weight, emotional eating, interoceptive awareness). Analyses were conducted using the per-protocol (PP) and the intention-to-treat approach (ITT). The PP analysis was conducted on participants with complete data at baseline ($N = 31$), four ($N = 26$), and six-month period ($N = 24$). For the ITT analysis, baseline values on outcome variables were carried over for participants who were not present at the assessment. Descriptive statistics (i.e., means and standard deviations) were used to summarize demographic characteristics and study variables across these three time periods. Statistical analyses were performed using RStudio (2021.09.1 Build 372) and STATA (SE v.16.1). To examine changes in scores, paired sample *t*-tests were performed on variables, including weight and blood pressure, using baseline and post-treatment data. A *p*-value of <0.05 was considered statistically significant. Cohen's d effect sizes and the corresponding 95 % confidence intervals were calculated for EES to examine any changes in scores before and after the treatment. For the MAIA-2 scale to assess interoceptive awareness, mean scores and standard deviations were estimated at three different time points and paired *t*-tests were used to compare changes in the means over time. Cronbach's alpha was calculated as a measure of the internal consistency and reliability of the questionnaires.

3. Results

3.1. Intervention feasibility

3.1.1. Recruitment

We enrolled 31 participants over a 5-month recruitment period. Of the 210 individuals assessed for eligibility (e.g., completed Qualtrics screener), 31 were eligible, completed the baseline assessment, and were enrolled (15 %). Fig. 1 outlines intervention enrollment and the reasons for ineligibility. On average, participants were 47.55 ± 12.41 years of age, 77 % had at least a bachelor's degree or higher, and had a mean BMI of 36.5 ± 6.5 kg/m^2 (see Table 1). Many (40 %) were living with a partner and/or married, and 73 % were employed full-time. At baseline, individuals reported an average EEQ score of 15.5 ± 7.8, indicating moderate levels of emotional eating. Individuals also had varied experiences with weight loss over the last 1–2 years, with 45 % having lost <5 % of their weight ($n = 14$; 100 % Black, 0 % White), and 55 % who had lost ≥ 5 % of their weight ($n = 17$; 18 % Black, 82 % White).

3.1.2. Attendance and retention

On average, individuals attended 5.2 (42 %) of the 12 sessions live (range = 0–16, median = 7, mode = 0), and 6.45 (53.7 %) of the 12 sessions either live or watched the video recording of the session back later. At post-treatment, 84 % ($n = 26$) of participants completed assessments and 77 % ($n = 24$) completed assessments at the 2-month follow-up. Age, race, previous weight loss, and BMI at baseline were not significantly different between those who completed assessment at baseline and those who completed assessment at the 2-month follow-up.

3.2. Acceptability

CSQ-8 scores indicate participants found the intervention to be moderately acceptable, with a mean total satisfaction score of 26.5 ± 4.6 at the two-month follow-up. The mean and standard deviation for

