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PAPER

Evaluating a 'non-diet' wellness intervention for improvement of metabolic fitness, psychological well-being and eating and activity behaviors

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CONTEXT: Current public health policy recommends weight loss for obese individuals, and encourages energy-restricted diets. Others advocate an alternative, 'non-diet' approach which emphasizes eating in response to physiological cues (eg hunger and satiety) and enhancing body acceptance.
OBJECTIVE: To evaluate the effects of a 'health-centered' non-diet wellness program, and to compare this program to a traditional 'weight loss-centered' diet program.
DESIGN: Six-month, randomized clinical trial.
SETTING: Free-living, general community.
PARTICIPANTS: Obese, Caucasian, female, chronic dieters, ages 30 – 45 y ($n=78$).
INTERVENTIONS: Six months of weekly group intervention in a non-diet wellness program or a traditional diet program, followed by 6 months of monthly after-care group support.
OUTCOME MEASURES: Anthropometry (weight, body mass index); metabolic fitness (blood pressure, blood lipids); energy expenditure; eating behavior (restraint, eating disorder pathology); psychology (self-esteem, depression, body image); attrition and attendance; and participant evaluations of treatment helpfulness. Measures obtained at baseline, 3 months, 6 months and 1 y.
RESULTS (1 y after program initiation): Cognitive restraint increased in the diet group and decreased in the non-diet group. Both groups demonstrated significant improvement in many metabolic fitness, psychological and eating behavior variables. There was high attrition in the diet group (41%), compared to 8% in the non-diet group. Weight significantly decreased in the diet group (5.9 ± 6.3 kg) while there was no significant change in the non-diet group (-0.1 ± 4.8 kg).
CONCLUSIONS: Over a 1 y period, a diet approach results in weight loss for those who complete the intervention, while a non-diet approach does not. However, a non-diet approach can produce similar improvements in metabolic fitness, psychology and eating behavior, while at the same time effectively minimizing the attrition common in diet programs.
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Keywords: non-diet intervention; eating behavior; metabolic fitness; weight loss

Introduction

Defining appropriate obesity treatment is a controversial issue. On the one side, current public health policy recommends weight loss for all obese individuals and encourages energy-restriction diets.[1] On the other side lies a growing minority of health professionals, fueled by a general public frustrated with high relapse rates and feelings of personal failure, who advocate an alternative, 'non-diet' approach. The non-diet approach emphasizes eating in response to physiological cues, ie using hunger and satiety as regulators of food intake as opposed to dietary restraint, and enhancing body acceptance, regardless of whether an individual is successful at weight control.

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A cultural preoccupation with thinness and a thriving commercial weight loss industry interact with the public policy endorsing diets, with the result that dieting behavior is now common, perhaps normative. The prevalence of dieting among women rose from a stable 14% between 1950 and 1966, to 26% when next reported in 1988, and then steadily increased to a reported 44% in 1996.[2–6] Despite this widening popularity of dieting behavior, the prevalence of obesity has also increased.[7–9] Trend data indicate an increase in obesity in women from 15.1% in 1960–1962 to 24.9% in 1988–1994, with the largest increase occurring in the 1980s.[8] (Figure 1 illustrates the increase in obesity over time, superimposed with the increase in dieting behavior.) While both the incidence of obesity and the incidence of dieting appear to have escalated in parallel, it is unclear whether a causal relationship exists. However, regardless of the nature of the relationship, in aggregate, successful dieting is being more than offset by weight gain.

Although there is abundant evidence that weight loss programs can produce short-term benefits, there are little data to support their efficacy in achieving lasting weight loss for the majority of participants.[10,11] For those individuals who complete obesity treatment programs and successfully lose weight, post-treatment weight regain is common. The few long-term follow-ups conducted on maintenance of weight loss following dietary weight loss treatment document that the majority of individuals regain virtually all of the weight that was lost during treatment.[12–19] As a panel of obesity researchers convened by the Institute of Medicine summarized: 'Studies paint a grim picture: those who complete weight-loss programs lose approximately 10% of their body weight, only to regain two-thirds of it back within a year and almost all of it back within 5 y'.[20]

This inability of weight loss treatment programs to successfully treat obesity has led to suggestions that traditional 'weight-centered' obesity treatment be replaced by a 'health-centered' approach, which shifts the focus to improving health behaviors, irrespective of weight outcome.[21] Since improving health behaviors can improve health and well-being rather independently of weight loss,[22–24] particularly comorbidities associated with the insulin resistance syndrome (eg hypertension, dyslipidemias and hyperinsulinemia), a health-centered approach addresses many of the health conditions common in obese patients directly, rather than relying on weight loss as a pre-condition.

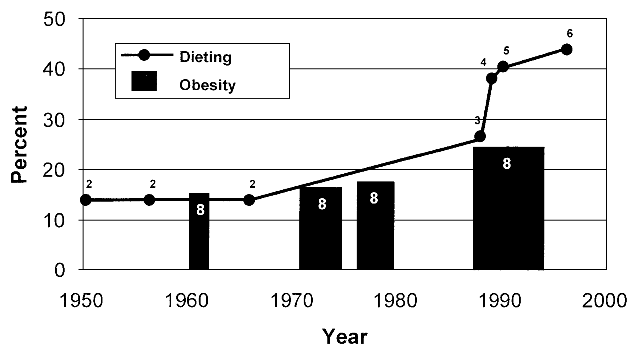

Figure 1 Prevalence of dieting and obesity over time. Numbers in the figure refer to reference numbers of studies from which data were derived.

