

Weight Loss on the Web: A Pilot Study Comparing a Structured Behavioral Intervention to a Commercial Program

Beth Casey Gold,* Susan Burke,† Stephen Pintauro,* Paul Buzzell,* and Jean Harvey-Berino*

Abstract

GOLD, BETH CASEY, SUSAN BURKE, STEPHEN PINTAURO, PAUL BUZZELL, AND JEAN HARVEY-BERINO. Weight loss on the web: a pilot study comparing a structured behavioral intervention to a commercial program. *Obesity*. 2007;15:155–164.

Objective: Internet weight loss programs have become widely available as alternatives to standard treatment, but few data are available on their efficacy. This study aimed to investigate the effectiveness of a structured behavioral weight loss website (VTrim) vs. a commercial weight loss website (eDiets.com).

Research Methods and Procedures: A randomized, controlled trial was conducted from February 2003 to March 2005, in 124 overweight and obese subjects ages 18 years and older with a BMI of 25 to 39.9 kg/m² (mean age, 47 ± 9 years; BMI, 32 ± 3 kg/m²; 20% men). Analyses were performed for the 88 subjects who had complete follow-up data. Participants were randomly assigned to 12-month VTrim (*n* = 62) or eDiets.com (*n* = 62) intervention. VTrim participants had access to a therapist-led structured behavioral weight loss program delivered on-line. eDiets.com subjects had access to a self-help commercial on-line weight loss program. Body weight, social support, and use of website components were measured at 0, 6, and 12 months.

Results: Repeated-measures analyses showed that the VTrim group lost significantly more weight than the eDiets.com group at 6 months (8.3 ± 7.9 kg vs. 4.1 ± 6.2 kg; *p* = 0.004) and

maintained a greater loss at 12 months (7.8 ± 7.5 kg vs. 3.4 ± 5.8 kg; *p* = 0.002). More participants in the VTrim group maintained a 5% weight loss goal (65% vs. 37.5%; *p* = 0.01) at 12 months.

Discussion: An on-line, therapist-led structured behavioral weight loss website produced greater weight loss than a self-help commercial website. Because commercial sites have great potential public health impact, future research should investigate the feasibility of incorporating a more structured behavioral program into a commercial application.

Key words: internet, weight management, behavior therapy, self-help, commercial weight loss

Introduction

Obesity has reached epidemic proportions in the United States. Currently, two-thirds of Americans are overweight (BMI >25 kg/m²), and one-third are obese (BMI >30 kg/m²) (1). Excess weight is associated with increased incidence of a variety of life-threatening diseases, including diabetes and hypertension (2). In addition to the health implications, the economic repercussions are also great. The United States spends between 92.6 and 117 billion dollars annually on overweight- and obesity-related healthcare (3,4).

The most efficacious non-medical weight loss treatment for moderate overweight and obesity is a structured group behavioral weight loss program (5). Treatment is built on the principles of self-monitoring, cognitive restructuring, stress management, social support, physical activity, and relapse prevention while being supported by a behavioral counselor (6). Weight losses produced by this level of treatment approximate 10% of baseline weight, or 9 to 10 kg over a period of 20 to 26 weeks (5,7). However, this intensity of care is usually localized near research-based universities and hospitals and is cost-prohibitive owing to the level of professional support required.

Received for review February 7, 2006.

Accepted in final form September 6, 2006.

The costs of publication of this article were defrayed, in part, by the payment of page charges. This article must, therefore, be hereby marked "advertisement" in accordance with 18 U.S.C. Section 1734 solely to indicate this fact.

*Department of Nutrition and Food Sciences, University of Vermont, Burlington, Vermont; and †eDiets.com, Inc., Deerfield Beach, Florida.

Address correspondence to Jean Harvey-Berino, Department of Nutrition and Food Sciences, University of Vermont, 250 Carrigan Wing, 109 Carrigan Drive, Burlington, VT 05405.

E-mail: jharvey@uvm.edu

Copyright © 2007 NAASO

The Internet holds promise as an avenue to disseminate state-of-the-art weight control strategies to larger populations. Fifty-seven percent of adults in the U.S. have Internet access, and 95 million U.S. adults use the web to find health information (8).

In 2001 and 2003, Tate et al. (9,10) published data on two Internet research-based weight loss interventions. The first study compared weight loss of an Internet education group to an Internet behavior therapy group conducted over 6 months (1.6 kg vs. 4.1 kg, respectively; $p = 0.04$) (9). The second study compared Internet weight loss behavior therapy to Internet behavior therapy plus counseling by means of e-mail. A significant difference in weight loss was observed with the increased intensity of on-line treatment plus e-counseling (4.4 kg vs. 2.0 kg, respectively; $p = 0.04$) (10). These results, although promising, are still one-half the level of weight loss expected in a traditional face-to-face intervention, as previously described.

Despite the lack of data supporting the efficacy of on-line weight loss programs, commercial websites have proliferated in recent years. WeightWatchers.com estimates that, in 2005, consumers will have spent \$110 million to participate in their on-line weight loss program (11). However, to date, very few studies have analyzed the effectiveness of commercial in-person or on-line weight loss programs. A systematic review of the literature on commercial weight loss programs identified only one study with a commercial on-line program in the design. The authors also concluded that Weight Watchers (in-person) is the only program whose efficacy has been "demonstrated in a large, multisite, randomized controlled trial" (12). Weight Watchers participants lost and maintained significantly more weight compared with self-help over 2 years (2.9 ± 6.5 kg vs. 0.2 ± 6.5 kg; $p < 0.001$) (13).

