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Baseline Psychosocial and Demographic Factors Associated with Study Attrition and 12-Month Weight Gain in the DIETFITS Trial

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Abstract

Objective: The purpose of this study was to examine correlates of failure—trial attrition and weight gain—in a randomized clinical weight loss trial.

Methods: The Diet Intervention Examining The Factors Interacting with Treatment Success (DIETFITS) trial included 609 adults (18–50 years; BMI 28–40). Participants were randomized to a 12-month Healthy Low-Fat or Healthy Low-Carbohydrate diet for weight loss. At baseline, participants completed psychosocial, demographic, and anthropometric measures. Stepwise logistic regressions identified baseline factors associated with 1) study attrition and 2) among trial completers, weight gain at 12 months.

Results: Having higher baseline food addiction and self-efficacy were linked to treatment failure. Being younger, not having a college education, having higher outcome expectations and quality of life, and lower social functioning and self-control increased the odds of trial attrition. Identifying as other than non-Hispanic White, not being married or cohabitating, having higher cognitive restraint and self-control, and lower amotivation, family encouragement, and physical limitations increased the odds of gaining weight by treatment's end.

Conclusions: Participants' baseline psychosocial and demographic factors may support or impede successful weight loss. Trialists should attend to these factors when designing treatments in order to promote participants' likelihood of completing the trial and achieving their weight loss goals.

Keywords

Obesity; weight loss; attrition; diet; psychosocial; intervention

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Introduction

Obesity presents a pressing public health challenge,¹ with 40% of adults in the U.S. obese,² and another third overweight.³ Although a healthy diet is key to obesity treatment and prevention, weight loss trials that incorporate dietary changes have mixed success, with variation in participants' levels of treatment engagement, dietary adherence, and weight outcomes.⁴ One challenge is understanding why some participants achieve greater success with lifestyle interventions compared to others. Attrition impacts trial success, with trial attrition rates ranging from 10% to more than 80% depending on the behavioral weight loss intervention type and targeted population.⁵ The current literature identifies several demographic characteristics that may be linked to attrition in weight loss interventions, including age, sex, education, ethnicity and smoking status.⁶ Another challenge among those who complete the trial is achieving clinically meaningful weight loss at trial completion.⁷

For both outcomes, despite decades of research in this area, there remain gaps in examining the role of psychosocial factors in predicting treatment outcomes among adults enrolled in behavioral weight loss interventions. According to reviews on this topic, more studies are needed that incorporate a broader range of psychosocial variables, are of longer duration, have larger sample sizes, include longitudinal data, and do not rely solely on univariate analyses.^{5,8,9} In fact, a 2018 review of psychosocial predictors of weight control identified 37 studies, of which only six included more than five psychosocial constructs in their analysis. This signals a need for weight management studies with a more comprehensive analysis of psychosocial factors.⁹

Understanding the factors that influence attrition and weight gain among adults with overweight or obesity who seek weight loss treatment is important, as it may lead to the implementation of alternative strategies that improve intervention retention and ultimately health-and weight-related comorbidities. While past studies have furthered our understanding of predictive factors, a more comprehensive examination of psychosocial factors in larger behavioral weight loss trials that span at least 12 months in length is indicated. Therefore, our study examined pretreatment factors associated with study attrition and pre-post weight gain in the Diet Intervention Examining The Factors Interacting with Treatment Success (DIETFITS) weight loss trial.

DIETFITS was a randomized clinical trial among 609 adults with overweight or obesity that compared a healthy low-fat dietary strategy to a healthy low-carbohydrate dietary strategy. The intervention lasted 12 months. No mean differences in weight change (the primary outcome) were found between treatment arms, with weight losses of 5-6 kg, on average, at 12 months.¹⁰

The current study examined baseline demographic and psychosocial correlates of poor treatment response in the weight loss trial. Poor treatment response was defined and operationalized in two ways, either 1) attrition from the trial before 12 months, or 2) among those who completed the trial, weight gain at 12 months relative to baseline weight. Our dual primary aims included (1) comparing study *non-completers* (i.e., those who did not complete the trial) to *completers* (i.e., those who attended the 12-month evaluation visit),

and (2) among trial completers, comparing *weight gainers* (i.e., participants who lost no weight from baseline to 12 months) to *weight losers* (i.e., participants who lost weight from baseline to 12 months).