Traditional diet programs (which encourage dietary restraint) may be particularly contraindicated for women with a history of chronic dieting, for several reasons: (1) restrained eating has a past history of failing to achieve long-term weight loss,[25–28] and this failure has been found to be damaging to self-esteem;[29] (2) weight loss failure may be damaging to chronic dieters' overall self-image, particularly in light of the inordinate amount of importance that they place on their weight and shape when evaluating themselves as a person;[30] and (3) restrained eating has the potential to intensify the diet/overeating cycle.[31,32] We propose that chronic dieters have a low potential for success via energy/dietary restriction, and that they may be better served by a non-diet approach oriented toward reducing their restrained eating and improving other health habits.

The purpose of this investigation was to evaluate the effects of a health-centered 'non-diet' wellness program on obese female chronic dieters, and to compare this program to the current standard of care, a traditional diet program directed towards weight loss. The programs were evaluated and compared with respect to attrition, attendance, participant evaluations of treatment helpfulness, and effects on psychology, eating pathology, activity habits, anthropometry and metabolic fitness. No control group or intent-to-treat group was utilized as previous research demonstrates that subjects who were randomized to a control group when seeking treatment for obesity frequently sought other treatment during the protocol period.[33]

Method

Procedure

Subjects were recruited from the Davis, California area using print, electronic and televised media. Prospective participants were informed that the intent of the research was to help large women with a history of dieting to get healthier, and were sent information and an application by mail. Applications were screened and those who met the following criteria were invited to an information and eligibility session: Caucasian; female; age 30–45 y; body mass index (BMI) $\geq 30\,kg/m^2$; non-smoker; not pregnant, intending to get pregnant, or lactating; practicing birth control if heterosexually active and premenopausal; Restraint Scale[34] score >15, indicating a history of chronic dieting; no recent myocardial infarction; no active neoplasms, type 1 diabetes or insulin-dependent type 2 diabetes, nor history of cerebrovascular or renal disease. Potential subjects taking medications known to affect weight/energy expenditure, such as weight loss drugs, were also excluded, with the exception of those that

were on anti-depressant or selective serotonin re-uptake inhibitor (SSRI) drug therapy.

A complete explanation of the study was given at the information and eligibility session, and informed consent was obtained in accordance with the dictates of the Institutional Review Board of the University of California, Davis. Heights and weights were measured and a clinical interview was conducted to assess for ability to effectively function in a group environment (eg to rule out those with personality disorders). Women who failed to meet the BMI requirements (30–45 kg/m^2) or were eliminated due to clinical assessment were thanked and allowed to leave; all others were enrolled. A follow-up screening conducted by a nurse practitioner confirmed that none of the medical exclusions applied.

To ensure balance in the treatment groups, the enrolled subjects (n = 78) were divided into BMI quartiles, and high-/low sets for dietary restraint,[34] degrees of flexible and rigid control of eating,[35] age, and self-reported activity level. The subjects in these subgroups were then randomly assigned to one of two treatment groups (Figure 2).

Treatment conditions

Two treatment arms were studied: a diet group and a non-diet group. Participants in both treatment groups attended 24 weekly sessions, each 90 min in length. A 6 month after-care program was available to each group, described as optional monthly group support sessions. No new material was presented in the aftercare sessions.

Diet group

Information presented was similar to most behavioral weight loss programs: the focus included eating behaviors and attitudes, nutrition, social support, and exercise.[36] Methods included those identified by Brownell and Kramer[36] as core to behavioral treatment: self-monitoring, stimulus control, reinforcement and cognitive change. Participants were taught to moderately restrict their fat and energy intake and were encouraged to monitor their diet by maintaining a food diary and to monitor their weight weekly. Walking at an intensity suggested by training heart rate range was encouraged. Material was presented on topics such as how to count fat grams and exchanges, understanding food labels, shopping for food, the benefits of exercise, and behavioral strategies for success. The program was taught by an experienced registered dietician and reinforced using the LEARN Program for Weight Control manual,[37] highly regarded for weight loss.

Non-diet group

There were five aspects to the treatment program: body-acceptance, eating behavior, activity, nutrition, and social support. Initial treatment focused on enhancing body-acceptance and self-acceptance, and subjects were supported in leading as full a life as possible, regardless of their body weight or whether they succeed at weight control. The goal was to first help participants disentangle feelings of self-worth from their weight. The secondary phase of treatment