The on-line study compared eDiets.com, a commercial weight loss website, to the LEARN Program for Weight Control 2000, a behavioral weight loss manual. This study determined that, after 1 year, LEARN participants lost significantly more weight than those randomized to eDiets.com ($4.0 \pm 5.1\%$ vs. $1.1 \pm 4.0\%$; $p < 0.05$). The authors concluded that this was a best-case scenario, because both conditions attended in-person clinic visits with a psychologist throughout the course of the study (14).

Commercial weight loss websites and research-based on-line programs contain similar as well as different components that encourage weight loss in unique ways. Commercial sites provide a vast array of support options that are impossible to replicate in a research setting: for example, chat room and discussion board support 24 hours a day within a network of thousands of members (eDiets.com averages 200,000 enrollees). Alternatively, structured on-line programs provide a higher level of individualized, tailored feedback from trained therapists, and group support is limited to 15 to 20 group participants. It is not clear how

these programmatic differences affect weight loss. Still, widespread on-line weight loss is promising from a public health standpoint. The Internet has tremendous potential to reach those who otherwise cannot access high-quality clinical programs. However, little is known regarding the efficacy of on-line weight loss programs, whether delivered commercially or as part of a university program. Moreover, it is important to understand the mechanism responsible for program effectiveness. Such data would provide the framework for designing future websites to be maximally effective.

The primary purpose of this study was to compare weight losses achieved through a behavioral on-line intervention vs. a commercial self-help website. A second aim was to evaluate the use of web components and their relationship to weight loss between groups and within groups to identify which web components correlated with weight loss.

Research Methods and Procedures

Subjects

One hundred twenty-four overweight and obese adults (101 women and 23 men) were recruited through advertisements in a local Burlington, VT, newspaper. Interested participants were directed to a secure website that screened out volunteers who did not meet the basic study criteria, which included: age over 18 years, BMI >25 and ≤ 39.9 kg/m², and regular access to a computer (not more than 3 years old with CD-ROM drive, Internet connection, at least 64 Megabytes of RAM, 350 MHz processor speed, and Windows 98 or higher as a computer operating system). After this initial screening, participants were further screened by telephone. They were deemed ineligible if they planned to move from the area or get pregnant within the next 12 months, had a history of major medical or psychiatric problems, smoked or had been a non-smoker for less than 1 year, took medications known to affect weight, were unable to participate in a mild to moderate exercise program, or were unable to regularly attend weekly meetings. All participants agreed not to participate in other weight loss treatment programs during the study (Figure 1).

Design

Interested individuals were invited to attend an orientation that further described the study protocol, and informed consent was obtained. Those consenting were required to participate in a "technology check" before randomization, which included sending and receiving lines of text in a chat program and submitting entries in an electronic food journal. Computer issues, if detected, were resolved before randomization. Once these tasks were successfully completed, participants ($n = 124$) were randomized to either VTrim ($n = 62$), an on-line thera-

