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Predictors of Weight Loss Success: Exercise vs. Dietary Self-Efficacy and Treatment Attendance

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Abstract

Pre-treatment diet and exercise self-efficacies can predict weight loss success. Changes in diet self-efficacy across treatment appear to be even stronger predictors than baseline levels, but research on changes in exercise self-efficacy is lacking. Using data from a pilot study evaluating tangible reinforcement for weight loss (N = 30), we examined the impact of changes in diet and exercise self-efficacy on outcomes. Multiple regression analyses indicated that treatment attendance and changes in exercise self-efficacy during treatment were the strongest predictors of weight loss. Developing weight loss programs that foster the development of exercise self-efficacy may enhance participants' success.

Keywords

Weight loss; Self-efficacy; Diet; Exercise; Treatment attendance

Recent statistics indicate that a third of Americans are obese and approximately another third are overweight (Flegel et al., 2010). Excess body weight increases risk for medical and psychiatric conditions, including type 2 diabetes, cardiovascular disease, osteoarthritis, some cancers, and mood, anxiety, and personality disorders (Flegel et al., 2005; Nguyen et al., 2010; Barry et al., 2008; Petry et al., 2008). Losing weight, even as little as 5% of body weight, leads to significant reductions in health risks (Institute of Medicine, 1995; National Heart, Lung, & Blood Institute (NHLBI), 1998; Powell et al., 2007). Although weight loss programs based on reducing dietary intake and increasing physical activity can be effective in promoting weight loss, results are usually modest, and attrition from weight loss programs is high (e.g., Honas et al., 2003). Identifying patient characteristics and behaviors associated with successful weight loss could inform the development of more effective interventions to address the growing obesity crisis (Fontaine & Cheskin, 1997).

The concept of self-efficacy is fundamental to behavior change interventions based on social cognitive theory. Self-efficacy refers to individuals' beliefs regarding their ability and competence to make the behavior changes required to achieve goals such as weight loss (Strecher et al., 1986). Individuals start pursuing goals with varying levels of self-efficacy, and higher self-efficacy is generally associated with greater effort and commitment to adopting healthy behaviors (Schwarzer, 1992). In turn, successful pursuit of goals can

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enhance self-efficacy (Batsis et al., 2009; McAuley & Blissmer, 2000; Strecher et al., 1986), increasing the likelihood behavior change will be maintained. Behaviors required for successful weight loss include reduction of caloric intake and increase in caloric expenditure, although the relationship between self-efficacy for these behaviors and successful weight loss is unclear.

Regarding pre-treatment diet self-efficacy, Prochaska et al. (1992) found that pre-treatment scores on a measure of diet self-efficacy, the Weight Efficacy Lifestyle Questionnaire (WEL; Clark et al., 1991), predicted weight loss among participants in a worksite weight loss program, but accounted for a very small proportion of the variance. Conversely, in a study of African American women receiving weight loss treatment from primary care physicians, pre-treatment WEL scores were actually associated with less weight loss, suggesting that self-efficacy beliefs can sometimes be inaccurate and arise from underestimating the difficulty of losing weight (Martin, Dutton, & Brantley, 2004). Fontaine and Cheskin (1997) found no association between pre-treatment WEL scores and either weight loss or program attendance in a sample of outpatients treated at a hospital based weight management program.

Some literature suggests that change in self-efficacy may be a more significant predictor of weight loss success than baseline self-efficacy. For example, while Martin et al. (2004) found that greater pre-treatment diet self-efficacy predicted less weight loss, they also observed that larger improvements in self-efficacy during treatment were associated with greater weight loss. Several other studies have also found that increases in diet self-efficacy scores from pre- to post-treatment are associated with greater weight loss (e.g., Bas & Donmez, 2009; Warziski et al., 2008).

Exercise is another crucial component of successful weight loss programs. In one study, Linde et al. (2006) examined both the WEL and an exercise self-efficacy scale adapted from the WEL as predictors of weight loss at various stages in treatment. They found pre-treatment scores on both the WEL and the exercise self efficacy scale were associated with behaviors required for weight loss and with weight loss during treatment. However, they did not assess whether changes in exercise self-efficacy from pre- to post-treatment predicted greater weight loss.