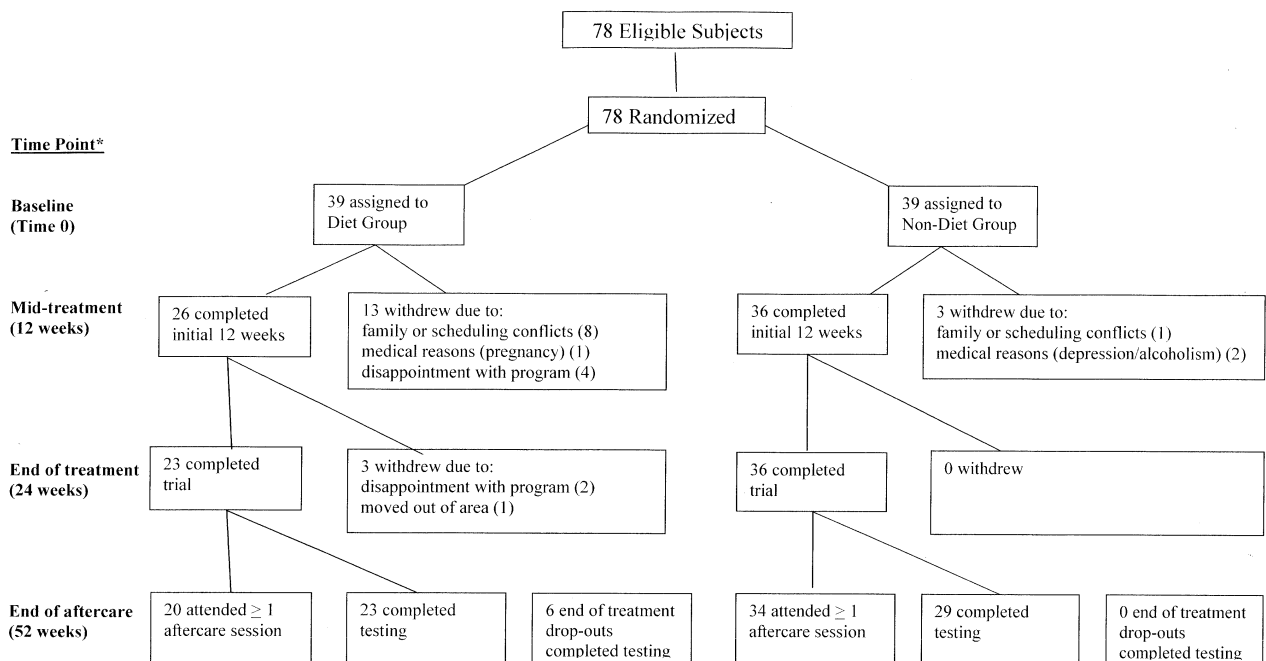

Figure 2 Trial profile. *Measurements taken at each time point listed.

focused on eating behavior. Standard nutritional instruction regarding diet quality was given; however, the emphasis was on regulating the quality and quantity of food intake according to internal cues of hunger, appetite and satiety. The activity component of the intervention focused on helping participants to identify and transform the barriers to becoming active, such as attitudes towards their bodies, and to find activity habits that were fun and appealing. The support group element was designed to help the women see their common experiences in a culture that devalues large women, and to gain support and learn strategies for asserting themselves and effecting change. The program was facilitated by a counselor who has conducted educational and psychotherapeutic workshops and groups using this non-diet approach, and reinforced with a written manual.[38]

Testing

Participants attended four testing sessions: baseline, 12 weeks (mid-treatment), 24 weeks (post-treatment) and 52 weeks (post-aftercare).

Anthropometric and metabolic fitness measures

Subjects reported to the laboratory in the morning, after having abstained from food, beverages or vigorous activity for 12 h. Weight was measured in the fasting condition to the nearest 0.1 kg on an electronic scale. Height was measured to the nearest 0.1 cm using a wall-mounted stadiometer. BMI was calculated from weight (kg)/height (m^2). Blood pressure (BP; including systolic pressure, diastolic pressure and mean arterial pressure) and pulse were assessed in duplicate via the DINAMAP™ Vital Signs Monitor using the oscillometric technique, with subjects in the seated position. Several sizes of blood pressure cuffs were available since the use of a small blood pressure cuff on an obese patient can result in false readings. Fasting blood samples were analyzed for blood lipids (total cholesterol, low density lipoprotein cholesterol, high density lipoprotein cholesterol, and triglyceride) using the Beckman Synchron LX-20™.

Energy expenditure

The Stanford Seven-Day Physical Activity Recall[39] was administered by interview to evaluate time spent in physical activity for the 7 days prior to the interview. It assesses frequency, intensity and duration of physical activity. A summary of energy expenditure was then derived by multiplying the average time per week of each activity by the average intensity of the activity in MET (metabolic equivalent) units. Time spent in sleep (1 MET), light activity (1.5 METs), moderate activity (4 METs), hard activity (6 METs), and very hard activity (10 METs) were multiplied by their respective MET values and summed.[40] One MET represents the metabolic rate of an individual at rest (1.6) and is set at 3.5 ml of oxygen consumed per kilogram of body mass per minute (approximately 1 kcal/kg/h). To eliminate inter-examiner error and reduce variability, all interviews were conducted by the same examiner.

Eating Behavior measures

The Eating Inventory (EI)[41] is a three factor questionnaire. The Cognitive Restraint subscale measures cognitive control of eating; the Disinhibition subscale measures the loss of control that follows self-imposed rules; and the Hunger subscale measures susceptibility to perceptions of hunger. The EDI-2[42] contains eight subscales; three assess attitudes and behaviors toward weight, body shape and eating (Drive for Thinness, Bulimia, and Body Dissatisfaction), and the remaining five subscales measure more general psychological characteristics that are clinically relevant to eating disorders (Ineffectiveness, Perfectionism, Interpersonal Distrust, Interoceptive Awareness, Maturity Fears). The Flexible and Rigid Control of Eating Behavior scales[43] are two restraint subscales drawn in part from the Eating Inventory.

Psychological measures

The Beck Depression Inventory, Revised (BDI)[44] measures alterations in mood and negative self-concept. The Rosenberg Self-Esteem Measure (RSE)[45] focuses on the evaluation of approval or disapproval the individual makes and maintains about herself. Behaviors associated with negative body image were assessed with the Body Image Avoidance Questionnaire (BIAQ).[46]

Statistical methods

Power analyses conducted on the RSE and BDI from two non-diet studies[47,48] determined that 20 subjects per treatment group ($n=40$ total) were needed to detect a difference of 0.75 standard deviations between groups with 80% power. We attempted to recruit 80 subjects to allow for 50% attrition.

All analyses were conducted using Statistica Version 5.1 (Statsoft Inc., Tulsa, Oklahoma, USA). Student's *t*-test was used to compare baseline characteristics between the two groups. Repeated measures analysis of variance (ANOVA) with a within-subject factor of time (four levels: baseline, 3 months, 6 months and 12 months) and a between subject factor of group (two levels: diet and non-diet) were run to test differences in variables. A least significant difference (LSD) *post hoc* test was run on any variable that indicated significant difference. For all statistics, significance was set at the 0.05 level.