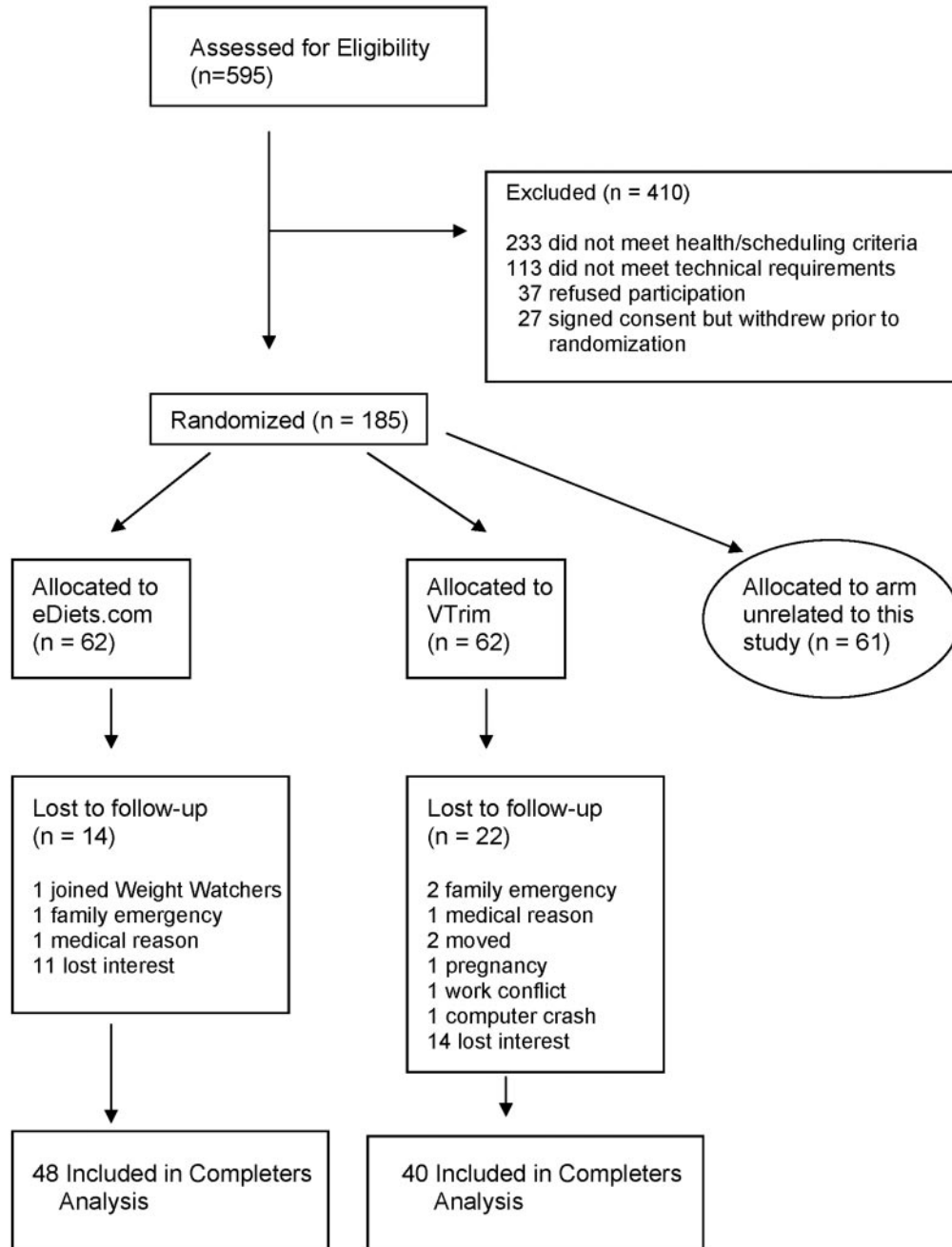


Figure 1: Flow diagram of the study participants.

pist-led behavioral weight loss program, or eDiets.com ($n = 62$), a commercial program. A post-randomization orientation meeting was held by group to instruct participants on website procedures for each site. All subjects were seen in-person for assessment measures at baseline and at 6 and 12 months. This study was conducted from February 2003 to March 2005 and was approved by the Committee on Human Research at the University of Vermont.

Procedures for VTrim Program

Subjects randomized to VTrim participated in a 6-month on-line therapist-led weight loss program and a subsequent 6-month on-line weight maintenance program. A unique username and password were established for each subject so that web use could be tracked throughout the study.

6-month Weight Loss Phase. The weight loss phase focused on the modification of eating and exercise habits through the use of behavioral strategies and self-manage-

ment skills. The program layout was similar to a workbook in that specific behavior modification lessons, such as "Eating in Social Situations," were featured each week, and the leader focused on the topic during the weekly on-line meeting. The instruction and support were delivered solely on-line. Participants self-reported their weight each week on-line, and they participated in hour-long weekly on-line chats, led by a trained therapist. Meetings reinforced the behavioral strategies outlined in the lessons. The lessons also included homework questions, and a therapist e-mailed weekly feedback on completed assignments. Participants were asked to reduce their energy intake by up to 1000 calories/d; individual goals were determined by multiplying baseline weight in pounds by 12 (an estimate of current calorie consumption) and subtracting 1000 calories. This reduction is known to produce a weight loss of approximately 1 to 2 pounds per week (15,16). Calorie goals ranged from 1200 to 2200 calories/d. Participants tracked energy intake in an on-line journal and had access to an on-line food database. They were encouraged to follow the 2000 U.S. Dietary Guidelines (17) while reducing their calories. Participants were also instructed to gradually increase their exercise energy expenditure and burn a minimum of 1000 calories/wk; aerobic activity, particularly walking, was encouraged. A therapist provided weekly feedback on journal entries. A discussion board was established to encourage peer-to-peer interaction and group support. Essentially, the website was designed to simulate all aspects of a traditional face-to-face intervention.

6-month Weight Maintenance Phase. The weight maintenance phase continued to provide the same features on-line but less frequently. Meetings were held bi-weekly, and therapist feedback was given only on the meeting week. Participants were encouraged to continue journaling every day and to use the support components of the website.

Procedures for eDiets.com Program

Participants randomized to eDiets.com had access to the eDiets.com website for the duration of the study (18). The membership fee was paid by the investigators, and eDiets.com provided registration codes for participants. A web-based interface was designed by eDiets.com that provided web use data to the investigators.

Subjects in the eDiets.com group participated in a pre-study orientation of the site, and participants determined how to self-guide their use of the weight loss program. After answering a series of profile questions on-line, subjects were prescribed a calorie goal based on an estimate of their resting metabolic rate, calculated using the Harris-Benedict equation, multiplied by an exercise activity factor (personal communication with eDiets.com, March 2006). A calorie deficit of ~1000 calories/d was prescribed to produce a 1- to 2-pound loss per week. A self-reported weight was entered weekly, and automated feedback messages were de-

livered based on weight loss progression. Each participant's individual calorie goal was not known by the investigators, but the intent was to allow the participants to use the site as they would commercially without additional guidance.

The eDiets.com program provided a calorie-controlled meal plan tailored to individual preferences. Participants were encouraged to follow their meal plan ("my diet"); recipe instructions and menu-specific grocery lists were offered as aids.

The program encouraged exercise ("my fitness"). Participants tailored their program on the basis of their exercise abilities and their likes and dislikes. An on-line exercise journal was provided to track weekly progress. There were check-in points interactively but no direct accountability to a therapist.