Methods

Details of the DIETFITS design and outcomes have been described previously.^{10,11} The Stanford Institutional Review Board approved all study procedures.

Sample

Adults from the San Francisco Bay area of California were recruited to the parent study using media advertisements and email lists. Participant recruitment and flow are described elsewhere.¹⁰ Five cohorts had staggered start dates between March 2013 and March 2015. Eligibility criteria for the parent study included men and premenopausal women aged 18 to 50 years with a body mass index (BMI) of 28 to 40. The major exclusion criteria were having uncontrolled hypertension or metabolic disease; diabetes; cancer; heart, renal, or liver disease; and being/becoming pregnant or lactating. Individuals were excluded if taking hypoglycemic, lipidlowering, antihypertensive, psychiatric, or other medications known to affect body weight or energy expenditure.

The analysis of study attrition focused on the total sample of 609 participants who enrolled in the study at baseline. Analysis of weight gain focused on 436 of these participants who had body weight measurements at both baseline and 12 months.

Intervention

The protocol included a 1-month run-in period during which participants were instructed to maintain their habitual diet, physical activity level, and body weight. The intervention involved 22 instructional sessions held over 12 months in diet-specific groups of approximately 17 participants per class. In-person sessions, led by registered dietitians, occurred weekly for the first 8 weeks, then every 2 weeks for 2 months, then every 3 weeks until the sixth month, and monthly thereafter. Dietitians were blinded to all laboratory measures and genotype information. Instructors emphasized emotional awareness and behavior modification to support dietary adherence and weight loss, as well as supplying basic information related to physical activity promotion to facilitate weight loss and maintenance. Behavioral modification strategies included empirically supported principles of self-regulatory behavior change (e.g., goal setting, self-efficacy building, supportive environments, and relapse prevention) based on social cognitive theory¹² and the transtheoretical model.¹³

The trial's main goal was to achieve maximal differentiation in intake of fats and carbohydrates between the two diet groups while otherwise maintaining equal treatment. No explicit instructions for energy restriction were given. Both diet groups were instructed to 1) maximize vegetable intake; 2) minimize intake of added sugars, refined flours, and trans fats; and 3) focus on whole foods that were minimally processed, nutrient dense, and prepared at home whenever possible. Other components of the emphasis on high-quality

food for both diet groups are described elsewhere.¹¹ Participants were encouraged to follow current physical activity recommendations.¹⁴

Measures

Participants attended study evaluation visits at baseline and at 3, 6, and 12 months. Sociodemographic and psychosocial measures were completed independently by participants via online surveys.

Sociodemographics—Sociodemographic data on age, gender, race/ethnicity, marital status, education, and employment status were collected at baseline.

Anthropometrics—Participants' current body weight was measured to the nearest 0.1 kg at baseline and at 3, 6, and 12 months using a calibrated scale (Scaletronix). Baseline and 12-month weights were used to calculate percent weight change over time. Height was measured at baseline to the nearest 0.1 cm using a wall-mounted stadiometer (SECA). Shoes were removed for both measurements. BMI was calculated as weight in kilograms divided by height in meters squared. Staff who measured anthropometrics were blinded to study arm.

Psychosocial Factors—All participants completed 15 validated psychosocial scales at baseline.¹⁵⁻²⁹ To complete the scales, participants received a secure personal link to an online survey where the scales were presented sequentially, in the same order to each participant. Participants were given one week to complete the scales. Table 1 presents each scale's description, source, subscales and scoring; scales are listed in the table in the order in which they were presented to participants.

Statistical analyses

Since overall weight change and attrition did not differ between the two diet-type treatment arms (low-carbohydrate and low-fat),¹⁰ data were collapsed across the two arms, as has been done previously.⁹ Further, because diet type was the randomization factor in the parent study, it was included as a covariate in all analyses. We first examined Spearman rank correlations among the psychosocial measures. The three emotional eating subscales all had correlations of 0.8 or greater with the overall emotional eating scale, as did the neophobia subscale with the overall Food and Eating Questionnaire. Thus, only the overall scales were included in the stepwise analyses in these instances. Because the categorical scales of depression, sleep, and food addiction are derived from their continuous measures (BDI, PSQI, and YFAS, respectively), we included only the continuous measures in the stepwise analyses.