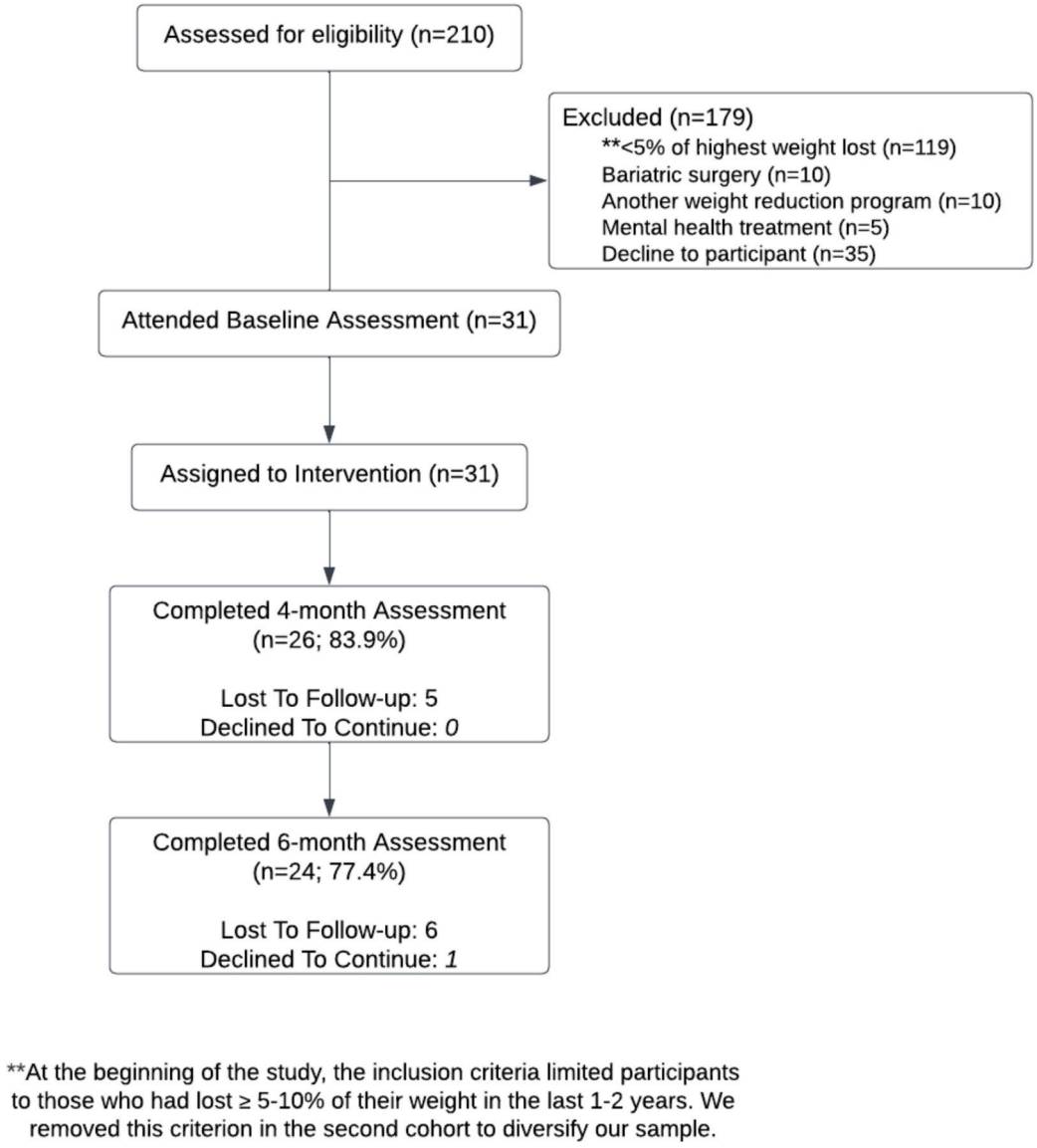

Fig. 1. Study CONSORT diagram.

Table 1
Demographic characteristics of SATISFY study participants ($N = 31$).

Sociodemographic characteristics	Mean ± SD
Race	
African American/Black	17 (54.84)
White	14 (45.16)
BMI (baseline)	36.48 (6.563)
Age (years)	47.55 (12.41)
Gender	
Woman	28 (90.32)
Man	3 (9.68)
School Level:	
High School	1 (3.23)
Vocational/Technical School Associate's Level	1 (3.23)
(2-year college)	5 (16.13)
Bachelor's Level (4-year college)	12 (38.71)
Master's Level	7 (22.58)
Doctoral Level	5 (16.13)
Annual Gross Income	
Under $10,000	2 (6.45)
$30,000 to $69,999	17 (54.83)
>$70,000	11 (35.48)
Refused	1 (3.22)

each question is summarized in Table 5. The mean scores for each question suggest a moderate to high level of satisfaction with the SATISFY study intervention, with the highest scores observed on overall satisfaction ($M = 3.38 \pm 0.78$), the quality of the intervention ($M = 3.54 \pm 0.72$), and that they would recommend it to a friend ($M = 3.46 \pm 0.59$). Table 5 details more on intervention feasibility.

3.2.1. *Exit interview*

Approximately 65 % of participants participated in the exit interviews. Data revealed a high level of intervention acceptability related to attitude, burden, intervention coherence and opportunity cost, and perceived effectiveness and self-efficacy. Overall, participants expressed satisfaction with the digital health tool, especially with the reminders to log their meals. However, they suggested the tool should provide more feedback on unhealthy eating behaviors, identify portion sizes of food consumed, and calculate the total amount of physical activity engaged in during the entire week. Corresponding descriptions and exemplary quotes are reported in Table 6.

Table 2
SATISFY intervention session content.

Session	Content
Welcome to SATISFY & Introduction to AAT	Participants were introduced to Appetite Awareness Training and began early appetite monitoring.
Clarifying Physical vs. Emotional Hunger	Participants learned the difference between physical and emotional hunger and the importance of tracking.
Recognizing cues to start/stop eating	Participants increased their awareness of hunger and satiety signals and recognized unhelpful eating patterns.
Making conscious decisions	Participants learned about the power of making conscious decisions and the role of fat in health.
Problem Solving & More About Carbs	Participants had an extended check-in and review. Participants also learned more about carbs and problem-solving from the diabetes prevention program (DPP).
Food Awareness	Participants were trained in food awareness monitoring (AAT) and to identify sources of healthy and satiating protein (DPP). Emphasis was placed on lower-fat protein sources and highlighted plant-based protein sources.
Effective Emotional Eating (EEE)	Participants learned the steps for responding to an urge to eat and to engage with emotional desires to eat.
Effective Emotional Eating (EEE): Urge Surfing	Participants continued to practice urge surfing, or how to manage urges to eat.
EEE, part 3: CBT basics	Participants examined their thoughts and feelings, and how it was connected to their behaviors.
Shopping and Cooking	Participants continued to practice making conscious decisions to eat and learn from the DPP about shopping & cooking.
Social Assertion Skills	Participants received training in social assertion skills and considerations for eating away from home.
Long-Term Plans	Participants reflected on past sessions, received self-coaching, awareness of lapses, self-monitoring, and discussed their long-term plans to continue their food journey.

Table 3
Mean/SD on preliminary outcomes variables at baseline, 4 months, and 6 months.