Although the website did not include a structured behavioral curriculum (lessons, activities), fundamental behavioral weight loss concepts were present. "Support central," monitored by experts and peers, offered opportunities for social support. The main components of "support central" were broken down into the following formats: professional-facilitated on-line meetings, all-hour chat rooms, discussion boards with hundreds of topics, an archive of frequently asked questions (with expert responses), and a mentor section where new members could team up with a more experienced member.

Assessments

Assessments were completed at 0, 6, and 12 months. The primary dependent measure was change in body weight. Weight was measured on a beam-balance scale with subjects in their street clothes and without shoes. Height was self-reported at baseline. Dietary intake was measured using the Block Food Frequency Questionnaire (19) and analyzed using the National Cancer Institute Dietary Analysis System software program (version 4.01; National Cancer Institute, Bethesda, MD). Physical activity was measured using the self-report format of the Paffenbarger activity questionnaire (20).

Process measures were implemented to explore mediators of weight change. Social influence components were assessed at 6 and 12 months using the Perceived Social Support Scale (21), which measured the degree to which subjects felt supported by their group members. Participants in the eDiets.com group encompassed the entire eDiets.com community and in VTrim included the 15 to 20 group participants assigned to one of three cohorts. The scale had 20 items; each item was given one point if the respondent reported feeling supported. Scores were summed, and a higher score represented more perceived support. The scale has been shown to have good internal consistency (0.90), good test-retest reliability (0.83), and good predictive validity (21).

An adaptation of the Eating Behavior Inventory (22), using a True/False scale as opposed to a Likert scale, was used to assess eating behaviors related to weight loss. The scale had 26 items; each item was given one point if the respondent engaged in a positive behavior related to weight control. Higher scores indicated engaging in behaviors more conducive to weight control.

Finally, web use of each site was tracked electronically to examine the relationship between usage and weight loss. Specific page hits within both sites were recorded with the associated username. Usage, measured in visits, could then be correlated to individual weight loss. Participants' use of specific features was also assessed separately for the first 6 months and final 6 months of the study.

Statistical Analysis

Data were analyzed using SPSS software (version 11.5; SPSS, Inc., Chicago, IL). Comparisons of baseline data for the two intervention groups were performed using an independent-samples *t* test for continuous variables and χ^2 tests for categorical data. Ongoing changes in weight were assessed by repeated measures ANOVA. Two analyses were performed on weight change: 1) a baseline-carried-forward (BCF)¹ analysis that included all randomized participants (in which missing values were imputed by carrying forward baseline values), and 2) a completers analysis that included only participants who completed the 6- and 12-month assessments.

Because the data were skewed, non-parametric comparisons of web use data were conducted using a Mann-Whitney test, and Spearman correlations were used to assess the correlations of web usage to weight change.

Results

Because the study was designed to include a weight loss component (0 to 6 months) and a weight maintenance component (6 to 12 months), data were analyzed in two distinct phases.

At baseline, there were no significant differences between groups in age, BMI, weight, education, or computer ability (Table 1). Attrition for VTrim was 18% ($n = 11$) at 6 months and 35% ($n = 22$) at 12 months. eDiets.com attrition was 19% ($n = 12$) at 6 months and 23% ($n = 14$) at 12 months. Attrition did not vary significantly by treatment group at either point in time (6 months: $\chi^2 = 0.053$, $p = 0.817$; 12 months: $\chi^2 = 1.833$, $p = 0.176$). There were no significant differences between groups for completers and non-completers at 6 and 12 months in age, BMI, education, or computer ability. Although not statistically significant, VTrim had a higher percentage of drop-outs at 12 months. A within-group comparison of VTrim completers vs. non-

Table 1. Baseline characteristics of participants in VTrim and eDiets.com groups

| Variable | VTrim ($n = 62$) | eDiets.com ($n = 62$) |
|------------------------------|-----------------------|----------------------------|
| Age (years, mean \pm SD) | 46.5 (10.7) | 48.9 (9.9) |
| BMI (kg/m ²) | 32.3 (3.9) | 32.5 (4.2) |
| Weight (kg) | 92.0 (15.7) | 90.2 (14.1) |
| Sex [n (%)] | | |
| Female | 48 (77) | 53 (86) |
| Male | 14 (23) | 9 (15) |
| Race [n (%)] | | |
| White | 61 (98) | 61 (98) |
| Education [n (%)] | | |
| High school | 4 (7) | 2 (3) |
| Some college | 16 (26) | 16 (26) |
| College degree | 24 (39) | 23 (37) |
| Graduate/professional degree | 18 (29) | 21 (34) |
| Marital status [n (%)] | | |
| Married | 45 (73) | 51 (82) |
| Separated/divorced | 11 (18) | 7 (11) |
| Never married | 6 (10) | 4 (7) |
| Computer ability [n (%)] | | |
| Novice | 1 (2) | 0 (0) |
| Basic software | 0 (0) | 1 (2) |
| Software + Internet | 41 (66) | 41 (66) |
| Hobbyist | 13 (21) | 12 (19) |
| Professional | 7 (11) | 8 (13) |

SD, standard deviation.

completers revealed a significant difference in education level ($\chi^2 = 8.2$, $p = 0.04$), with completers being more highly educated than drop-outs. A further analysis revealed that 40% of the drop-outs in the VTrim condition left for reasons beyond their control, such as moving, pregnancy, family/medical emergency, and computer problems (Figure 1).