Analyses were conducted using R (3.5.1) and SAS 9.4 (SAS Institute, Cary, NC). For descriptive data, mean $\pm$ standard deviation (SD) describe continuous variables, while N (%) describe categorical variables. For comparability across psychosocial scales, we report standardized (z-scored) odds ratios and confidence intervals in all analyses. Given the exploratory, hypothesis-generating nature of this paper, we used $p < .05$ and did not adjust for multiple testing. Bivariate logistic regression analyses, controlling for treatment arm, and

descriptive information for each baseline variable are presented in supplemental tables S1 and S2.

Study Attrition—Stepwise logistic regression was used to examine the odds of study attrition (versus study completion) before 12 months using the baseline psychosocial, sociodemographic and anthropometric variables as correlates. All participants who were randomized and assigned to a diet type at baseline were included in these analyses (N=609). The analyses were conducted using $p < 0.15$ as entry criteria and $p < .10$ as stay criteria. Treatment arm was forced into all steps of the model regardless of its significance value, given its role as the randomization factor in the parent study. Model building stopped when no additional variables met entry or removal criteria. For attrition, model building stopped after the 8th step; the final model is presented. In the case of missing data on any variable, that observation was deleted from the analysis and only complete case analyses were conducted (see Table 2 for number of participants who completed each measure). Because reasons for dropout may be outside of a participant's control (e.g., a participant becoming pregnant and therefore no longer eligible to participate in the trial or someone who has been hospitalized), it is possible that this subgroup of participants differs from the other participants who dropped out. Given this possible distinction, a sensitivity analysis was conducted excluding the small number of individuals who dropped out of the trial due to a health reason (n=17).

Weight Gain between Baseline and 12 Months—Stepwise logistic regression was used to examine the odds of gaining weight (versus losing weight) at 12 months using the same psychosocial, sociodemographic, and anthropometric variables. As in attrition analyses, $p < 0.15$ was used as entry criteria and $p < .10$ as stay criteria, and treatment arm was forced into all steps of the model. Model building stopped when no additional variables met entry or removal criteria. For weight gain, this occurred after the 13th step; the final model is presented. Only participants who had a 12-month weight measurement were included in these analyses (N=436).

Results

Table 2 shows the baseline demographic, anthropometric, and psychosocial characteristics of DIETFITS participants. Briefly, somewhat over half of participants were non-Hispanic White (58%), and the majority were female (57%), college educated (75%), employed full-time (76%), with a mean (SD) age of 39.29 (6.77) years and mean BMI of 33.36 (3.35) kg/m².

Study Attrition

At 12 months, 173 (28%) participants did not provide weight data (i.e., “non-completers”), while 436 (72%) did (i.e., “completers”). Stepwise multiple logistic regression analysis (N=587) identified the following significant correlates of study attrition at 12 months (descriptive information is also presented): being younger (37.6 vs. 40.0 years), having less than a college education (38% vs. 20%), having higher outcome expectations (93.6 vs. 83.9), having higher self-efficacy for nutrition change (75.6 vs. 72.3), having less self-control on the

self-evaluating scale (11.7 vs. 12.9), having more symptoms of food addiction (2.9 vs. 2.6), scoring higher on the general health (SF-36) scale (64.5 vs. 65.0), and having lower social functioning (SF-36; 82.8 vs. 87.5) (Table 3). In the sensitivity analysis, all correlates remained significant apart from outcome expectations and the SF-36 overall scale (Table S3).

Weight Gain

Among the 436 participants who remained in the trial for the entire 12 months, 80 (18%) gained weight between baseline and 12 months while 356 (82%) lost weight. Of the 80 weight gainers, 5 consistently gained weight throughout the trial, never losing any weight between baseline, 3, 6 and 12 months. The remaining 75 participants fluctuated in their weights over the course of the trial, with the majority losing weight between baseline and 3 or 6 months and then regaining between 6 and 12 months.