Variable	Baseline (n = 31)	4 months (n = 31)	6 months (*n* = 31)	Effect size[a] *d* (95 % CI)	p-Value*
Disinhibition	9.81 ± 3.42	7.23 ± 3.53	7.03 ± 3.43	0.81 (0.29–1.33)	0.002
EES-subscale					
Anger/ frustration	14.16 ± 9.48	12.15 ± 10.16	8.91 ± 7.04	0.63 (0.11–1.13)	0.02
Anxiety	12.16 ± 6.22	10.19 ± 6.51	8.62 ± 4.88	0.63 (0.12–1.14)	0.02
Depression	10.16 ± 5.00	7.88 ± 4.88	6.95 ± 4.42	0.68 (0.16–1.19)	0.01
Blood pressure					
Systolic	130.62 ± 15.33	126.81 ± 14.38	128.64 ± 15.12	0.13 (−0.37–0.63)	0.61
Diastolic	87.91 ± 9.27	87.68 ± 10.51	86.03 ± 9.07	0.20 (−0.29–0.70)	0.42
BMI	36.48 ± 6.53	36.42 ± 6.40	36.45 ± 6.45	0.004 (−0.49–0.50)	0.99

[a] Effect size was estimated from baseline to 6 months (T1–T3).
* P-value was estimated for the corresponding paired t-tests comparing T1–T3.

3.3. Preliminary changes on interoceptive awareness, emotional eating, blood pressure, and weight-related outcomes

Table 3 reports the ITT analysis, including the mean values for the Emotional Eating Scale (EES), blood pressure, and BMI at baseline, post-treatment (4 months after baseline), and 2-month follow-up (6 months after baseline) for the SATISFY study. The results of the PP (not presented) are parallel to the ITT analysis. All statistically significant variables were confirmed with both the ITT and PP analysis.

Table 4
Multidimensional Assessment of Interoceptive Awareness (MAIA-2, 37-items) scale analysis by timepoint. Means and standard deviations.

Subscales/dimensions	Baseline (n = 31)	4 months (n = 31)	6 months (n = 31)
Noticing (awareness of uncomfortable, comfortable, and neutral body sensations)	3.37 (0.94)	3.59 (1.00)	3.54 (0.94)
Not-Distracting (tendency not to ignore or distract oneself from sensations of pain or discomfort)	1.80 (1.13)	2.13 (1.19)	2.20 (1.21)
Not-Worrying (tendency not to worry or experience emotional distress with sensations of pain and discomfort)	2.60 (1.04)	2.73 (1.06)	2.80 (1.08)
Attention Regulation (ability to sustain and control attention to body sensations)	2.59 (1.13)	2.91 (0.87)	3.03 (0.98)
Emotional Awareness (awareness of the connection between body sensations and emotional states)	3.09 (1.03)	3.68 (0.95)*	3.73 (0.92)*
Self-Regulation (ability to regulate distress by attention to body sensations)	2.59 (1.11)	2.95 (0.95)	3.10 (0.99)
Body Listening (active listening to the body for insight)	2.04 (1.16)	2.50 (1.02)	2.91 (1.13)**
Trusting (experience of one's body as safe and trustworthy)	2.49 (1.35)	3.27 (1.37)*	3.47 (1.30)**

Notes. Paired *t-tests* to compare the baseline mean for each subscale with corresponding means at 4 and 6 months were used to estimate *p-values*.
* $p < .05$.
** $p < .01$.

Table 5
Intervention acceptability scores on CSQ-8.

	Item	Mean	SD
1	Quality of service	3.54	0.72
2	Kind of service wanted	3.38	0.77
3	Needs met	2.91	0.78
4	Would recommend to a friend	3.46	0.59
5	Satisfaction with help received	3.38	0.77
6	Dealt with problems	3.21	0.66
7	Overall satisfaction	3.38	0.71
8	Would return to program	3.29	0.69

3.3.1. Emotional Eating Scale

From T1–T2, none of the EES subscales' means were significantly different. Compared to baseline, at the 2-month follow-up, mean scores on all subscales significantly decreased (EES-Anger, $p = .02$, d = 0.63; EES-Anxiety, p = .02, d = 0.63); EES-Depression, $p = .01$, d = 0.68).

3.4. TFEQ—disinhibition

Compared to baseline, mean scores on the TFEQ-disinhibition subscale decreased at T2 and T3 ($p < .01$ at both timepoints).

3.5. Blood pressure

Systolic and diastolic blood pressure were not significantly different from T1–T2, or from T1 to T3.

3.6. Weight

From T1 to T2, participants achieved a mean percent weight change of −0.12 % ± 0.02 %. From T1 to T3, the mean percent weight change

Table 6
Intervention acceptability, assessment of digital tool, and suggestions for future programs assessed by participants' exit interviews ($N = 20$).