Body Weight Change

An intention-to-treat analysis examined weight change using BCF. A repeated measures ANOVA revealed a significant group \times time interaction ($p = 0.02$) (Figure 2). A post hoc *t* test showed that the VTrim group lost more weight than the eDiets.com group from baseline to 6 months (6.8 ± 7.8 kg vs. 3.3 ± 5.8 kg; $p = 0.005$) (i.e., $7.3 \pm 7.8\%$ vs. $3.6 \pm 6.1\%$). At 12 months, using BCF, the VTrim group had maintained a significantly higher weight loss (5.1 ± 7.1 kg vs. 2.6 ± 5.3 kg; $p = 0.034$) (i.e., $5.5 \pm 7.6\%$ vs. $2.8 \pm 5.5\%$).

¹ Nonstandard abbreviation: BCF, baseline-carried-forward.

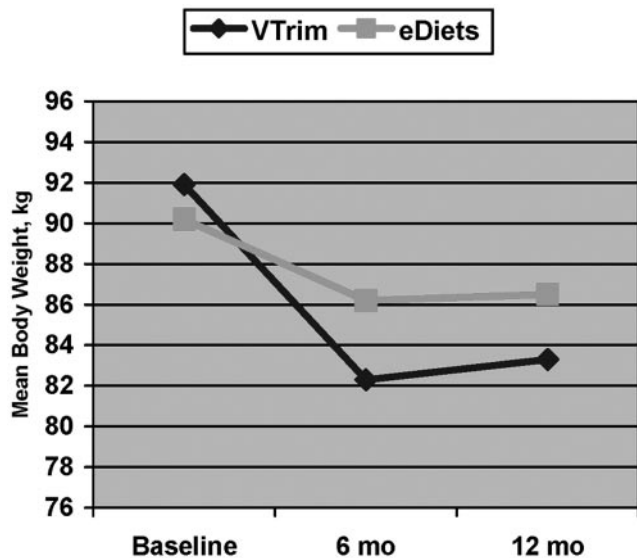


Figure 2: Change in body weight by group for weight loss and maintenance.

A completers analysis for participants with objective follow-up data was conducted at all three time-points (0, 6, and 12 months). Repeated measures ANOVA examining weight change showed a significant group \times time interaction ($p = 0.003$). Post hoc t tests showed that those in the VTrim group lost more weight than those in the eDiets.com group from baseline to 6 months (8.3 ± 7.9 kg vs. 4.1 ± 6.2 kg; $p = 0.004$) (i.e., $8.9 \pm 7.8\%$ vs. $4.4 \pm 6.5\%$). Both groups began to regain from 6 to 12 months (1.2 ± 3.3 kg vs. 0.64 ± 4.8 kg; $p = 0.548$), but at 12 months the VTrim group had maintained a significantly higher weight loss (7.8 ± 7.5 kg vs. 3.4 ± 5.8 kg; $p = 0.002$) (i.e., $8.6 \pm 7.9\%$ vs. $3.7 \pm 6.0\%$). In addition, 65% of participants in the VTrim group lost 5% or more of initial body weight, compared with 37.5% of participants in the eDiets.com group at 12 months ($\chi^2 = 6.6, p = 0.01$).

Website Usage

Usage of common web features (log-ins, self-report weigh-ins, attendance at facilitated on-line meetings) was

compared between groups. A comparison of the medians showed that participants in the VTrim group used these features significantly more than the eDiets.com participants during both phases, with the exception of self-report weigh-ins, which were not significantly different between 6 and 12 months (Table 2).

Correlations between the use of web features, both the above-mentioned and site-specific, and weight change during the weight loss (0 to 6 months) and weight maintenance (6 to 12 months) phases were explored (Tables 3 and 4). From baseline to 6 months, a few eDiets.com features correlated with weight change, and virtually all VTrim web features correlated with weight change. From 6 to 12 months, there was a noticeable decline in usage frequency for both groups. With the exception of viewing lessons in the VTrim group, there were no significant correlations between site-specific feature use and weight change.

Body Weight Change and Log-in Frequency

Because log-in frequency was significantly different between groups, an analysis of covariance was performed to see whether log-in frequency influenced weight change from 0 to 6 months. Since the log-in data were skewed to the right, a square-root transformation was used to reduce the skewness before using log-in frequency as the covariate. After adjusting for frequency of log-ins, there was no significant difference between VTrim and eDiets.com in weight change (6.2 ± 1.0 kg vs. 6.2 ± 1.0 kg; $p = 0.996$).

Changes in Dietary Intake and Exercise

Changes in dietary intake (kcal/d) and physical activity at 0, 6, and 12 months were examined using repeated measures ANOVA for those with complete data ($n = 88$). There was a significant time effect for decreasing calorie intake ($p < 0.001$) and increasing physical activity ($p = 0.01$) but no group \times time effect, indicating that both groups changed over time. From 0 to 6 months, dietary intake decreased for both groups an average of 457 kcal/d, and exercise increased an average of 372 kcal/wk. From 6 to 12 months, dietary intake decreased an average of 20 kcal/d, and exercise increased an average of 49 kcal/wk.