Stepwise logistic regressions (N=428) showed that the following baseline factors increased the odds of gaining weight by 12 months: identifying as any race/ethnicity other than non-Hispanic White (49% vs. 36%), not being married or living with a partner (51% vs. 31%), having higher levels of food addiction (2.8 vs. 2.3), self-evaluating self-control (14.1 vs. 12.6), and cognitive restraint (9.8 vs. 9.1), and having lower levels of self-efficacy for nutrition change (69.7 vs. 72.9), amotivation (2.1 vs. 2.2), family encouragement (12.1 vs. 13.2), and physical health role limits (4.8 vs. 9.1) (Table 4).

Discussion

In a 12-month diet-based weight loss intervention examining the relation between 41 pretreatment demographic and psychosocial factors and treatment failure, 8 of these factors were linked to attrition from the trial and, among individuals who completed the trial, 9 factors were linked to weight gain from baseline to 12 months.

Food addiction was found to be the most prominent psychosocial correlate of failure. This construct, defined and assessed using the Yale Food Addiction Scale, includes symptoms such as consuming more food than planned, making repeated unsuccessful attempts to stop eating certain foods, and giving up social activities. Our findings are consistent with those from Burmeister et al. who found that more symptoms of food addiction, which may be indicative of internalized weight bias and body shame, were associated with reduced weight loss at 7 weeks among adults in a weight loss program.³⁰ However, our findings differ from that of Chao et al.³¹ and Lent et al.³² who demonstrated that more symptoms of food addiction (using the same YFAS measure) was related to neither study attrition nor weight loss among 178 adult participants in group-based lifestyle interventions.

Several factors may contribute to these inconsistent findings. These include, first, our greater ability to detect an effect due to our larger sample size (609 participants vs. 178 participants in both the Chao and Lent studies). Second, the longer length of the DIETFITS trial (52 weeks vs. 14 weeks in Chao et al. and 26 weeks in Lent et al., respectively) may have allowed for more time to detect the negative effects of food addiction. Third, the use of meal replacements in the Chao et al. lifestyle intervention may have allowed individuals with

higher levels of food addiction to overcome the common obstacle of interacting frequently with tempting foods, thus obscuring the impact of food addiction on attrition and weight change.

Younger age, not having a college education, and having higher initial levels of self-efficacy for dietary change and outcome expectations increased the odds of attrition from the trial. In past research on behavioral weight loss studies, age is often found to be associated with attrition^{5,33,34} although not always.⁷ Lower education has been found to correlate with attrition in some^{5,7,35} but not all studies.^{33,36} Self-efficacy's impact on dietary changes is unclear: one study demonstrated similar findings that higher initial self-efficacy is worse,³⁶ while other studies have seen the opposite⁵ or no effect.³⁵ It is possible that elevated baseline self-efficacy and outcome expectations reflect an initial overconfidence among the subgroup who eventually dropped out, which could have resulted in a greater amount of disappointment or demoralization when weight loss was slower than expected.³⁷ Of note, when we excluded participants who dropped out of the trial due to a health reason, the impact of outcome expectations was no longer significant. While beyond the scope of this study, future research should further explore links between participants' baseline characteristics and reasons for not completing weight loss trials. Moreover, teaching weight loss trial participants how to be realistic about their expectations and initial skillset for losing weight could potentially help to avert some attrition and improve satisfaction with their personal outcomes.

Consistent with most prior research, the current analysis did not find gender^{5,7,35,36,38} or race/ethnicity^{33,35} to be associated with study attrition. However, past studies have yielded inconsistent results for other baseline variables that were not found to be linked to study attrition in DIETFITS, including marital status,^{5,7,35,36} employment status,^{7,35,36} BMI^{7,33-35,38} and depressive symptoms.^{7,33,35} Further, unlike prior research, we did not find perceived stress to be a correlate of attrition.^{5,36,39} It is possible that our sample's generally high socioeconomic status allowed participants to locate or afford resources to better manage stressors. Given the known link between lower SES and higher stress,⁴⁰ the impacts of stress on study participation may have been mitigated by higher SES. In addition, in contrast to prior research, we found higher baseline levels of self-control⁵ and health-related quality of life³⁵ to be associated with greater attrition.

