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From Morbid Obesity to a Healthy Weight Using Cognitive-behavioral Methods: A Woman's Three-year Process with One and One-half Years of Weight Maintenance

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CASE STUDY

From Morbid Obesity to a Healthy Weight Using Cognitive-Behavioral Methods: A Woman's Three-Year Process With One and One-Half Years of Weight Maintenance

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Abstract

Background: Obesity is a national health problem regularly confronting medical professionals. Although reduced-energy (kilocalorie [kcal]) eating and increased exercise will reliably reduce weight, these behaviors have been highly resistant to sustained change.

Objective: To control eating using theory-based cognitive-behavioral methods that leverage the positive psychosocial effects of newly initiated exercise as an alternate to typical approaches of education about appropriate nutrition.

Method: A woman, age 48 years, with morbid obesity initiated exercise through a 6-month exercise support protocol based on social cognitive and self-efficacy theory (The Coach Approach). This program was followed by periodic individual meetings with a wellness professional intended to transfer behavioral skills learned to adapt to regular exercise, to then control eating. There was consistent recording of exercises completed, foods consumed, various psychosocial and lifestyle factors, and weight.

Results: Over the 4.4 years reported, weight decreased from 117.6 kg to 59.0 kg, and body mass index (BMI) decreased from 43.1 kg/m^2 to 21.6 kg/m^2. Mean energy intake initially decreased to 1792 kcal/day and further dropped to 1453 kcal/day by the end of the weight-loss phase. Consistent with theory, use of self-regulatory skills, self-efficacy, and overall mood significantly predicted both increased exercise and decreased energy intake. Morbid obesity was reduced to a healthy weight within 3.1 years, and weight was maintained in the healthy range through the present (1.3 years later).

Conclusion: This case supports theory-based propositions that exercise-induced changes in self-regulation, self-efficacy, and mood transfer to and reinforce improvements in corresponding psychosocial factors related to controlled eating.

Introduction

Only 32% of the US adult population is presently at a healthy weight (body mass index [BMI] less than 25 kg/m^2).[1] Obesity, defined as a BMI of 30 kg/m^2 or greater, is now present in 34% of adults, with some subgroups reaching 50% prevalence.[1] The probability of health risks, such as hyperlipidemia, hypertension, and type 2 diabetes, increase with the degree of overweight, with morbid obesity (BMI 40 kg/m^2 or greater) associated with the greatest likelihood of such problems.[2]

Although an increase in physical activity and a reduction in energy (kilocalorie [kcal]) intake will reliably reduce weight, maintaining these behaviors has been remarkably difficult in our obesogenic environment, which frequently promotes inactivity and overeating. Recently, researchers have questioned whether efforts at weight loss through attempting changes in eating behavior remain justified given their predictable pattern of failure beyond the short term.[3] Even with bariatric surgery, behavioral changes required to maintain the weight initially lost are difficult to sustain.[4] It is clear that simply providing individuals with education in healthy eating and exercise is insufficient; however, such efforts persist as the dominant helping modality.[5] It is suggested that such ineffective and atheoretical techniques be replaced by methods driven by variables derived from accepted health behavior-change theory.[6] Although less frequently applied, theory-driven approaches have demonstrated improved effects; however, they also have lacked an ability to sustain weight loss and reductions in health risks when their focus is on severe energy restrictions (ie, "diets"), which is typical.[3,5]

Exercise is a strong predictor of maintained weight loss[7,8]; however, the basis for this is unclear. Although often used as an adjunct to dieting, some researchers suggest that the benefits of exercise go well beyond associated energy expenditures (which are often minimal in deconditioned individuals), and may foster psychosocial changes that carry over to improved eating.[9,10] In the Winter 2012 issue of *The Permanente Journal,* we proposed a behavioral weight-management intervention based on social cognitive theory and self-efficacy theory,[11,12] with exercise as an initial and central component.[13] Consistent with those theories, findings supported that treatment-induced improvements in individuals' self-regulatory skills, self-efficacy, and mood improved both their exercise and eating behaviors. Very importantly, psychosocial changes associated with the supported exercise transferred to better-controlled eating and weight loss. It was thought that these psychosocial changes would also enable long-term behavioral changes and a sustained healthy weight. In agreement

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with previous findings,[14] logging of both exercise and eating, and their implications for feedback on goal attainment and making behavioral adjustments when indicated, was a central tenet. The maintenance of weight loss by deferring reduced-energy eating until regular exercise and associated changes in targeted psychosocial factors are first established was thus supported. The following single case report illustrates this approach and provides an instructive example of its processes and effects.