Table 2. Comparison of usage of common web features

| Web site feature median | 0 to 6 months | | | 6 to 12 months | | |
|-------------------------|---------------|------------------|----------|----------------|----------------|----------|
| | eDiets | VTrim | <i>p</i> | eDiets | VTrim | <i>p</i> |
| Log-ins | 47 (25 to 65) | 193 (120 to 309) | <0.001 | 14 (8 to 23) | 90 (21 to 154) | <0.001 |
| Self-reported weight | 16 (8 to 22) | 24 (20 to 25) | 0.002 | 8 (2 to 13) | 8 (2 to 12) | 0.622 |
| Facilitated meeting | 1 (0 to 3) | 21 (19 to 23) | <0.001 | 0 (0 to 0) | 11 (6 to 14) | <0.001 |

Medians (ranges) are given. Q, quartile.

Table 3. Correlation of web site usage to weight change in VTrim group

| Web site feature | 0 to 6 | | 6 to 12 | |
|---|--------------|--------|--------------|-------|
| | months r_s | p | months r_s | p |
| Log-ins | -0.53 | <0.001 | -0.12 | 0.478 |
| Self-report weigh-in | -0.68 | <0.001 | -0.12 | 0.482 |
| Facilitated online meeting | -0.53 | <0.001 | -0.25 | 0.127 |
| Bulletin board | -0.40 | 0.004 | -0.11 | 0.49 |
| Progress graphs | -0.43 | 0.002 | -0.16 | 0.24 |
| Behavior modification lesson | -0.70 | <0.001 | -0.39 | 0.02 |
| Food/exercise journal | -0.50 | <0.001 | -0.12 | 0.48 |
| Calorie look-up database | -0.29 | 0.04 | 0.052 | 0.76 |
| Food pantry (kcal information for frequently eaten foods) | -0.18 | 0.21 | -0.07 | 0.69* |
| Exercise calorie database | -0.27 | 0.05 | -0.16 | 0.33* |
| Participant biographies | -0.44 | 0.001 | -0.30 | 0.07 |
| Menu planner | 0.62 | 0.62 | -0.03 | 0.84* |
| Archived journals with feedback | -0.36 | 0.01 | -0.14 | 0.40 |
| Recipe box | -0.16 | 0.25 | -0.30 | 0.06* |
| Monthly challenge (incentive to meet goals) | -0.30 | 0.03 | -0.14 | 0.41 |
| Need a boost (motivational tips) | -0.27 | 0.05* | 0.05 | 0.79 |
| Carmen's story (motivational mascot) | -0.50 | <0.001 | -0.174 | 0.30* |
| Local events guide | -0.27 | 0.06 | 0.11 | 0.50* |
| News flashes | -0.28 | 0.05 | -0.15 | 0.37* |
| BMI calculator | -0.45 | 0.001 | -0.02 | 0.92* |
| Waist-to-hip ratio | -0.16 | 0.27* | -0.13 | 0.46* |
| Target heart rate | -0.17 | 0.23* | -0.06 | 0.72* |

* Feature was used by <50% of participants.

Social Influence Components

Changes in perceived group social support were examined for both groups at 6 and 12 months. The mean score for the VTrim group was twice as high as for eDiets.com at 6 months (6.7 ± 3.2 vs. 3.5 ± 2.9 ; $p < 0.001$) and at 12 months (7.6 ± 2.7 vs. 2.8 ± 2.9 ; $p < 0.001$).

Eating Behavior Assessment

Eating behaviors conducive to weight control were assessed at 0, 6, and 12 months. At baseline, there were no significant differences in the scores between groups (8.8 ± 3.2 vs. 9.8 ± 3.8 ; $p = 0.137$). The mean change in score for VTrim was significantly higher than for eDiets.com at 6 months (5.5 ± 4.0 vs. 3.2 ± 3.8 ; $p = 0.005$), indicating that the VTrim group adopted more behaviors conducive to weight control at 6 months. From 0 to 12 months, the mean change score for both groups was significantly different (0.83 ± 3.4 vs. -1.4 ± 3.8 ; $p = 0.005$); however, the actual score for both groups reverted back to near baseline. These results indicated that both groups were not able to sustain the behaviors necessary for weight control between 6 and 12 months.

Discussion

This study showed that participants who received a structured, therapist-led behavioral on-line intervention lost significantly more weight than those who had access to a self-help commercial weight loss website. Furthermore, the structured on-line intervention was able to replicate weight losses expected of a traditional, in-person intervention (~9 kg over 20 to 26 weeks) (5,7). Additionally, the structured intervention almost doubled the percentage of people who were able to achieve a 5% weight loss goal (65% vs. 37.5%). Weight losses of as little as 5% have been shown to reduce risk associated with weight-related co-morbidities (23).

Weight loss in both groups was observed only during the first 6 months of the study, and associations between web usage and weight change were evident during this time. From 6 to 12 months, both groups began to regain, and there was only one correlation between web usage and weight change in the VTrim group. The trend of decreased usage was also noted in a previous university-based on-line program (9), but losing interest is not

Table 4. Correlation of web site usage to weight change in eDiets group

| Web site feature | 0 to 6 months r_s | p | 6 to 12 months r_s | p |
|---------------------------------|---------------------|--------|----------------------|-------|
| Log-ins | -0.41 | 0.003 | 0.00 | 0.98 |
| Self-report weigh-in | -0.50 | <0.001 | 0.00 | 0.96 |
| Facilitated online meeting | -0.05 | 0.74 | 0.12 | 0.45* |
| Bulletin board (view) | -0.26 | 0.06 | 0.28 | 0.08* |
| Bulletin board (post) | -0.18 | 0.23* | -0.06 | 0.71* |
| Exercise program ("my fitness") | -0.20 | 0.17 | -0.12 | 0.50* |
| Menu planner ("my diet") | -0.05 | 0.75† | N/A | N/A |
| 24-hour chat room | -0.19 | 0.18* | 0.24 | 0.16* |
| eDietsU‡ | 0.02 | 0.87* | —§ | —§ |
| Request a mentor | 0.21 | 0.16* | —§ | —§ |
| View expert Q & A | -0.15 | 0.30* | 0.05 | 0.77* |
| Join Circle of Winners¶ | 0.08 | 0.60* | 0.31 | 0.04* |

N/A, not applicable; Q & A, question and answer.