Results

There was no significant difference between the two groups on baseline values corresponding to any of the outcome

variables. The socio-demographic profile of the two groups is similar.

Unless otherwise specified, data on study drop-outs were not included in the analysis due to limited participation in many aspects of testing. Study participants who did not complete all testing points were also excluded from the analysis to ensure consistency of comparison over time. (Figure 2 indicates numbers of subjects in these categories.) Results of some aspects of testing were occasionally invalid or unavailable, resulting in small variation in the number of subjects reported on for each measure.

Participants (Table 1)

Table 1 shows the socio-demographic characteristics of the initial subject population. Subjects were predominately employed, in a significant domestic relationship, and had completed some college courses. The socio-demographic profile of the completers and study drop-outs was similar.

Table 1 Subject characteristics ($n = 78$)

	Number
Age (y)	39.3±4.5
Weight (kg)	99.0±11.4
BMI (kg/m^2)	35.7±3.6
Education	
High school or less	14%
Some college	45%
College graduate	39%
Employment status	
Not employed	9%
Employed	90%
Hours worked*	
≤30 h/week	16%
>30 h/week	77%
Job category	
Professional	41%
Clerical	28%
Technical	6%
Physical	3%
Other	14%
Relationship status	
Married or Domestic partnership	76%
Single	23%

Unless otherwise specified, values are means±standard deviations.
*Refers to those currently employed.

Group leader evaluations

All participants who enrolled in the study were asked to evaluate their group leaders at mid-treatment. There were no perceived differences in knowledge or qualifications. Both groups viewed their leader as motivating.

Attrition and attendance (Tables 2 and 3)

There was a significant difference ($P < 0.05$) in participation between the two groups both at mid-treatment and post-treatment. By mid-treatment, 13 subjects had dropped out of the diet group (33%) compared to three (8%) who dropped out of the non-diet group. By post-treatment, an additional three subjects dropped out of the diet group (total drop-outs 41%), while no additional subjects dropped out of the non-diet group (total remained at 8%). Among those subjects that had not dropped out, there was no significant difference in average attendance for the first 12 weeks (79% in the diet group and 83% in the non-diet group), although there was a significant difference between the groups for weeks 12–24 (67% in the diet group and 76% in the non-diet group). There was a significant decrement in attendance for the diet group when the first 3 months are compared to the second 3 months, but no significant change for the non-diet group.

Table 3 Aftercare attendance

	Attendance (months 25–30)	
Measure	*Diet group*	*Non-diet group*
Participants who did not attend any sessions (*n*)	3	2
Participants who did not attend any sessions (percentage of total)	13%	6%
Of those attended ≥1 session, average sessions attended (*n*)	3.0±1.9	3.2±1.4
Of those attended ≥1 session, average sessions attended (percentage of total)	50.0%±30.6	52.9%±23.4

Values are means±standard deviations. There were no significant between-group differences.

Table 2 Attrition, attendance by treatment condition over time (initial $n = 39$ diet group; $n = 39$ non-diet group)

	Pre-treatment to mid-treatment (Weeks 1–12)		*Mid-treatment to post-treatment (Weeks 13–24)*	
Measure	*Diet group*	*Non-diet group*	*Diet group*	*Non-diet group*
Drop-outs (*n*)	13	3	3	0
Drop-outs (as cumulative percentage of initial)	33%	8%	41%	8%
Attendance (number of sessions)	9.5±2.2	9.9±1.4	8.0±2.9†	9.2±2.2*
Attendance (percentage sessions attended)	79%±13.3	83%±10.7	67%±14.4†	76%±8.9*

Values are means±standard deviations.
†A significant within-group difference between the initial and final 12 weeks.
*The change between time points is significantly different between groups.

There was no significant difference in the percentage of participants who chose not to participate in any aftercare sessions: 13% of the diet group participants did not participate in any of the aftercare sessions, compared to 6% of the non-diet group participants. There was no significant difference in average attendance of those that attended one or more of the six aftercare sessions: diet group participants attended 50.0% of the sessions and non-diet group participants attended 52.9% of the sessions.

Anthropometric and metabolic fitness measures (Table 4)

Weight significantly decreased in the diet group. LSD *post hoc* analysis indicated that the significant difference from baseline occurred at mid-treatment and was still maintained in the post-treatment and post-aftercare results; however, there was no significant difference between mid-treatment, post-treatment and post-aftercare. There was no weight gain during the post-aftercare period. The mean weight loss post-aftercare was 5.9±6.3 kg, which represents 5.8% of the initial mean body weight. There was also a significant reduction in mean BMI, from 36.6 to 34.5 kg/m^2. There was no significant change in weight or BMI in the non-diet group. The six diet group drop-outs who returned for post-aftercare testing gained an average of 1.3±2.6 kg; there was not sufficient power for significance testing in this population.

Both groups significantly improved in total cholesterol, LDL, triglycerides and systolic blood pressure, and significantly worsened in HDL between baseline and post-aftercare; these changes predominately occurred at mid-treatment for the diet group, and not until post-aftercare for the non-diet group. Only the HDL was significantly different at post-aftercare (less of a decrement for the diet group). There was no change in diastolic blood pressure for either group.