Case Report

A white woman, age 48 years, with morbid obesity (BMI of 43.1 kg/m^2) initially wanted to change her sedentary lifestyle into a physically active one. A later goal (after 4 months of maintaining regular exercise) was to reduce her weight by half by also modifying her diet. Her physician supported those goals and communicated their links to improvements in her health. She joined a YMCA in the southeastern US that incorporated a standardized cognitive-behavioral protocol based on tenets of social cognitive theory and self-efficacy theory[11,12] (The Coach Approach). This protocol previously had demonstrated success at reducing the typically high rates of dropout from newly initiated exercise.[15] The Coach Approach has been fully described elsewhere.[15] To summarize briefly, it consists of six 1-hour sessions over 6 months that address an array of self-regulatory and self-management skills (eg, productive self-talk, self-reward, preparing for specific barriers, recovery from lapses). Long-term goals are identified, documented, and broken down into process-oriented short-term goals where ongoing progress is tracked graphically. Behavioral contracting is also used when specific expectations (eg, "increase weekly cardiovascular exercise from 60 to 90 minutes") are agreed on and formalized. A proprietary computer program serves to standardize the process.

The certified wellness specialist who facilitated the woman's one-on-one Coach Approach appointments continued meetings every 4 to 6 weeks beyond its completion to facilitate and support changes in eating behaviors, as well as to revise exercise modalities and volumes. Common themes throughout the meetings were as follows: 1) using self-regulatory skills (productive self-talk, self-reward, etc), 2) building self-efficacy (ie, feelings of ability and mastery) around health behavior change, 3) improving mood (eg, anxiety, depression, fatigue, vigor), and 4) logging all exercises completed via another computer program (FitLinxx, Shelton, CT) and logging consumption of food and associated kcal in a personal journal. According to the theoretical basis of the behavior-change processes, self-regulatory skills were intended to address common barriers that challenge maintained exercise and appropriate eating (eg, discomfort, social pressure). Taking long-term goals (eg, "lose 50 lb [22.7 kg] within 1 year"), breaking them down into short-term process goals (eg, "have soup prior to a meal to curb hunger"; "participate in at least 1 group exercise class each week"), and viewing progress through constant logging of corresponding data were intended to promote self-efficacy. Exercise alone, sometimes supplemented with mind-body modalities (eg, tai chi, yoga), was intended to improve both short-term and long-term mood.

The 4 months of exercise before the subject initiated energy reduction would theoretically enable a transfer of exercise-related improvements in self-regulation skills, self-efficacy, and mood to attain

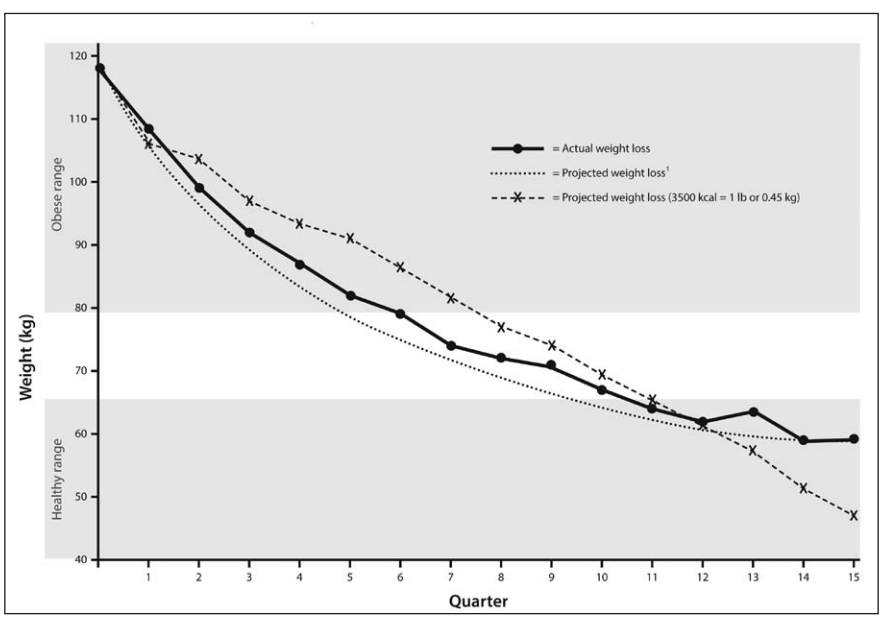

Figure 1. Actual and projected weight loss

[1] Hall KD, Sacks G, Chandramohan D, et al. Quantification of the effect of energy imbalance on body weight. Lancet 2011 Aug 27;378(9793):826-37. DOI: http://dx.doi.org/10.1016/S0140-6736(11)60812-X