Poor attendance and attrition from treatment are among the biggest barriers to the success of behavioral weight loss interventions (Gardner et al., 2007; Honas et al., 2003; Teixeira et al., 2004), and better session attendance is associated with greater weight loss during treatment and better maintenance of weight loss after treatment (Chao et al., 2000). The ability to persevere in treatment may be related to self-efficacy. For example, Bernier and Avard (1986) found that participants who completed treatment had higher pre-treatment self efficacy than those who dropped out prematurely.

The goal of the current study was to evaluate the effects of pre-treatment self-efficacy for diet and exercise, as well as changes in self-efficacy occurring during treatment, on weight loss success. Finding an effect of baseline self-efficacy could improve understanding of individual differences in the likelihood of experiencing success in a behavioral weight loss intervention, while strong effects of changes in self-efficacy would argue for including techniques for improving self-efficacy in behavioral weight loss programs. Given the mixed findings regarding associations between dietary self-efficacy and weight loss and the relative paucity of studies examining associations between exercise self-efficacy and weight loss, examining the contribution of both forms of self-efficacy should shed light on their relative importance to weight loss success. Because practicing the behavior changes recommended by behavioral weight loss programs could contribute to both weight loss and to changes in

self-efficacy, treatment attendance and changes in caloric intake and physical activity level were included in the analysis.

Method

Participants

Thirty adult primary care patients (25 women and 5 men) participated in the study, which was designed to compare a standard cognitive behavioral weight loss intervention (*Diabetes Prevention Program*, Wing & Gillis, 1996) to the same intervention with the addition of tangible reinforcements for weight loss and completion of activities that promote weight loss. All participants were referred by primary care physicians at an outpatient internal medicine clinic affiliated with the University of Connecticut Health Center. They were between 18 and 55 years old, had a body mass index (BMI) between 25.0 and 39.9, and had resting blood pressure between 90 and 140 systolic and between 60 and 90 diastolic. All participants were able to speak and read English at the 6th grade level and expressed willingness to be randomly assigned to a treatment group. Potential participants were excluded if they had any serious acute or chronic medical problems that would impact their ability to adhere to dietary and exercise regimens, if they were pregnant or breast feeding, if they had a current, uncontrolled psychiatric condition or serious psychiatric symptoms, if they met criteria for dependence on a substance other than nicotine, if they were planning to quit smoking in the next three months, if they had a history of any eating disorder, if they reported losing more than 10% of their heaviest body weight in the last six months, or if they had participated in a formal weight loss program in the last three months. The University's Institutional Review Board approved the study, and all participants signed written informed consent.

Procedures

After providing informed consent, participants met with a research assistant at the medical clinic to complete a 1–2 hour baseline evaluation to determine study eligibility, current level of physical activity, current dietary intake, and self-efficacy for regulating diet and exercise. Following the interview, eligible participants received a pedometer and a set of food diaries and were instructed to wear the pedometer and complete the food diaries on one weekday and one weekend day prior to their first appointment with a counselor.

Measures

Weights were obtained using a digital scale that was calibrated monthly to ensure accurate measurements. Physical activity was evaluated using the average number of steps recorded on the pedometer over the two assigned days and the Paffenbarger Physical Activity Questionnaire (PAQ; Paffenbarger et al., 1978), which computes calories burned per week based on self reported physical activity. Food diary reports were entered into the My Pyramid Tracker Program (USDA Center for Nutrition Policy and Promotion, 2005) to obtain average daily calories consumed.