Table 4 Anthropometric and metabolic fitness measures by treatment condition over time ($n=23$ for diet; $n=29$ for non-diet; $n=6$ for diet group drop-outs)

	Mean values ± standard deviation				*Baseline to post-aftercare comparison (P values)*	
Measure	*Baseline (time 0)*	*Mid-treatment (12 weeks)*	*Post-treatment (24 weeks)*	*Post-aftercare (52 weeks)*	*Within-group analysis*	*Between-group analysis*
Weight (kg)						
Diet	101.1±13.2	97.4±14.1†	96.5±14.0†	95.2±11.8†	0.000	0.000
Non-diet	99.6±12.0	100.2±12.0	100.1±11.7*	99.9±11.7*	1.0	
Diet drop-outs[a]	94.6±10.7	Not available	Not available	95.9±9.2		
BMI (kg/m^2)						
Diet	36.6±4.1	35.2±4.2†	34.9±4.2†	34.5±3.5†*	0.000	0.002
Non-diet	35.9±4.1	36.1±4.1	36.1±3.9	36.1±4.1	1.0	
Diet drop-outs	35.1±3.3	Not available	Not available	35.6±2.8		
Weight change from baseline						
Diet		−3.7±4.7	−4.6±6.5	−5.9±6.3		
Non-diet		0.7±2.3	0.5±3.4	−0.1±4.8		
Diet drop-outs[a]		Not available	Not available	1.3±2.6		
Total Cholesterol (mmol/l)						
Diet	5.19±0.74	4.86±0.86†	4.97±0.90	4.34±0.76†	0.000	0.872
Non-diet	5.19±0.74	5.28±0.82	5.34±0.76	4.37±0.76†	0.000	
HDL-C (mmol/l)						
Diet	1.23±0.26	1.14±0.20†	1.18±0.29	1.12±0.30†	0.003	0.030
Non-diet	1.19±0.25	1.15±0.22	1.18±0.21	1.05±0.22†	0.000	
LDL-C (mmol/l)						
Diet	3.07±0.53	2.78±0.66†	2.97±0.67	2.76±0.73†	0.003	
Non-diet	3.10±0.63	3.17±0.65	3.27±0.60	2.87±0.68†	0.010	
Triglycerides[b] (mmol/l)						
Diet	1.94±0.82	1.78±0.57	1.58±0.82†	1.41±0.85†	0.001	0.321
Non-diet	2.03±1.22	2.02±0.83	1.91±0.88*	1.55±0.72†	0.005	
Systolic blood pressure (mmHg)						
Diet	126.9±11.3	125.2±12.6†	119.1±12.6†	118.7±10.2†	0.001	0.341
Non-diet	125.3±13.0	128.0±16.0	120.1±10.9†	120.8±14.0†	0.034	
Diastolic blood pressure (mmHg)						
Diet	72.8±7.9	72.8±7.7	70.6±8.9	71.0±7.2	0.279	0.597
Non-diet	70.7±8.5	72.1±9.3	69.2±7.0	70.2±8.8	0.772	

†A significant within-group difference from baseline.
*A significant between-group difference.
[a]There was not sufficient power for significance testing among the diet drop-outs.
[b]$n=21$ for diet group; $n=28$ for non-diet group; three subjects were excluded for abnormally high TG (>4.5).

Activity measures (Table 5)
Although some of the activity intensity levels indicated significant changes during the course of the study for both groups, these significant differences were not maintained at the 1 y testing. There was, however, a significant increase in total energy expenditure in the non-diet group that was maintained at the 1 y testing, and a significant decrease in the diet group. The sum of time spent in moderate, hard and very hard activity increased 32.1% for the non-diet group between baseline and the 1 y testing, and 30.4% in the diet group, although this change was not significant.

Eating behavior measures (Table 6)
Both groups started with relatively low cognitive restraint, which changed in opposite directions in the two groups: it significantly increased in the diet group and significantly decreased in the non-diet group. For both groups, this change occurred at mid-treatment and was sustained through post-aftercare. Both groups also demonstrated significant improvement on the two other EI subscales: Hunger and Disinhibition. *Post-hoc* analysis indicated that the improvement in Hunger was not significantly different between groups; however, the improvement in Disinhibition was significantly greater in the non-diet group.

Both groups demonstrated significant improvement in four of eight EDI subscales: Drive for Thinness, Bulimia, Ineffectiveness, and Interoceptive Awareness; *post hoc* analysis did not show a significant between-group difference in these variables. The non-diet group additionally demonstrated significant improvement on the Perfectionism and Body Dissatisfaction subscales, while the diet group demonstrated significant improvement on the Interpersonal Distrust subscale. The Maturity Fears subscale was low and remained unchanged.

The diet group increased in flexible control of eating by mid-treatment, and this was sustained through post-aftercare; there was no change in flexible control in the non-diet group. The diet group initially decreased in rigid control, however, scores returned to baseline levels at post-aftercare. The non-diet group, on the other hand, decreased in rigid control by mid-treatment and sustained this decrease through aftercare. Many non-diet group members reported difficulty completing these restraint measures as the questions assumed dietary control, although their goal was to become unrestrained eaters. For example, the flexible control question. 'When I have eaten my quota of calories, I am usually good about not eating any more' was difficult to respond to as they were not calorie counting.

Table 5 Reported energy expenditure by treatment condition over time ($n=23$ for diet; $n=29$ for non-diet)