* Feature was used by <50% of participants.

† Data for 50 participants from 0 to 6 months only.

‡ Self-reflection and motivation exercises.

§ Feature not accessed by any participants.

¶ Bulletin board community of people with like interests.

unique to an on-line delivery. Wing et al. (24) found that during the first 6 months of in-person treatment over 2 years, attendance averaged 61%, with only 27% attendance at later sessions. This tendency suggests that future research should explore methods of motivating on-line weight loss participants beyond the first 6 months. Site features that have been shown to correlate with weight loss are ideal areas to enhance with additional support components.

As in two previous on-line weight loss studies, log-ins correlated to weight change (9,10). A closer look at the data revealed that higher log-in frequency may have accounted for the increased weight loss of the VTrim group. More participants regularly used the VTrim program as opposed to eDiets.com. There is a need to understand what keeps people engaged. After adjusting for log-in frequency, weight change was *exactly* the same in both groups. However, it is unclear whether simply logging in more facilitates greater weight loss or whether the quality of the weight loss program generates more log-ins and consequently greater weight loss.

The comprehensive tracking of both conditions revealed that features that provided immediate feedback or that were dynamic in nature (e.g., self-report weigh-in) appeared to correlate to weight change. Conversely, static features (e.g., recipes) that did not offer feedback or new information did not correlate to weight change. There were limitations to tracking web usage, such as accounting for a print option

that would allow people to refer to information without using the site, but these preliminary insights are useful.

The weight loss of eDiets.com participants rivaled the results of the most recent evaluation of an in-person commercial program and was comparable to previous results of university-based on-line programs (9,10,13). The results of this study are in stark contrast to a previous trial using eDiets.com in the design (14). This study began 2 years later, and the eDiets.com website, as utilized in this study, provided more diet, fitness, and support options. These changes may have facilitated the greater weight loss observed in this study. VTrim, however, far exceeded those results, with weight losses comparable to high-quality in-person behavioral weight loss treatment. The wide reach of an Internet weight loss program has been thought to supersede the fact that weight losses have been below traditional face-to-face programs (9). The results of this study determined that an on-line, structured behavioral intervention can potentially reach greater numbers of people without sacrificing the weight loss achieved. However, it is not yet known whether disseminating intense on-line programs to larger populations is feasible and/or economical.

It should be noted that removing the face-to-face element of a structured behavioral weight loss program does not lessen the therapist intensity of an on-line format or the cost of delivering such a program. The VTrim group leader was simply behind the computer, not in the room. Commercial

self-help websites are more economical but also provide less professional contact. During the time frame of this study, eDiets.com charged \$99.00 for a 1-year membership. If VTrim were offered commercially, it would cost significantly more. The fact that the eDiets.com group lost an average of 4 kg at such a minimal cost could have significant public health implications. However, it is unclear how to evaluate the potential impact without statistics on the attrition rate of commercial on-line programs.

Major strengths of this study were that it was a randomized trial with objective weight data and it was the first study to look at a commercial on-line weight loss program without involving additional professional contact, such as regular clinic visits, as was described in a previous trial (14). The results suggest that a structured on-line behavioral intervention can achieve initial weight losses comparable to traditional face-to-face programs. However, the "staying power" of this format seems to diminish over time, as evidenced by the fact that associations between weight change and web usage no longer existed after 6 months, and participants in both groups began to regain weight. Harvey-Berino (25) determined that an on-line weight maintenance program was an effective treatment modality after a traditional in-person weight loss program. However, the ability of a strictly on-line program to produce long-term weight loss and maintenance of that loss has yet to be demonstrated. It is also unclear whether the method of on-line delivery should remain the same throughout the program.

Attrition for the VTrim group was higher (35%) than the range of 20% to 25% typically observed in behavioral weight loss programs of this duration (26). Additionally, more VTrim participants dropped out in the second half of the study as compared with eDiets.com ($n = 11$ vs. $n = 2$, respectively). The first 6 months of the VTrim intervention were therapist-intense. From 6 to 12 months, meetings and feedback were biweekly vs. weekly. It is possible that as the program intensity lessened, more VTrim participants lost interest because they were not receiving the same level of attention as they received from 0 to 6 months. Alternatively, the eDiets.com group participated in the same program for the duration of the study, so, theoretically, expectations would have remained the same throughout.

In summary, the results of this study showed that a structured on-line behavioral weight loss program achieved significantly greater weight loss than a commercial on-line program. Furthermore, the structured on-line program was able to achieve results typically seen in traditional face-to-face programs. This study should be replicated on a larger scale. The feasibility and cost-effectiveness of providing frequent therapist contact to large populations is not yet clear, nor is the long-term efficacy of web-based weight loss programs. However, given the continual increase in obesity prevalence and the

wide-reach potential of the Internet as a treatment modality, further research in this area is warranted.