Intervention acceptability[a]	Participant quotations
Affective Attitude: How participants felt about the intervention and why	• "… it was to the point where you didn't feel like you were on a diet or anything, and it was just natural to just start getting aware of your feelings for hunger." • "I really liked it. I don't know what the long-term goals are, what this looks like in the future, but if it does open up to the public, I would most definitely participate."
Burden: The perceived amount of effort/time that is required to participate in the intervention	• "I tend to be a little impatient…it seemed long, the format of the meetings, I found sort of a little too repetitive." • "Well, at first I wasn't liking the idea of committing so much time, but once I got into it, and like I said, uh, the group setting, I really enjoyed that…I mean, we were at the end and I didn't even realize it."
Intervention Coherence & Opportunity Costs: Extent to which the participant understood the intervention and how it worked, and the benefits of engaging in the intervention	• "I'm very pleased with learning how to, um, sense my anger and my hunger and um, and learn to follow that. And, and, and it helps you not to overeat really. That's good." • "[give] some kind of incentive to keep the people in the group. I don't know. But life happens. Cuz I know a couple things happened to me, but I was still determined to do it. I guess people were not motivated."
Perceived Effectiveness & Self-efficacy: Was intervention perceived as likely to achieve its purpose, and the participant's confidence they can perform the behavior/task required in intervention	• "It forced me to have to really think before I eat, so it made me actually become very conscious of asking, am I hungry?, do you really want this?, why are you doing that? …I did like the fact of the big mindfulness part of it." • "I think the awareness part. Being aware of what, when I'm hungry, when I'm, when I'm not hungry and trying to control, um, the eating in between."
Digital Health Tool	
Notifications for logging were helpful	• "I was one of those people that, um, got reminded at 8:00 PM. Like, hey, you haven't logged anything, friend. And I was like, oh my goodness, I forgot. But I would go back and list everything. And it made me like accountable."
Did not acknowledge unhealthy eating behaviors	• "It just didn't capture the fact that like where I keep falling down… it's not really catching the fact. That's like, you know, yeah. I had, I had a plateful of vegetables for lunch. I had a piece of chicken breast and a plate full of vegetables and some fruit and dinner. And I had like four servings worth of like cookie dough ice cream." • …sometime I know I eat more than what is an appropriate portion… And it's not, and like, do you eat vegetables? Yeah. I eat vegetables every single day, but that doesn't mean that I'm eating healthy either.
Did not allow for additional logging features	• "I kind of wish it calculated ... instead of just the 30 min of the exercise, if you did more than that… you can see like how much you did throughout the whole week." • "I think that at times, it's annoying to have to go back in [to log] each meal… so I think if there is a way to, we could do it all at one time."
Suggestions for Future Programs	
Have more time and/or one-to-one sessions with the interventionist/nutritionist	• "I think the one thing that I would change is maybe having at least ... a one time or two time, one to one… I think that that would be nice to have it, um, like on top of it. Um, just to make people maybe a little bit more accountable." • "I would've liked to have a little bit more from the nutritionist than what I got."
Examine other intervention delivery formats different than videoconferencing	• "I think... just, you know, Zoom in general is I'm, I'm over it, and it's hard, you know." • I mean, it's easier in a lot of respects to meet all over Zoom, but I get zoom to death during the week. Yeah. And it's like, this is just another meeting and it's like, you know, okay. So, I mean, Zoom is a blessing and a, and a curse for me. Yeah. So that's for everyone else, I guess."
Make intervention content more comprehensive	• "I think there could've been more…to help people actually go through that and figure that out… I think more time spent on what you're eating and maybe, um, some, you know, like with sugar and what sugar does to your body and what, what the effects it has, you know, so that…people kind of get into their heads and really understand, okay, dang, I really shouldn't be eating this, um, so I don't know." • "…So I guess understanding the biological significance would, I think maybe give people more of an understanding like, oh, this is actually real, like this is happening in my body and this is why maybe I should eat like, more complex carbs…or things like that."
Provide more options for intervention sessions at different times	• "I thought it was too late because I got to bed around nine, so, but it was fine. I just felt rushed, getting home, eating. Hurry up, sit down." • "I have to say that, um, the meeting time for me was just not that great. Um, and going into it, you know, it's an hour and a half, but you think, oh, it's gonna be okay, but it's seven 30 at night for most people, I know, it's extremely busy."
Provide meal planning and customization options	• "I've been thinking about this a lot. I just feel like, like maybe some people, their body reacts differently to certain types of food. So, I think maybe just a couple of different options would definitely help people." • "I guess once again, that flexibility, um, I don't know that sort of the American style of eating three meals a day. And having snacks is as useful for me as it might be for others. Maybe other people eat that way. As I, as, as I mentioned on my last call yesterday, um, I'm older and I'm probably one of the older respondents in the…in the study, but we tend to eat less."

[a] Using the framework of acceptability (Bryant et al., 2019).

was 0.02 % ± 0.04 %. At post-treatment and the 2-month follow-up, 50 % and 63 % of participants respectively had achieved weight stabilization. See Table 3.

3.7. Interoceptive awareness

Table 4 reports the ITT analysis and mean scores and standard deviations for the eight dimensions at baseline, 4 months, and 6 months. Compared to baseline, emotional awareness and trusting significantly increased at 4 and 6 months ($p < .05$ and $p < .01$, correspondingly), and body listening increased at 6 months ($p < .01$). Paired *t*-tests for all other dimensions were not statistically significant.

4. Discussion

This study examined the feasibility and acceptability of the SATISFY intervention, a 12-week program in a sample of adults with a larger body and reporting emotional eating. Participants attended approximately 50 % of the remote sessions and 77 % of participants were retained at T3. Furthermore, reductions in emotional eating were observed at T2, with participants largely maintaining their weight from T1–T3. Finally, participants reported the intervention was acceptable, with scores in the moderate to moderately high range. Overall, the results of this study provide some optimistic evidence about the potential of the SATISFY program to help participants with emotional eating maintain their weight.