	Mean values ± standard deviation				*Baseline to post-aftercare comparison (P-values)*	
Measure	*Baseline (time 0)*	*Mid-treatment (12 weeks)*	*Post-treatment (24 weeks)*	*Post-aftercare (52 weeks)*	*Within-group analysis*	*Between-group analysis*
Met hours per week						
Sleep						
Diet	57.0 ± 7.5	56.0 ± 7.4	55.9 ± 7.1	58.8 ± 8.2	0.155	0.360
Non-diet	58.6 ± 12.0	55.7 ± 4.9	56.4 ± 6.7	57.7 ± 7.6	0.425	
Flexibility/strength						
Diet	0.0 ± 0.2	0.3 ± 0.7	0.2 ± 0.4	0.3 ± 0.7	0.149	0.555
Non-diet	0.3 ± 0.5	0.1 ± 0.4	0.4 ± 0.7	0.3 ± 0.6	0.439	
Light activity						
Diet	108.6 ± 6.9	106.8 ± 8.3	107.1 ± 7.3	105.5 ± 8.2	0.250	0.640
Non-diet	106.1 ± 6.9	108.1 ± 6.2	105.8 ± 8.3	105.8 ± 8.4	0.816	
Moderate activity						
Diet	1.9 ± 2.9	2.9 ± 3.3	3.4 ± 3.1	1.8 ± 2.3	0.905	0.418
Non-diet	1.7 ± 2.1	2.1 ± 1.9	3.8 ± 3.6†	2.3 ± 3.2	0.291	
Hard activity						
Diet	0.4 ± 1.7	1.6 ± 1.8†	1.7 ± 2.0	1.1 ± 1.4	0.192	0.621
Non-diet	1.0 ± 2.1	1.9 ± 2.6	1.2 ± 1.3	1.4 ± 2.0	0.466	
Very hard activity						
Diet	0.0 ± 0.0	0.0 ± 0.2	0.0 ± 0.0	0.1 ± 0.5	0.261	0.312
Non-diet	0.1 ± 0.03	0.0 ± 0.2	0.2 ± 0.4	0.2 ± 0.8	0.182	
Sum of moderate, hard and very hard activity						
Diet	2.3 ± 3.1	4.5 ± 4.3†	5.2 ± 3.9†	3.0 ± 2.8	0.370	0.238
Non-diet	2.8 ± 2.9	4.0 ± 3.7	5.2 ± 3.7†	4.0 ± 3.9	0.111	
Daily energy expenditure (kcal)						
Diet	3334.7 ± 496.1	3329.0 ± 527.9	3315.3 ± 481.4	3191.9 ± 455.7†	0.005	
Non-diet	3310.8 ± 416.9	3403.7 ± 401.9†	3444.5 ± 372.6†*	3400.6 ± 417.3†*	0.047	0.000

†A significant within-group difference from baseline.
*A significant between-group difference.

Table 6 Eating behavior measures by treatment condition over time ($n=22$ for diet group; $n=29$ for non-diet group)

	Mean values ± standard deviation				Baseline to post-aftercare comparison (P-values)	
Measure	*Baseline (time 0)*	*Mid-treatment (3 months)*	*Post-treatment (6 months)*	*Post-aftercare (12 months)*	*Within-group analysis*	*Between-group analysis*
Eating inventory						
Restraint						
Diet	7.4±4.1	11.2±3.9†	12.0±3.6†	10.5±4.1†	0.000	0.000
Non-diet	7.5±3.6	5.6±3.0†*	5.7±3.7†*	5.6±3.3†*	0.006	
Hunger						
Diet	8.1±3.5	5.4±3.4†	5.6±4.0†	6.0±3.6†	0.000	0.085
Non-diet	8.3±3.0	6.8±3.1†*	5.0±3.0†	4.9±3.2†	0.000	
Disinhibition						
Diet	12.7±2.6	9.4±3.2†	8.8±3.1†	9.4±3.7†	0.000	0.017
Non-diet	12.9±2.3	10.4±4.0†	8.7±3.9†	8.0±3.8†*	0.000	
Eating disorders inventory						
Drive for thinness						
Diet	6.0±5.0	3.5±3.0†	3.5±2.8†	2.9±2.9†	0.001	0.980
Non-diet	7.5±5.1	5.2±5.6†	3.5±4.0†	2.9±3.9†	0.000	
Bulimia						
Diet	5.0±4.0	1.4±1.7†	1.2±2.0†	1.0±1.5†	0.000	0.852
Non-diet	4.4±3.5	2.4±2.5†	1.3±1.4†	0.9±1.8†	0.000	
Body dissatisfaction						
Diet	19.4±5.1	18.3±7.4	15.5±6.8†	17.2±8.4	0.087	0.078
Non-diet	18.8±4.2	17.7±8.4	13.8±7.2†	15.0±8.2†	0.001	
Ineffectiveness						
Diet	4.4±5.2	2.8±5.1†	1.9±4.9†	2.3±4.7†	0.003	0.635
Non-diet	3.3±3.3	3.3±3.5	2.3±2.5	2.0±3.5†	0.030	
Perfectionism						
Diet	6.8±5.7	5.7±6.0	6.6±6.1	6.0±5.8	0.154	0.068
Non-diet	6.0±4.0	5.1±3.9†	5.0±3.5†*	5.1±3.1†	0.042	
Interpersonal distrust						
Diet	2.5±2.5	2.1±3.0	1.4±2.3†	1.5±2.6†	0.039	0.889
Non-diet	2.0±3.1	2.2±2.7	1.9±2.1	1.5±2.4	0.218	
Interoceptive awareness						
Diet	4.2±4.9	2.0±2.9†	1.5±2.6†	1.3±1.9†	0.000	0.154
Non-diet	4.1±3.3	4.5±4.7	3.3±3.8*	2.3±3.9†*	0.011	
Maturity fears						
Diet	1.1±1.5	0.9±1.3	0.4±0.7	0.5±1.0	0.130	0.014
Non-diet	1.2±1.9	1.8±3.2*	1.3±2.6*	1.4±2.4*	0.582	
Control scales						
Flexible control						
Diet	3.2±2.5	5.6±3.0†	6.4±2.7†	6.0±3.1†	0.000	0.000
Non-diet	3.3±2.0	3.5±2.2*	4.1±2.2*	3.9±2.2*	0.278	
Rigid control						
Diet	7.1±2.3	5.1±1.6†	5.7±2.1†	7.0±2.9	0.931	0.000
Non-diet	6.8±3.0	3.2±1.7†*	2.7±2.0†*	4.4±2.4†*	0.000	

†A significant within-group difference from baseline.
*A significant between-group difference.