kcal = kilocalorie.

and sustain improvements in eating behaviors and a maintained healthy weight. More specifically, improved self-talk and feelings of behavioral control would transfer from adapting to exercise to adapting to controlled eating, whereas exercise-induced mood changes would improve emotional eating. Daily goals for energy intake were modified approximately every 3 months on the basis of current weight. For example, when the woman's weight was 118 kg (Month 1), the daily goal was 1800 kcal. When her weight was 68 kg (Month 30), the goal was 1300 kcal. Guidelines were followed to reduce daily energy intake between 500 and 1000 kcal below the projected energy requirement for weight maintenance, but not below 1200 kcal.[16]

Data available for our analyses were derived from physician records; the FitLinxx exercise recording device; and the personal food log, which also included responses to items on self-regulation, self-efficacy, and mood initiated within The Coach Approach (adapted from validated inventories). Responses to these items ranged from 1 to 10, with 1 denoting an extreme negative response (eg, *not at all; never*) and 10 denoting an extreme positive response (eg, *extremely; often*). Weekly self-weighing was cross-checked with physician records for accuracy. Recording of energy intake and expenditure was cross-checked with validated calorie conversion tables, which adjusted for the present weight.[17] The 6-month Coach Approach treatment was included in the YMCA membership, and a fee for the additional individual meetings was paid by the subject.

Analyses

We first reported the observed pattern of weight loss, contrasting it with accepted prediction models. Next, energy intake and energy expenditure through exercise were assessed. We then evaluated responses to the items related to the psychosocial factors of interest and assessed whether they predicted exercise or eating behaviors, or both. Finally, we evaluated the associations of changes in weight with measures of cardiovascular function and blood chemistry findings. In supplementary analyses, we assessed the relationship of several lifestyle behaviors, which were possibly associated with both weight and other health risks,[18,19] with the observed changes in weight. Because the subject's goal was to reduce weight by 50% (from 118 kg to 59 kg), the 3.7 years (44 months) to attain this was termed the "weight-loss phase," and the 0.7 year (9 months) recorded after that was termed the "weight-maintenance phase." However, in actuality, a healthy weight (BMI less than 25 kg/m^2) was reached in 3.1 years (37 months) and remained through the period reported (an additional 1.3 years [16 months]). For some planned analyses, data were aggregated by quarter-year, beginning with the weight-loss phase.

Weight and Energy Change

Weight fluctuated by less than 1 kg during the 4 months before the subject's alteration of kcal intake (January 2008). During the 3.7 years of the weight-loss phase, weight was reduced from 117.6 kg (BMI = 43.1 kg/m^2) to 59.0 kg (BMI = 21.6 kg/m^2), a 49.8% reduction. During Quarter 1 of the weight-loss phase, energy intake was 1792.1 kcal/day (standard deviation [SD] = 281.9). It was significantly reduced to 1452.9 kcal/day (SD = 207.2) during Quarter 15 (t = 9.25, $p < 0.001$, 95% confidence interval [CI] = 266.8, 411.6). Although not tracked by the subject at this point, the projected

Table 1. Changes in measures of body composition, cardiovascular function, and blood chemistry over 6.5 years