The WEL and the Self-Efficacy for Exercise Scale (SEE; McAuley, 1992; Resnick & Spellbring, 2000) were used to assess self efficacy for regulating diet and exercise, respectively. The WEL assesses self-efficacy related to avoiding overeating when faced with situations such as availability of food, negative emotions, physical discomfort, positive activities related to eating and social pressure to eat. Scores range from 0 to 180, with higher scores indicating greater self efficacy. The SEE evaluates perceived confidence in one's ability to exercise when faced with a variety of barriers including fatigue, time constraints, physical or emotional discomfort, lack of social support, or competing activities. Scores

range from 0 to 1800, with higher scores indicating greater self efficacy. Both instruments have demonstrated reliability and validity (Resnick & Spellbring, 2000; Rossi et al., 1995).

Participants met with the research assistant for a post-treatment evaluation using the same measures at the end of the 12-week intervention. A week prior to the post-treatment evaluation, participants were reminded to wear the pedometer and complete food diaries on at least one weekday and one weekend day and to bring the pedometer and food diaries to the post-treatment evaluation.

Treatment Intervention

Participants received the Diabetes Prevention Program (DPP; Wing & Gillis, 1996) patient manual. The DPP focuses on long-term dietary changes, encourages exercise, and addresses cognitions and emotions that can interfere with weight loss. Participants were instructed to read 1–2 chapters from the manual each week and complete suggested activities. They also met with a counselor once a week for twelve weeks for 30-minute weigh-in and supportive counseling sessions. During the counseling sessions, counselors reviewed topics from the manual, provided advice and encouragement, and answered questions. Participants were advised to self monitor food intake and exercise, remain within daily calorie limits based on starting body weight, and wear the pedometer and set a goal of walking 10,000 steps per day, working up to that goal gradually. In addition to the DPP intervention, participants in one condition could earn chances to win prizes when they met weekly weight loss goals or completed the recommended activities (see Petry et al., in press).

Data Analysis

Paired sample t-tests were used to assess changes in weight, average daily caloric intake, average daily pedometer steps, caloric expenditure per week reported on the PAQ, and self efficacy (WEL and SEE scores) between the baseline and post-treatment interviews. Multiple regression analysis was conducted to evaluate predictors of weight loss. The dependent variable was defined as the change in weight between baseline and week 12, and independent variables were group assignment (DPP vs. DPP + Incentives), baseline WEL score, baseline SEE score, number of treatment sessions attended, and changes between baseline and post-treatment in caloric intake, weekly calorie expenditure on the PAQ, average daily pedometer steps, and WEL and SEE scores. When data were missing at post-treatment, they were assumed to be unchanged from baseline.

Results

Participants included in the study were 25 women and 5 men with a mean BMI of 34.2 ± 3.7 , mean age of 40.9 ± 9.4 , and mean education of 13.9 ± 2.3 years. Twelve (40%) were Black, eight (26.7%) were White, six (20%) were Hispanic, three (10%) were Asian, and one was biracial. Fourteen were assigned to DPP and 16 were assigned to DPP + Incentives.

On average, patients attended 6.4 ± 4.6 of the 12 treatment session. Weight decreased significantly from baseline, with an average weight loss of 4.9 ± 7.5 lbs (Table 1). Significant changes from baseline were noted with respect to weekly calorie expenditure and daily caloric intake, but not daily pedometer steps. The mean WEL score increased significantly over the course of treatment, but the mean SEE score did not increase significantly for the overall sample.

The results of the multiple regression analysis are displayed in Table 2. Results indicate that treatment attendance and increased self efficacy for exercise (SEE score) between intake and post-Predictors of Weight Loss Success treatment were significantly associated with weight loss. Although changes in diet and exercise self-efficacy were positively correlated ($r = .601$,

$p = .006$), neither the change in diet self-efficacy nor the change in exercise self-efficacy were associated with number of treatment sessions attended (diet: $r = .428$, $p = .068$; exercise: $r = .257$, $p = .287$).