Psychological measures (Table 7)

Both groups demonstrated significant improvements in depression which were sustained post-aftercare. The non-diet group also improved in self-esteem, although this improvement did not occur until post-aftercare. The diet group demonstrated improvement in self-esteem post-treatment, but this was not sustained post-aftercare. Both groups demonstrated significant improvement in body image avoidance behaviors; this was significantly greater in the non-diet group.

Participant self-evaluations (Table 8)

The following data are drawn from the responses at mid-treatment, or, if the subjects dropped out previous to that time, at the time of drop out (last observation carried forward). It includes all subjects who initially enrolled. There was a significant difference between groups in participant self-evaluations at 3 months. In response to the statement: 'The program has helped me feel better about myself', 51% of the diet group endorsed 'agree' or 'strongly agree', as contrasted to 93% of the non-diet group. In response to the

Table 7 Psychological measures by treatment condition over time

Measure	Mean values ± standard deviation (n = 29 for non-diet group; n = 22 for diet group)				Baseline to post-treatment comparison (P-values)	
	Baseline (Time 0)	Mid-treatment (3 months)	Post-treatment (6 months)	Post-aftercare (12 months)	Within-group analysis	Between-group analysis
Beck depression inventory						
Diet	10.9 ± 10.2	5.8 ± 7.0†	5.2 ± 6.8†	5.4 ± 6.9†	0.000	0.236
Non-diet	10.8 ± 7.6	10.1 ± 7.8	7.2 ± 6.9†	7.1 ± 8.8†	0.006	
Rosenberg self-esteem inventory						
Diet	30.1 ± 6.2	31.9 ± 5.4	32.2 ± 5.5†	31.6 ± 6.9	0.145	0.497
Non-diet	30.0 ± 4.3	30.8 ± 4.9*	31.5 ± 5.0	32.0 ± 5.8†	0.013	
Body image avoidance						
Diet	39.6 ± 8.5	37.5 ± 11.0	35.3 ± 8.8†	35.3 ± 7.7†	0.008	0.000
Non-diet	38.9 ± 8.5	34.4 ± 8.2†*	30.7 ± 8.2†*	32.0 ± 9.0†*	0.000	

†A significant within-group difference from baseline.
*A significant between-group difference.

Table 8 Participant self-evaluations at mid-treatment ($n = 39$ diet group: $n = 39$ non-diet group)

Statement	Agree/strongly agree		No opinion		Disagree/strongly disagree	
	Diet	Non-diet	Diet	Non-diet	Diet	Non-diet
The program has helped me feel better about myself*	51%	93%	35%	4%	15%	3%
I feel like I have failed (or am failing) in the program*	38%	5%	18%	5%	44%	90%

*A significant between-group difference ($P < 0.05$)

Table 9 Participant self-evaluations at post-aftercare ($n = 23$ diet group; $n = 29$ non-diet group)

Statement	Agree/strongly agree		No opinion		Disagree/strongly disagree		
	Diet	Non-diet	Diet	Non-diet	Diet	Non-diet	P-value
This program has helped me feel better about myself*	78.3%	93.1%	8.7%	3.5%	13.0%	3.4%	0.001
I feel like I have failed in the program*	34.8%	6.9%	0	17.2%	65.2%	75.9%	0.014

*A significant between-group difference ($P < 0.05$).

statement 'I feel like I have failed (or am failing) in the program', 38% of the diet group endorsed 'agree' or 'strongly agree', as contrasted to 5% of the non-diet group. The drop-outs from both programs endorsed 'no opinion' in response to whether the program has helped them feel better about themselves. However, all of the drop-outs from the diet group ($n = 13$) endorsed 'agree' in response to the question 'I feel like I have failed in the program', whereas all of the dropouts from the non-diet group ($n = 3$) endorsed 'disagree'.

When similar questions were posed post-aftercare to the subjects that completed the program, 93% of the non-diet group endorsed strongly agree or agree in response to the question. 'My involvement with the Healthy Living Project has helped me feel better about myself', compared to 78% of the diet group. Thirty-five percent of the diet group agreed or strongly agreed with the statement 'I feel like have failed in the program', compared to 7% of the non-diet group. There was a significant between-group difference in both of these responses. Of the six diet group drop-outs that completed the questionnaire, three reported that they felt like they failed, two had no opinion, and one disagreed with the statement.

Comment

The non-diet approach produced similar improvements in metabolic fitness, psychology and eating behavior variables and at the same time effectively minimized the attrition problems which plague participants in diet programs. There was weight loss only in the diet group. The noteworthy outcome variables are discussed separately, as follows.

Weight

The purpose of a non-diet intervention is to directly improve health and associated health behaviors. Weight loss is not a goal; instead, participants are encouraged in improving body-acceptance. That weight did not significantly change contradicts the commonly held belief that dietary restraint is a necessary precondition to weight maintenance.

The primary purpose of a diet intervention is to decrease weight and, in so doing, improve the health risks that are associated with obesity. The diet intervention did produce significant weight loss during the 6 month treatment program, which was maintained after the 6 month aftercare program, achieving the clinically recommended 5–10% weight loss[1] (mean weight loss = 5.8%). These short-term results should be viewed with caution given the high weight loss recidivism typical of diet programs that often occurs after cessation of the program.