In terms of weight gain correlates, we found that identifying as other than non-Hispanic White, not being married, and having higher levels of food addiction increased the odds of 12-month weight gain. Several past studies examining multiple correlates of weight change in a lifestyle intervention found race/ethnicity to be a significant correlate, whereby non-Hispanic White participants tended to lose more weight than those of racial/ethnic minority groups.³³ In contrast, most studies have not found being married to be a significant correlate of weight change,^{41,42} and one study found the reverse association (i.e., those who were unmarried had better weight outcomes).⁷ It is possible that being married or living with a partner served as a form of accountability for DIETFITS participants, which proved especially useful given the trial's length and intensity.

We also identified significant correlates of weight outcomes that have previously not been associated with weight outcomes, including self-efficacy for nutrition change³⁴, amotivation (i.e., lack of motivation to engage in an activity),^{34,39} health-related quality of life (SF-36),⁴³ and cognitive restraint.⁹ Unlike past research on multiple correlates of weight change, age was not significantly associated with weight change in our overall sample,^{33,42,43} though our findings are consistent with those from other behavioral weight loss interventions.^{39,43} Our finding that gender was not a significant correlate of weight change is consistent with some research,³³ while other studies have found males to lose more weight than females.^{34,39,42} Finally, consistent with prior research, baseline levels of depressive symptoms⁷ did not impact weight outcomes.

Overall, there are mutable and immutable factors associated with trial failure. Immutable factors include most demographic characteristics. While these cannot be changed in advance of weight loss trials, it is critical for trialists to be aware of how they may impact participants' weight loss outcomes and consider extra forms of support from which these participants may benefit. Mutable factors, in contrast, could be addressed in advance of trial participation in order to maximize the likelihood of participant success. These factors include many psychosocial factors, such as outcome expectations, self-efficacy for nutrition change, self-control, motivation, and cognitive restraint. For instance, having higher levels of food addiction and self-efficacy increased the odds of both attrition and weight gain in this trial. Knowing this, trialists could work with participants in advance of or during the trial to lower their levels of food addiction and set realistic expectations upfront so that self-efficacy for making dietary changes is not unrealistically elevated; doing so may increase participants' chances of achieving trial goals. Future studies should empirically examine the mechanisms at play underlying such psychosocial factors. Similarly, understanding how being younger or lacking a college education - both of which may be associated with fewer monetary resources or spare time - influences attrition requires further empirical investigation.

This study's strengths include the breadth of psychosocial factors assessed at baseline among all participants, compared to past studies' typical examination of a narrower set of these factors. In fact, our study included psychosocial variables that merit further investigation, including motivational levels, emotional eating, body dissatisfaction, perceived social support, self-control, and perceived stress.⁹ Another strength is the DIETFITS trial length. Twelve months offered an adequate time to assess weight loss, while a number of other trials examining baseline correlates of treatment outcomes have been shorter in duration.⁵ Finally, while we were interested in exploring correlates of study attrition, the 28% 12-month attrition rate is, in fact, reasonably low relative to a number of other studies in the field, where attrition levels can be more than 80%.⁵ Further exploration of factors that kept the attrition rate to this level could be useful to the field. Although at least part of the reason for this likely lies in the relatively high educational level of the sample, it is possible that the focus, in both dietary arms, on optimizing healthy dietary choices as opposed to caloric restriction may have contributed to the lower attrition rates.

This study's limitations include the reasonable homogeneity of the sample on some basic demographic variables, including the fact that it was mostly a non-Hispanic White, highly

educated sample. This trial also excluded individuals over 50 and with particular conditions, diseases, and medications known to affect body weight or energy expenditure, which may limit the generalizability of the study. Future research should examine correlates of attrition and weight gain among a more diverse population. The administration of the psychosocial scales also presents a limitation: altogether, participants completed 322 psychosocial questions at baseline. This may have produced survey fatigue and decreased accuracy with each question answered; as a result, the association between the psychosocial variables and the two primary study outcomes may be underestimated. It is also possible that collecting these data remotely through an online survey may have negatively affected response quality. Further, given varying operationalizations of success and attrition in weight loss trials,⁴⁴ our ability to directly compare results is limited. As highlighted in past reviews, heterogeneity across studies with respect to sample size, population type, and measures impede direct comparisons between weight loss trials.^{5,8} Future studies that randomize by other participant characteristics, such as race/ethnicity and/or gender, could examine differences between these subgroups.