Discussion

This study was one of the first to examine the role of changes in self-efficacy on weight loss outcomes. After accounting for other variables, including those related to caloric intake and expenditure, increased exercise self-efficacy was a significant predictor of short-term weight loss. On the other hand, baseline self-efficacies for both diet and exercise were unrelated to weight loss, indicating that changes in self-efficacy (particularly for exercise) may be more important than baseline self-efficacy in the achievement of weight loss. Individuals who build greater confidence in their ability to exercise, even in the face of barriers, may be more likely to exercise and therefore lose more weight. If these results are replicated in other samples, future studies may evaluate interventions that improve one's self-efficacy to exercise. These may include treatments that focus on reinforcement of progress toward exercise, making plans for exercise, and providing education about exercise (Williams & French, 2011). Previous studies found associations between increased diet self-efficacy and weight loss but did not simultaneously examine the effect of changes in exercise self-efficacy. We did not find change in diet self-efficacy to be a significant predictor of success, but given the strong association between changes in diet and exercise self-efficacy, diet self-efficacy would likely have predicted weight loss had exercise self-efficacy not been included in the analysis.

In accordance with previous research (Chao et al., 2000), we also found a significant association between session attendance and weight change such that participants who attended more sessions achieved greater weight loss. This association may have occurred because participants who attend a greater number of sessions were more motivated to lose weight. It is also possible that participants who were less successful losing weight became frustrated and were therefore less likely to attend treatment. Also, participants who lost more weight may have been more effective at problem-solving regarding barriers (e.g., scheduling difficulties, fatigue) that would have gotten in the way of both attending sessions and engaging in weight loss behaviors.

This study provided important information about the role of exercise self-efficacy and its relation to successful weight loss, although it is important to note its limitations. Our sample size was small and thus power was limited. Additionally, we accounted for missing post-treatment data by assuming no change from baseline, assuming that participants who did not complete the follow-up, on average, probably experienced few changes in these variables. However, it is certainly possible that participants who drop out represent a unique set of individuals with different outcomes. It will be advantageous to replicate this study with a larger group of individuals and examine differences between those who dropped out and those who did not. Another limitation is that most of the information regarding caloric expenditure and intake was self-reported, and thus potentially biased. The fact that changes in caloric consumption and expenditure were not related to weight loss may reflect inaccurate self-reporting. Finally, this study did not include a long-term follow-up, and whether or not sustained weight loss maintenance is predicted by increases in exercise self-efficacy during treatment is an important issue to address.

In conclusion, achievement of a healthy weight is a difficult process that is influenced by a number of factors. This study provided evidence that attendance at treatment and improvements in exercise self-efficacy are both important for successful weight loss. In the future, it will be helpful to design treatment strategies that will not only improve treatment

retention but also one's confidence in oneself to complete elements of the weight loss program, particularly those related to exercise.

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Table 1

Baseline and post-treatment measures of physical activity, diet, and self efficacy and Weight Loss, and Treatment Attendance Outcomes

Outcome	Pre treatment	Post-treatment	Change
Mean weight (lbs)	198.9 ± 25.7	194.0 ± 26.7	t(29)=3.56, p=.001
Pedometer steps per day	6375 ± 2515	7367 ± 4240	t(25)= -1.25, p=.224
PAQ kcal per week	2257 ± 2368	3714 ± 2757	t(229)= -3.36, p=.002
Average daily caloric intake	1988 ± 526	1562 ± 473	t(25)=4.00, p<.001
Diet self-efficacy score	130.4 ± 33.7	146.0 ± 21.8	t(29)= -3.12, p=.004
Exercise self-efficacy score	1055 ± 459	1147 ± 442.8	t(29)=-1.69, p=.103

PAQ = Paffenbarger Physical Activity Questionnaire

Table 2

Standardized Regression Coefficients for Predictor Variables in the Multiple Regression Analysis of Predictors of Weight Loss (N=30)

Predictor Variable	β	<i>p</i>
Group Assignment (DPP vs. DPP+ Incentives)	-.011	.925
Sessions attended	-.609	.003
Baseline diet self-efficacy	-.306	.148
Baseline exercise self-efficacy	-.012	.935
Change in average daily calories	-.158	.251
Change in average daily pedometer steps	-.161	.255
Change in PAQ kcal per week	-.183	.278
Change in diet self-efficacy	-.207	.329
Change in exercise self-efficacy	-.443	.008

DPP=Diabetes Prevention Program