4.1. Feasibility

On average, participants attended between 42 and 53 % of the remote intervention. Sessions were held on a weekday evening, which may have influenced attendance. Participants were also told they could watch the session back at another time if they were not present and had access to part of the lesson content through the digital health platform. This may have influenced treatment attendance. Participants may have also been experiencing fatigue from many virtual work meetings and overall feelings of exhaustion from extended time in online spaces, which replaced traditional in-person interactions, possibly leading to decreased motivation to attend. Limited attendance may have affected treatment outcomes. Previous literature highlights the role of attendance in predicting weight outcomes in studies, with those who attend more sessions tending to have better weight outcomes (Piernas et al., 2020; Rosas et al., 2020). Session attendance in this study was less than average compared to other digital small group studies; for example, in previous weight management studies using virtual small groups, participants attended approximately 75 % of sessions and obtained about 3.2 % weight loss (Azar et al., 2015). Though reasons for attendance may have varied (e.g., time of intervention sessions, prior commitments), future research may need to consider alternative frameworks to ensure intervention content is received without requiring live attendance at sessions. For example, adding a community health worker or coach who would meet with participants individually instead of using a group format may help participants still engage with the intervention content and achieve important health outcomes.

4.2. Acceptability

Overall, participants reported moderate to moderately high scores on their satisfaction with the intervention. With the highest scores received on the quality of service and if they would recommend the intervention to a friend. These findings suggest that the SATISFY program may demonstrate promise to meet the needs of those who engage with the program. However, lower scores on other subscales may indicate that participants were also interested in program elements that were not present, which could have influenced attendance. Exit interview data revealed some of the reasons for dissatisfaction. Participants expressed interest in having in-person meetings, one-on-one support from the interventionist, and earlier session times. They felt that in-person and individualized sessions would have improved their accountability, noting that virtual sessions made it harder to connect and contributed to their Zoom fatigue. Participants also expressed the desire to have more nutrition information such as meal planning options, and ways to customize their meals. They also suggested improvements to the digital tool, such as including a feature that calculated the total hours of exercise for the entire week, instead of daily. For example, in exit interviews (see Table 6), participants expressed appreciation for the reminder notifications to log into the digital tool but desired more comprehensive feedback such as acknowledging unhealthy eating behaviors and what happens biologically when food is consumed. Future iterations of this intervention may benefit from incorporating these participant recommendations to enhance program satisfaction.

4.3. Preliminary changes in outcome variables

Over time, participants improved interoceptive awareness on three out of the eight dimensions: increased awareness of the connection between body sensations and emotions (emotional awareness), improved active listening to their body (body listening), and enhanced sense of safety and trust in their body (trusting). Scholars have found that lower interoceptive awareness is associated with increased emotional eating (Bullock & Goldbacher, 2023). These preliminary results demonstrate the intervention may have promise to increasing participants' interoceptive awareness which may help with emotional eating to better regulate appetite.

Additionally, in this study, participants were able to reduce their disinhibition from baseline to T2. This is encouraging due to previous research indicating that those with a higher level of disinhibition are at higher risk for weight regain following intentional weight loss (Bryant et al., 2019). Previous research has highlighted the role that food-related disinhibition may have in binge eating, weight gain, and its association with the trait of impulsivity (Crow et al., 2001; Kruger et al., 2016). The results of this study may demonstrate this program's potential to help those navigating loss of control and/or the tendency to overeat in variable emotional states.

On average, participants were able to decrease emotional eating and maintain their weight over 6 months. Emotional eating is an eating behavior that has been negatively associated with weight loss maintenance (Flore et al., 2022; Varkevisser et al., 2019) and has predicted a 7-year increase in BMI and higher waist circumference (Konttinen et al., 2019). Further, though longer-term follow-up is needed to see if weight stabilizes, it is encouraging that >50 % of participants were able to maintain their weight for the duration of this study. The results of this study may also reflect the benefit of receiving training to improve adherence to biological signals of hunger and fullness. In fact, interventions that improve one's ability to adhere to signals of hunger and fullness have helped participants to be less likely to have eating disorders and chronically diet, while decreasing blood pressure, lowering cholesterol, reducing body dissatisfaction, and improving weight maintenance (Schaefer & Magnuson, 2014).

Findings from this study should be considered in light of several limitations. First, this study had a one-group, pretest-posttest design which furthered challenges limiting threats to internal validity (e.g., selection bias, history, maturation). In addition, because there was no control group, there are limitations to statements that can be made regarding the intervention's effectiveness to reduce outcomes of interest, and how it compares to other similar treatments. Originally, the study's recruitment criteria required participants to have experienced previous weight loss in the last 12–24 months; however, due to challenges with recruitment and the desire for increased racial/ethnic diversity, this criterion was removed. Additionally, participants' self-selection to participate in the intervention may have also introduced bias. Furthermore, we are unable to evaluate the extent that observed changes in outcome variables can be attributable to the intervention.

5. Conclusion

In summary, the results of the SATISFY study demonstrate that a weight gain prevention intervention was acceptable in a diverse sample. Implementation of various strategies to enhance remote attendance would be important in a full trial and future implementation of this method. Additionally, future research using an efficacy trial design needs to examine whether this intervention may influence decreases in emotional eating and disinhibition, and increases in interoceptive awareness, a characteristic that is associated with awareness of satiety and BMI. Additionally, future research may examine weight maintenance over a longer duration of treatment with a larger sample, and with a randomized, two-arm comparison design.

CRediT authorship contribution statement

Rachel W. Goode: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Loneke T. Blackman Carr:** Writing – review & editing, Writing – original draft. **Yiwen Xu:** Writing – review & editing, Writing – original draft, Formal analysis. **Tyisha Harper-Cooks:** Writing – review & editing, Writing – original draft, Project administration. **Stephanie Wilhoit-Reeves:** Writing – review & editing, Writing – original draft. **Ramine C. Alexander:** Writing – review & editing, Writing – original draft. **Ana Paola Campos:** Writing – review & editing, Writing – original draft. **Julian Robles:** Writing – review & editing, Writing – original draft. **Deborah F. Tate:** Writing – review & editing, Writing – original draft.