These findings have implications for future weight loss trials. Indeed, more work in this area is indicated to enhance the ability to match participants to appropriate treatments in order to optimize outcomes and efficiently use limited resources. Commensurate with this observation, understanding barriers to behavioral weight loss – including psychological factors – was flagged as an area of needed research in the 2018 U.S. Preventive Services Task Force obesity treatment guidelines.⁴⁵

Taken together, our findings suggest that not all individuals are equally poised to achieve success in group-based weight loss trials. Indeed, some participants may be better suited for other types of interventions, such as remotely-delivered or less intensive alternatives. Furthering our understanding of how best to optimize intervention participation and intervention-derived outcomes can benefit all individuals seeking such treatments.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What is already known about this subject?

- A major conundrum facing behavioral weight loss trials is study attrition, as well as the surprising circumstance of some participants actually gaining weight beyond their original baseline levels. Despite decades of research in this area, there remain gaps in examining the role of psychosocial factors in shaping both of these outcomes.
- Reviews on the topic indicate the need for more studies that incorporate a broad range of psychosocial variables, are of longer duration, have larger sample sizes, include longitudinal data, and do not rely solely on univariate analyses.

What does your study add?

- This study addresses these gaps by examining pretreatment psychosocial and demographic factors associated with study attrition and pre- to post-intervention weight gain in the DIETFITS weight loss trial, a 12-month randomized clinical trial among 609 adults with overweight or obesity.
- We find that several baseline factors increase the odds of trial attrition: being younger, not having a college education, having higher outcome expectations, having higher self-efficacy for nutrition change, having less self-control, having more symptoms of food addiction, scoring higher on the general health (SF-36) scale, and having lower social functioning (SF-36). Other factors increase the odds of gaining weight by the end of the trial, including identifying as other than non-Hispanic White, not being married, having higher levels of food addiction, self-control, and cognitive restraint, and having lower levels of self-efficacy for nutrition change, amotivation, family encouragement, and physical health.
- Our results show that participants' baseline psychosocial factors may support or impede trial success, suggesting areas to monitor or upon which to potentially intervene before weight loss treatment begins.