Acknowledgments

This study was supported by U.S. Department of Agriculture Hatch Act Funds (Grant VT-NS-00,904) awarded to J.H-B. and S.P. We thank Heather Leonard and Nicci Micco for facilitating the VTrim on-line weight loss groups. We gratefully acknowledge Alan Howard for his statistical expertise, Amy Starinski for data entry, and Joe Brand at eDiets.com for web tracking support. S.B. was an employee of eDiets.com for the duration of the study. eDiets.com provided web tracking access to the investigator but had no role in the data management or analysis and did not write any part of the manuscript.

References

1. **Flegal KM, Carroll MD, Ogden CL, Johnson CL.** Prevalence and trends in obesity among US adults, 1999–2000. *JAMA.* 2002;288:1723–7.
2. **Mokdad AH, Ford ES, Bowman BA, et al.** Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. *JAMA.* 2003;289:76–9.
3. **Finkelstein EA, Fiebelkorn IC, Wang G.** National medical spending attributable to overweight and obesity: how much, and who's paying? *Health Aff (Millwood)* 2003;(Suppl Web Exclusives):W3-219–26.
4. **Wolf AM.** Economic outcomes of the obese patient. *Obes Res.* 2002;10(Suppl 1):58S–62S.
5. **Wing RR.** Behavioral approaches to the treatment of obesity. In: Bray GA, Bouchard C, eds. *Handbook of Obesity: Clinical Applications.* 2nd ed. New York: Marcel Dekker, Inc.; 2004, pp. 147–67.
6. **Foreyt JP, Poston WS II.** The role of the behavioral counselor in obesity treatment. *JADA.* 1998;10(Suppl 2):S27–30.
7. **Wadden TA.** The treatment of obesity: an overview. In: Stunkard AJ, Wadden TA, eds. *Obesity: Theory and Therapy.* New York: Raven Press; 1993, pp. 197–217.
8. **Pew Internet and the American Life Project.** Health Information Online. May 2005. Available at: http://www.pewInternet.org/PPF/r/156/report_display.asp. Accessed January 30, 2006.
9. **Tate DF, Wing RR, Winett RA.** Using Internet technology to deliver a behavioral weight loss program. *JAMA.* 2001;285:1172–7.
10. **Tate DF, Jackvony EH, Wing RR.** Effects of Internet behavioral counseling on weight loss in adults at risk for type 2 diabetes: a randomized trial. *JAMA.* 2003;289:1833–6.
11. **Weight Watchers International.** Weight Watchers International website. Available at: http://www.weightwatchersinternational.com/ireye/ir_site.zhtml?ticker=wtw&script=410&layout=7&item_id=720144. Accessed January 30, 2006.
12. **Tsai AG, Wadden TA.** Systematic review: an evaluation of the major commercial weight loss programs in the United States. *Ann Intern Med.* 2005;142:56–66.

13. **Heshka S, Andersen JW, Atkinson RL, et al.** Weight loss with self-help compared with a structured commercial program: a randomized trial. *JAMA*. 2003;289:1792–8.
14. **Womble LG, Wadden TA, McGuckin BG, Sargent SL, Rothman RA, Krauthamer-Ewing ES.** A randomized controlled trial of a commercial Internet weight loss program. *Obes Res*. 2004;12:1011–8.
15. **National Institutes of Health.** *The Practical Guide: Identification, Evaluation, and Treatment of Overweight and Obesity in Adults*. Bethesda, MD: National Institutes of Health; 2000.
16. **Jeffrey RW, Wing RR, Thorsen C, et al.** Strengthening behavioral interventions for weight loss: a randomized trial for food provision and monetary incentives. *J Consult Clin Psychol*. 1993;61:1038–45.
17. **U.S. Department of Agriculture and U.S. Department of Health and Human Services.** *Dietary Guidelines for Americans 2000*. 5th ed. Home and Garden Bulletin No. 232. Washington, DC: U.S. Government Printing Office, 2000.
18. **eDiets.com.** Available at <http://www.ediets.com>. Accessed January 30, 2006.
19. **Block G.** A review of validations of dietary assessment methods. *Am J Epidemiol*. 1982;115:492–505.
20. **Paffenbarger RS Jr, Wing AL, Hyde RT.** Physical activity as an index of heart attack risk in college alumni. *Am J Epidemiol*. 1978;108:161–75.
21. **Procidano ME, Heller K.** Measures of perceived social support from friends and from family: three validation studies. *Am J Community Psychol*. 1983;11:1–24.
22. **O'Neil PM, Curry HS, Hirsch AA, et al.** Development and validation of the eating behavior inventory. *J Behav Assess*. 1979;1:123–132.
23. **Goldstein DJ.** Beneficial health effects of modest weight loss. *Int J Obes Relat Metab Disord*. 1992;16:397–416.
24. **Wing RR, Venditti EV, Jakicic JM, Polley BA, Lang W.** Lifestyle intervention in overweight individuals with a family history of diabetes. *Diabetes Care*. 1998;21:350–8.
25. **Harvey-Berino J, Pintauro S, Buzzell P, Gold EC.** Effect of Internet support on the long-term maintenance of weight loss. *Obes Res*. 2004;12:320–9.
26. **Wing RR, Jeffrey RW.** Sample size in clinical outcome research: the case of behavioral weight control. *Behav Ther*. 1984;52:404–13.