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Declaration of competing interest

All authors declare that they have no conflicts of interest.

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Transparency statement

The study was pre-registered at _Clinical Trials.gov (Improving Appetite Regulation in Patients With Obesity - Full Text View - ClinicalTrials.gov). The analysis plan was not formally pre-registered. De-identified data from this study are not available in a public archive. De-identified data from this study will be made available (as allowable according to institutional IRB standards) by emailing the corresponding author. The analytic code used to conduct the analyses presented in this study is not available in a public archive. They may be available by emailing the corresponding author. Materials used to conduct the study are not publicly available.

Data availability

The data that has been used is confidential.

References

Allen, H. N., & Craighead, L. W. (1999). Appetite monitoring in the treatment of binge eating disorder. *Behavior Therapy, 30*(2), 253–272. https://doi.org/10.1016/S0005-7894(99)80007-0

Anand, C., Hengst, K., Gellner, R., & Englert, H. (2023). Effects of the healthy lifestyle community program (cohort 1) on stress-eating and weight change after 8 weeks: A controlled study. *Scientific Reports, 13*(1), 3486. https://doi.org/10.1038/s41598-022-27063-4

Arnow, B., Kenardy, J., & Agras, W. S. (1995). The Emotional Eating Scale: The development of a measure to assess coping with negative affect by eating. *The International Journal of Eating Disorders, 18*(1), 79–90. https://doi.org/10.1002/1098-108x(199507)18:1<79::aid-eat2260180109>3.0.co;2-v

Attkisson, C. C., & Zwick, R. (1982). The client satisfaction questionnaire. *Evaluation and Program Planning, 5*(3), 233–237. https://doi.org/10.1016/0149-7189(82)90074-X

Azar, K. M. J., Aurora, M., Wang, E. J., Muzaffar, A., Pressman, A., & Palaniappan, L. P. (2015). Virtual small groups for weight management: An innovative delivery mechanism for evidence-based lifestyle interventions among obese men. *Translational Behavioral Medicine, 5*(1), 37–44. https://doi.org/10.1007/s13142-014-0296-6

Boutelle, K. N., Eichen, D. M., Peterson, C. B., et al. (2022). Effect of a novel intervention targeting appetitive traits on body mass index among adults with overweight or obesity: A randomized clinical trial. *JAMA Network Open, 5*(5), Article e2212354. https://doi.org/10.1001/jamanetworkopen.2022.12354

Brewer, E. A., Kolotkin, R. L., & Baird, D. D. (2003). The relationship between eating behaviors and obesity in African American and Caucasian women. *Eating Behaviors, 4*(2), 159–171. https://doi.org/10.1016/S1471-0153(03)00021-7

Bryant, E. J., Rehman, J., Pepper, L. B., & Walters, E. R. (2019). Obesity and eating disturbance: The role of TFEQ restraint and disinhibition. *Current Obesity Reports, 8*(4), 363–372. https://doi.org/10.1007/s13679-019-00365-x

Bullock, A. J., & Goldbacher, E. M. (2023). Interoceptive awareness and emotional eating in college women: The role of appetite and emotional awareness. *J Am Coll Health J ACH., 71*(8), 2445–2450. https://doi.org/10.1080/07448481.2021.1970566

Carnethon, M. R., Pu, J., Howard, G., et al. (2017). Cardiovascular health in African Americans: A scientific statement from the American Heart Association. *Circulation, 136*(21). https://doi.org/10.1161/CIR.0000000000000534

Craighead, L. (2006). *The appetite awareness workbook: How to listen to your body and overcome bingeing, overeating, and obsession with food*. New Harbinger Publications.

Crow, S., Kendall, D., Praus, B., & Thuras, P. (2001). Binge eating and other psychopathology in patients with type II diabetes mellitus. *The International Journal of Eating Disorders, 30*(2), 222–226. https://doi.org/10.1002/eat.1077

De Lauzon, B., Romon, M., Deschamps, V., et al. (2004). The Three-Factor Eating Questionnaire-R18 is able to distinguish among different eating patterns in a general population. *The Journal of Nutrition, 134*(9), 2372–2380. https://doi.org/10.1093/jn/134.9.2372

De Wilde, E. F., & Hendriks, V. M. (2005). The Client Satisfaction Questionnaire: Psychometric properties in a Dutch addict population. *European Addiction Research, 11*(4), 157–162. https://doi.org/10.1159/000086396

Deaver, C. M., Miltenberger, R. G., Smyth, J., Meidinger, A., & Crosby, R. (2003). An evaluation of affect and binge eating. *Behavior Modification, 27*(4), 578–599. https://doi.org/10.1177/0145445503255571

Finkelstein, E. A., Khavjou, O. A., Thompson, H., et al. (2012). Obesity and severe obesity forecasts through 2030. *American Journal of Preventive Medicine, 42*(6), 563–570. https://doi.org/10.1016/j.amepre.2011.10.026

Flore, G., Preti, A., Carta, M. G., et al. (2022). Weight maintenance after dietary weight loss: systematic review and meta-analysis on the effectiveness of behavioural intensive intervention. *Nutrients, 14*(6), 1259. https://doi.org/10.3390/nu14061259