Table 1.**Psychosocial Measures.**

Psychosocial Scale	Description	Interpretation
Outcome expectations ¹⁵	16-item measure, assesses expected improvement due to eating changes.	Scores range from 0-160. Higher scores indicate higher expectations.
Self-efficacy for nutrition change ¹⁶ Food and Eating Questionnaire ¹⁷	15-item measure, assesses self-efficacy for nutrition change. 20-item measure, assesses individual differences in food preference patterns. Contains three subscales: neophobia, pickiness and apathy.	Scores range from 0-100. Higher scores reflecting greater self-efficacy Neophobia scores range from 7-35. Pickiness and apathy scores range from 4-20. Higher scores indicate higher degrees on each subscale.
Emotional Eating Scale (EES) ¹⁸	25-item measure, assesses measure emotional eating. Contains three subscales: Anxiety, Depression, and Anger/Frustration.	Scores range from 0-100. Higher scores indicate greater emotional eating.
Treatment Self-Regulation Questionnaire (TSRQ) ¹⁹	15-item measure, assesses degree of autonomy or control within an individual's motivation for eating a healthy diet. Contains four subscales: amotivation, autonomous motivation, controlled motivation, and a relative autonomy motivation index.	Each subscale score ranges from 1-7. Higher scores indicate higher degree of that type of motivation.
Body dissatisfaction ²⁰	11-item measure, assesses beliefs about specific parts of one's body being too large. It is a subscale of the Eating Disorder Inventory (EDI).	Scores range from 0-33 with higher scores indicative of increased body dissatisfaction.
Social Support for Eating Habits ²¹	20-item measure, assesses 4 subscales of family and friend encouragement and discouragement. Derived from the 36-item social support for eating habits survey.	Each subscale score ranges from 5-25 points. Higher scores indicating greater encouragement or discouragement.
Perceived Stress Scale (PSS-14) ²²	14-item measure, assesses how stressful one perceives different situations in their life.	Scores range from 0-56 with higher scores indicating greater perceived stress.
Food Choice Questionnaire (FCQ) ²³	36-item measure, assesses underlying motives for food choice on 9 dimensions: health; mood; convenience; sensory appeal; natural content; price; weight control; familiarity; and, ethical concern.	Each subscale score ranges from 1-4. Higher scores indicate increasing importance for each factor.
Self-Control and Self-Management (SCMS) ²⁴	16-item measure, assesses self-control and self-management. Contains three subscales: Self-Monitoring (SMS), Self-Evaluating (SES), and Self-Reinforcing (SRS).	Scores range from 0-16. Higher scores on each subscale indicate higher self-control for each factor.
Yale Food Addiction Scale (YFAS) ²⁵	27-item measure, assesses symptoms of food addiction.	Scores range from 0-7. Higher scores indicate more symptoms of food addiction. Can also be interpreted categorically as diagnosis met (scores ≥ 3) versus no diagnosis (scores < 3).
Short Form Health Survey (SF-36) ²⁶	36-item measure, assesses quality of life. Contains 8 subscales: general health perceptions, physical functioning, role limitations because of physical health problems, role limitations because of emotional problems, energy/fatigue, emotional wellbeing, social functioning, and bodily pain.	Scores range from 0-100. Higher scores indicate greater functioning.
Three Factor Eating Questionnaire (TFEQ) ²⁷	51-item measure. Contains three subscales: cognitive restraint (cognitive control of eating behavior), disinhibition (of control), and hunger (susceptibility to hunger).	Scores range from 0-51. Higher scores indicate higher levels of each factor.
Beck Depression Inventory (BDI-IA) ²⁸	21-item measure, assesses depressive symptoms.	Scores range from 0-63. Higher scores indicating increased degrees of depression. Can also be interpreted categorically as depressed (scores >10) versus none or minimal depression (scores <10).
Pittsburgh Sleep Quality Index (PSQI) ²⁹	19-item measure, assesses sleep quality.	Scores range from 0 (no difficulty) to 21 (severe difficulty in all areas). Can also be interpreted categorically as poor sleep (scores >5) or good sleep (scores ≤ 5).

Table 2.Baseline characteristics of DIETFITS participants¹

Characteristics	Baseline Summary	Range	N
Demographic and anthropometric	N (%) / Mean (SD)²		
Age, years	39.3 (6.8)	21-50	609
Gender			
Female (ref: male)	346 (57)		609
Race/Ethnicity			
Non-Hispanic White (ref: all others)	354 (58)		598
Marital Status			
Married/living with a partner (ref: not married/living with a partner)	375 (62)		607
Education			
College degree or more (ref: less than college)	455 (75)		607
Employment Status			
Full-time employed (ref: all others)	463 (76)		609
Baseline BMI, kg/m ²	33.4 (3.4)	25.7-41	609
Psychosocial			
Outcome expectations	86.6 (30.5)	16-160	604
Self-efficacy for nutrition change	73.2 (14.4)	34.29-100	603
Food and Eating Questionnaire – overall	43.9 (9.6)	24-80	602
Neophobia	14.2 (5.3)	7-33	602
Pickiness	8.1 (3.7)	4-20	602
Apathy	8.6 (2.6)	4-19	602
Emotional Eating Scale – overall	31.6 (19.3)	0-88	604
Anger	8.3 (6.9)	0-30	604
Anxiety	9.4 (6.5)	0-32	604
Depression	13.9 (7.7)	0-36	604
Treatment Self-Regulation Questionnaire			
Autonomous	6.3 (0.8)	1.5-7	602
Externally controlled	3.3 (1.3)	1-7	602
Amotivation	2.2 (1.1)	1-7	602
Relative autonomous	3.0 (1.4)	-2.17-6	602
Body dissatisfaction	18.9 (7.6)	1-33	602
Social support for eating habits			
Family encouragement	13.3 (5.4)	5-25	601
Family discouragement	11.4 (4.3)	4-25	601
Friend encouragement	10.4 (4.6)	5-25	602
Friend discouragement	10.6 (3.9)	5-24	602
Perceived Stress Scale	22.6 (7.6)	4-44	602
Food Choice Questionnaire			
Weight control	2.6 (0.7)	1-4	603