Metabolic fitness measures

Elevated cholesterol, LDL, triglycerides and blood pressure, and low HDL are risk factors for cardiovascular disease, and are associated with obesity. Both groups were similarly successful in improving the first four risk factors, although, for reasons unknown, this was accompanied by a worsening of HDL. It is very promising to see that improvement occurred in the non-diet group despite the absence of weight loss, as all of the short-term benefits of weight loss are typically undone[22] following the weight regain that typically occurs after weight loss programs.

Eating behavior and psychological measures

Restrained eating is defined as an individual's tendency to eat less than desired. A goal of the non-diet group was to help participants decrease their dietary restraint. This is in direct contrast to the increased restraint that was a goal of the diet group and a requirement for successful dieting. These restraint goals were successfully achieved in both groups. Despite the differing restraint styles, both groups demonstrated improvement in disinhibition and hunger, as well as improvement in many of the psychological variables and characteristics that are common to disordered eating. Improvements in the diet group should be viewed with caution as previous studies suggest that improvements made in traditional weight loss programs are predicated upon lost weight,[49] which is frequently not maintained.

Energy expenditure

Low levels of activity are related to all of the metabolic symptoms associated with obesity.[50] The CDC/ACSM guidelines[51] suggest individuals accumulate at least 150 min of moderate and/or vigorous physical activity over the course of a week. Using this criterion, the non-diet group was already successfully meeting the guidelines at baseline (a mean of 168 min ± 154), while the diet group was just shy of meeting the guidelines (a mean of 138 min ± 186); these variables were not significantly different between groups. However, both groups showed large increases over time and maintained an exercise routine well in excess of the recommended guidelines at 1 y: the non-diet group increased the time spent by 32.1%, to 240 ± 234 min, and the diet group increased their time spent by 30.4%, to 180 ± 168 min. These large increases were not statistically significant either within or between groups, which was likely due to the high variability. There was also a significant increase in reported total daily energy expenditure in the non-diet group that was maintained at the 1 y testing, and a significant decrease in the diet group. The non-diet group was encouraged in increasing lifestyle activity, as opposed to an emphasis on structured activity, which may provide explanation for this increased expenditure.

Attrition and participant self-evaluations

There was a large disparity between groups in the attrition data: almost half of the diet group dropped out (42%) while almost all (92%) of the non-diet group completed the program. It is unlikely that the group leader had a large effect on the dropout rate as both leaders received similar evaluations. The large drop-out in the diet group is consistent with the high attrition rates reported in the literature. Review by a consensus panel of experts found that attrition rates can be as high as 80% and seem to vary considerably.[52] Unfortunately, individual studies frequently do not report attrition data.[53] For example, Cogan *et al*[53] reviewed 50 weight loss studies culled from the 1980s psychological literature and found only 11 studies that reported on the number of participants pre-treatment, post-treatment and follow-up. Of these 11 studies, 19% of the participants dropped out between pre-treatment and post-treatment, and 27% had dropped out from pre-treatment to follow-up. An earlier review estimates long-term participation in weight reducing programs to be less than 50%.[54] Wadden *et al*[55] conducted a large multi-center study of hospital-based weight loss programs. Among the women, they found 18% drop-out after the first 3 weeks of treatment, rising to 34% after 19 weeks, and 44% after 26 weeks. Commercial programs using a similar approach of balanced-deficit dieting are, if anything, even less successful than physician-directed or research weight reduction studies in terms of attrition; the only known publication of this data indicates 50% drop-out within the first 6 weeks and 70% within 12 weeks.[56]

Participants in the non-diet group showed a significant improvement on the Rosenberg Self-Esteem Inventory (RSE), although this did not occur until 1 y after treatment was initiated. Diet group participants, on the other hand, demonstrated an initial improvement, which was not maintained over time. Furthermore, almost all of those

initially enrolled in the non-diet group agreed with the statement 'The program has helped me feel better about myself' (93%), compared to only half of those enrolled in the diet group (51%). Also, the dropouts from the diet group overwhelmingly indicated that they felt like they failed in the program at mid-treatment, whereas a similar response was not evident in the three dropouts from the non-diet group. These data suggest that redefining success in a treatment program as helping people feel better about themselves, irrespective of whether they succeed at weight loss, may have contributed to the non-diet group's success in maintaining participation. It also raises concerns that the lack of long-term success in weight loss programs may be contributing to dieters' feelings of failure and inadequacy.

Data for most measures were only reported for program participants due to the difficulty in follow-up on the program drop-outs. Considering that the diet group had high attrition and that part of the attrition in diet programs is attributable to participants dropping out of treatment when they are not successful,[33] the amount of weight loss may be inflated in the diet group and the changes in the psychological and behavioral parameters may look more favorable than was actually the case, had all of the subjects been considered. The six diet group drop-outs who returned for 1 y follow-up testing, for example, demonstrated an average 1.3 kg weight gain.

Conclusions

The clinical guidelines on the treatment of obesity recommend weight loss for obese patients in order to improve health.[1] Although traditional diet programs have been highly successful in producing short-term weight loss for subjects who adhere to the treatment protocol, they are also plagued with high attrition and post-treatment weight regain/loss of associated health improvements. If the weight loss cannot be accomplished or sustained, the benefits of diet programs may be limited and risk factors may become worse if individuals give up on health habit improvements when they are unsuccessful at achieving or sustaining weight loss. The principle finding of this study was that a non-diet approach, in the absence of weight loss, can produce similar health improvements, while at the same time effectively minimizing the attrition problems common to participants in diet programs.

As a result, a non-diet program appears to be an effective alternative to diet programs in improving health. Since non-diet participants report feeling successful and 'better about (them)selves', and higher self-esteem, and since these improvements are not predicated on maintaining lost weight, it is hoped that these improvements can be better sustained over the long term. Health care practitioners are thus encouraged to refer women with a history of chronic dieting to non-diet intervention.

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