Frayn, M., & Knäuper, B. (2018). Emotional eating and weight in adults: A review. *Current Psychology, 37*(4), 924–933. https://doi.org/10.1007/s12144-017-9577-9

Frayn, M., Livshits, S., & Knäuper, B. (2018). Emotional eating and weight regulation: A qualitative study of compensatory behaviors and concerns. *Journal of Eating Disorders, 6*(1), 23. https://doi.org/10.1186/s40337-018-0210-6

Garaulet, M., Canteras, M., Morales, E., López-Guimera, G., Sánchez-Carracedo, D., & Corbalán-Tutau, M. D. (2012). Validation of a questionnaire on emotional eating for use in cases of obesity: The Emotional Eater Questionnaire (EEQ). *Nutrición Hospitalaria, 27*(2), 645–651. https://doi.org/10.1590/S0212-16112012000200043

Goode, R. W., Bardone-Cone, A., Wilhoit-Reeves, S., et al. (2023). Creating an appetite awareness and lifestyle modification intervention for Black women at risk for binge eating disorder: A pilot open trial. *Clinical Obesity, 13*(6), Article e12613. https://doi.org/10.1111/cob.12613

Goode, R. W., Kalarchian, M. A., Craighead, L., et al. (2018). The feasibility of a binge eating intervention in Black women with obesity. *Eating Behaviors, 29*, 83–90. https://doi.org/10.1016/j.eatbeh.2018.03.005

Goode, R. W., Alexander, R., & Burke, L. (2023). Reducing emotional eating in Black women with obesity: The APPETITE Study. *Obesity, 31*, 53–289. https://doi.org/10.1002/oby.23939

Haedt-Matt, A. A., Keel, P. K., Racine, S. E., et al. (2014). Do emotional eating urges regulate affect? Concurrent and prospective associations and implications for risk models of binge eating. *The International Journal of Eating Disorders, 47*(8), 874–877. https://doi.org/10.1002/eat.22247

Hales, C. M., Carroll, M. D., Fryar, C. D., & Ogden, C. L. (June 26, 2020). Products - Data Briefs - Number 360 - February 2020 Accessed February 2, 2024 https://www.cdc.gov/nchs/products/databriefs/db360.htm.

Hays, N. P., & Roberts, S. B. (2008). Aspects of eating behaviors "disinhibition" and "restraint" are related to weight gain and BMI in women. *Obesity, 16*(1), 52–58. https://doi.org/10.1038/oby.2007.12

Jebeile, H., Baur, L. A., Kwok, C., et al. (2024). Symptoms of depression, eating disorders, and binge eating in adolescents with obesity: The fast track to health randomized clinical trial. *JAMA Pediatrics, 178*(10), 996–1005. https://doi.org/10.1001/jamapediatrics.2024.2851

Konttinen, H., van Strien, T., Männistö, S., Jousilahti, P., & Haukkala, A. (2019). Depression, emotional eating and long-term weight changes: A population-based prospective study. *International Journal of Behavioral Nutrition and Physical Activity, 16*(1), 28. https://doi.org/10.1186/s12966-019-0791-8

Kruger, R., De Bray, J., Beck, K., Conlon, C., & Stonehouse, W. (2016). Exploring the relationship between body composition and eating behavior using the Three Factor Eating Questionnaire (TFEQ) in young New Zealand women. *Nutrients, 8*(7), 386. https://doi.org/10.3390/nu8070386

Masheb, R. M., & Grilo, C. M. (2006). Emotional overeating and its associations with eating disorder psychopathology among overweight patients with binge eating disorder. *The International Journal of Eating Disorders, 39*(2), 141–146. https://doi.org/10.1002/eat.20221

Mehling, W. E., Acree, M., Stewart, A., Silas, J., & Jones, A. (2018). The Multidimensional Assessment of Interoceptive Awareness, Version 2 (MAIA-2). Costantini M, ed *PLOS ONE, 13*(12), Article e0208034. https://doi.org/10.1371/journal.pone.0208034.

Mensinger, J. L., Calogero, R. M., & Tylka, T. L. (2016). Internalized weight stigma moderates eating behavior outcomes in women with high BMI participating in a healthy living program. *Appetite, 102*, 32–43. https://doi.org/10.1016/j.appet.2016.01.033

Nicholls, W., Devonport, T. J., & Blake, M. (2016). The association between emotions and eating behaviour in an obese population with binge eating disorder. *Obesity Reviews, 17*(1), 30–42. https://doi.org/10.1111/obr.12329

Nordmo, M., Danielsen, Y. S., & Nordmo, M. (2020). The challenge of keeping it off, a descriptive systematic review of high-quality, follow-up studies of obesity treatments. *Obes Rev Off J Int Assoc Study Obes., 21*(1), Article e12949. https://doi.org/10.1111/obr.12949

Ogden, C. L., Fryar, C. D., Martin, C. B., et al. (2020). Trends in obesity prevalence by race and Hispanic origin—1999–2000 to 2017–2018. *JAMA, 324*(12), 1208. https://doi.org/10.1001/jama.2020.14590

Péneau, S., Ménard, E., Méjean, C., Bellisle, F., & Hercberg, S. (2013). Sex and dieting modify the association between emotional eating and weight status. *The American Journal of Clinical Nutrition, 97*(6), 1307–1313. https://doi.org/10.3945/ajcn.112.054916