Characteristics	Baseline Summary	Range	N
Demographic and anthropometric	N (%) / Mean (SD) ²		
Self-Control and Self-Management - overall	37.9 (9.8)	15-62	604
Self-monitoring	15.1 (5.1)	0-24	604
Self-evaluating	12.5 (7.6)	0-25	604
Self-reinforcing	10.2 (5.3)	0-20	604
Yale Food Addiction Scale	2.6 (1.6)	0-7	606
Food addicted (categorical) ^a , No. (%)	68 (11)		
SF-36			
General health	64.9 (18.0)	15-100	606
Physical functioning	90.6 (11.5)	15-100	606
Role limitations – physical	9.25 (20.9)	0-100	606
Role limitations – emotional	19.8 (33.3)	0-100	606
Energy/fatigue	52.6 (17.9)	0-95	606
Emotional well-being	74.1 (15.6)	20-100	606
Social functioning	86.2 (18.2)	25-100	606
Pain	82.4 (16.8)	0-100	606
Three Factor Eating Questionnaire			
Cognitive restraint	9.3 (4.2)	1-20	603
Disinhibition	9.2 (3.4)	1-16	603
Hunger	6.1 (3.3)	0-14	603
Beck Depression Inventory	9.7 (8.2)	0-39	609
Depressed (categorical) ^b , No. (%)	257 (42)		609
Pittsburgh Sleep Quality Index	5.3 (2.9)	0-17	606
Poor sleep (categorical) ^c , No. (%)	237 (39)		606

¹ N=609.

² Mean (SD) is displayed for all variables except for the three variables indicated as categorical, which are displayed as N. (%)

^a YFAS: Food addicted 3

^b BDI-I: Depressed 10

^c PSQI: Poor sleep > 5

Table 3.Stepwise logistic regression predicting attrition at 12 months ¹.

Baseline Factor	Adjusted Odds Ratio ²	95% CI	P-value
Age	0.94	0.92, 0.97	<.0001
Education (college or more)	0.40	0.26, 0.62	<.0001
Outcome expectations	1.19	0.97, 1.47	.09
Self-efficacy for nutrition change	1.23	1.01, 1.52	.04
Self-control: self-evaluating	0.84	0.68, 1.03	.09
Food addiction	1.43	1.16, 1.76	.0009
SF-36: general health	1.22	0.99, 1.50	.07
SF-36: social functioning	0.78	0.63, 0.96	.02
Diet type (low-fat) ³	1.14	0.77, 1.68	.51

¹N=587. Reference group is completers.²Odds ratios and confidence intervals for psychosocial scales z-scored for comparability.³Diet type included as a forced covariate.

Table 4.Stepwise logistic regression predicting weight gain at 12 months ¹.

Baseline Factor	Adjusted Odds Ratio ²	95% CI	P-value
Non-Hispanic White (vs. all others)	0.45	0.26, 0.79	.005
Married/living with a partner	0.51	0.30, 0.87	.01
Self-efficacy for nutrition change	0.70	0.53, 0.92	.01
Treatment Self-Regulation Questionnaire: amotivation	0.77	0.58, 1.03	.07
Social support: family encouragement	0.72	0.53, 0.97	.03
Self-control: self-evaluating	1.29	0.99, 1.69	.06
Food addiction	1.46	1.10, 1.93	.009
SF-36: physical health role limits	0.71	0.50, 1.01	.06
TFEQ: cognitive restraint	1.29	0.99, 1.68	.06
Diet type (low-fat) ³	1.31	0.77, 2.21	.32

¹ N=428. Reference group is weight losers.² Odds ratios and confidence intervals for psychosocial scales z-scored for comparability.³ Diet type included as a forced covariate.