Piernas, C., MacLean, F., Aveyard, P., et al. (2020). Greater attendance at a community weight loss programme over the first 12 weeks predicts weight loss at 2 years. *Obesity Facts, 13*(4), 349–360. https://doi.org/10.1159/000509131

Risica, P. M., Nelson, T., Kumanyika, S. K., et al. (2021). Emotional eating predicts weight regain among black women in the SisterTalk intervention. *Obesity, 29*(1), 79–85. https://doi.org/10.1002/oby.23045

Rosas, L. G., Lv, N., Xiao, L., et al. (2020). Effect of a culturally adapted behavioral intervention for Latino adults on weight loss over 2 years: A randomized clinical trial. *JAMA Network Open, 3*(12), Article e2027744. https://doi.org/10.1001/jamanetworkopen.2020.27744

Schaefer, J. T., & Magnuson, A. B. (2014). A review of interventions that promote eating by internal cues. *Journal of the Academy of Nutrition and Dietetics, 114*(5), 734–760. https://doi.org/10.1016/j.jand.2013.12.024

Segal, Y., & Gunturu, S. (2024). Psychological issues associated with obesity. In *StatPearls*. StatPearls Publishing Accessed December 16, 2024 http://www.ncbi.nlm.nih.gov/books/NBK603747/.

Smith, J. M., Serier, K. N., Belon, K. E., Sebastian, R. M., & Smith, J. E. (2020). Evaluation of the relationships between dietary restraint, emotional eating, and intuitive eating moderated by sex. *Appetite, 155*, Article 104817. https://doi.org/10.1016/j.appet.2020.104817

Spoor, S. T. P., Bekker, M. H. J., Van Strien, T., & Van Heck, G. L. (2007). Relations between negative affect, coping, and emotional eating. *Appetite, 48*(3), 368–376. https://doi.org/10.1016/j.appet.2006.10.005

Stunkard, A. J., & Messick, S. (1985). The three-factor eating questionnaire to measure dietary restraint, disinhibition and hunger. *Journal of Psychosomatic Research, 29*(1), 71–83. https://doi.org/10.1016/0022-3999(85)90010-8

Truesdale, K. P., Stevens, J., & Cai, J. (2008). Effect of 3-year weight history on blood pressure: The atherosclerosis risk in communities study. *Obes Silver Spring Md., 16*(5), 1112–1119. https://doi.org/10.1038/oby.2008.27

Truesdale, K. P., Stevens, J., Lewis, C. E., Schreiner, P. J., Loria, C. M., & Cai, J. (2005). Changes in risk factors for cardiovascular disease by baseline weight status in young adults who maintain or gain weight over 15 years: The CARDIA study. *International Journal of Obesity, 30*(9), 1397–1407. https://doi.org/10.1038/sj.ijo.0803307, 2006.

Tylka, T. L., Annunziato, R. A., Burgard, D., et al. (2014). The weight-inclusive versus weight-normative approach to health: Evaluating the evidence for prioritizing well-being over weight loss. *Journal of Obesity, 2014*, 1–18. https://doi.org/10.1155/2014/983495

Van Strien, T. (2018). Causes of emotional eating and matched treatment of obesity. *Current Diabetes Reports, 18*(6), 35. https://doi.org/10.1007/s11892-018-1000-x

Varkevisser, R. D. M., van Stralen, M. M., Kroeze, W., Ket, J. C. F., & Steenhuis, I. H. M. (2019). Determinants of weight loss maintenance: A systematic review. *Obes Rev Off J Int Assoc Study Obes., 20*(2), 171–211. https://doi.org/10.1111/obr.12772

Wang, Y., Beydoun, M. A., Min, J., Xue, H., Kaminsky, L. A., & Cheskin, L. J. (2020). Has the prevalence of overweight, obesity and central obesity levelled off in the United States? Trends, patterns, disparities, and future projections for the obesity epidemic. *International Journal of Epidemiology, 49*(3), 810–823. https://doi.org/10.1093/ije/dyz273

Ward, Z. J., Bleich, S. N., Cradock, A. L., et al. (2019). Projected U.S. state-level prevalence of adult obesity and severe obesity. *The New England Journal of Medicine, 381*(25), 2440–2450. https://doi.org/10.1056/NEJMsa1909301

Warner, E. T. (2012). Obesity treatment for socioeconomically disadvantaged patients in primary care practice. *Archives of Internal Medicine, 172*(7), 565. https://doi.org/10.1001/archinternmed.2012.1

Willig, A. L., Richardson, B. S., Agne, A., & Cherrington, A. (2014). Intuitive eating practices among African-American women living with type 2 diabetes: A qualitative study. *Journal of the Academy of Nutrition and Dietetics, 114*(6), 889–896. https://doi.org/10.1016/j.jand.2014.02.004

Wing, R., Gillis, B., Venditti, B., & Kriska, A. (2017). Diabetes prevention program group lifestyle balance. Published online https://www.diabetesprevention.pitt.edu/wp-content/uploads/2015/01/2017-DPP-Complete-Manual-of-Operations-for-Print-Final-11-15-17.pdf.

Wingo, B. C., Carson, T. L., & Ard, J. (2014). Differences in weight loss and health outcomes among African A mericans and whites in multicentre trials. *Obesity Reviews, 15*(S4), 46–61. https://doi.org/10.1111/obr.12212