	Before weight loss (month/year)							Weight-loss phase				Maintenance phase	
Measure[a]	9/05	12/05	3/06	5/06	12/06	9/07	11/07	4/08	3/10	9/10	3/11	1/12	3/12
Weight (kg)	111.6	111.6	112.0	110.8	110.7	116.6	117.6	109.3	71.2	64.4	63.4	59.0	59.0
BMI (kg/m^2)	42.8	42.8	41.1	40.7	40.6	42.8	43.1	40.1	26.1	23.6	23.3	21.6	21.6
Resting heart rate (bpm)	90	96	102	88	91	90	107	98	74	69	68	62	62
Blood pressure, systolic/diastolic (mm Hg)	138/88	132/84	124/88	120/80	120/80	136/80	130/80	98/92	110/76	128/70	102/64	120/84	118/80
Cholesterol (mg/dL) Total	---	---	---	---	---	223	---	---	228	236	212	199	210
HDL	---	---	---	---	---	60	---	---	81	90	89	89	97
LDL	---	---	---	---	---	144	---	---	136	133	107	100	99
Triglycerides (mg/dL)	---	---	---	---	---	145	---	---	57	67	82	52	71
Total cholesterol/HDL ratio	---	---	---	---	---	3.7	---	---	2.8	2.6	2.4	2.2	2.2
Fasting blood glucose (mg/dL)	---	---	---	---	---	88	---	---	84	---	85	---	86

[a] Height was 1.65 m throughout the 6.5 years.
--- indicates that the corresponding variable was not measured or reported at this time.
BMI = body mass index; bpm = beats per minute; HDL = high-density lipoprotein; LDL = low-density lipoprotein.

energy intake required to maintain her original weight was approximately 2300 kcal.[20] The mean energy expenditure from exercise was 232.1 kcal/day (SD = 203.3) (80.4% from cardiovascular exercise; 19.6% from resistance exercise), and did not significantly differ over time. The observed pattern of weight loss was nearly identical to the projection based on a recent algorithm by Hall and colleagues,[21] where there was an expectation of 50% of overall weight loss attained within the first year, and 95% of overall weight loss occurring by the end of the third year. In the present case, 52.0% of the woman's 58.6-kg weight loss was lost in the first year and 94.6% was lost by the end of Year 3 (Figure 1). Use of the present data in the Harris-Benedict equation (which estimates kcal needed to maintain one's weight)[20] suggested that a mean energy deficit of 393 kcal/day occurred. If the commonly used "3500 kcal deficit = 1 lb (0.45 kg) loss" was applied throughout the weight-loss phase, the expected weight loss would have been 74.6 kg (27% greater than the loss observed; Figure 1). The linear bivariate relationship between the difference in energy intake and energy expenditure (from exercise), and weight, was strong (r = 0.73, $p < 0.001$). This indicated that most of the variance in weight was accounted for by this composite factor (exercise plus reduced-energy intake).

Within the 0.7-year weight-maintenance phase reported, its first quarter (Quarter 12) was contrasted with its final quarter (Quarter 15). There was an additional significant reduction in weight of 1% (t = 7.85, $p < 0.001$; 95% CI = 0.7, 1.2) from a mean of 60.2 kg (SD = 1.0) to a mean of 59.3 kg (SD = 0.6). There was also a significant increase in daily energy expenditure from exercise (t = 4.69, $p < 0.001$; 95% CI = 74.3, 182.2) from a mean of 193.0 kcal (SD = 143.6) to a mean of 321.2 kcal (SD = 217.9). There was no significant change in energy intake per day (mean = 1523.5 kcal, SD = 371.0 to mean = 1469.8 kcal, SD = 302.4).

Effects of Psychosocial Variables

Scores on items associated with self-regulation (eg, productive self-talk, self-reward, preparing for specific barriers, recovery from lapses) for exercise, self-efficacy (ie, feelings of ability and mastery) for exercise, mood (eg, anxiety, depression, fatigue, vigor), self-regulation for controlled eating, and self-efficacy for controlled eating all considerably improved over 3.7 years. After that, a plateau was observed, without any confounding ceiling effects. Consistent with previous research,[13] substantial mood improvements occurred within 6 months. All other variables demonstrated a more linear increase throughout the weight-loss phase, with each score reported as "1" at the start of treatment, increasing to "8" (for self-efficacy and mood items) and "9" (for self-regulation items). On the basis of previous research using a social cognitive framework,[13] scores for self-regulation for exercise, self-efficacy for exercise, and mood were simultaneously entered into a multiple regression equation as predictors of energy expenditure from exercise during 1.5 years (because this was the goal period to increase exercise volume). A large portion of the variance in energy expenditure from exercise (76%) was accounted for in our analysis. Also consistent with the previously referred-to behavioral research,[13] self-regulation for controlled eating, self-efficacy for controlled eating, and mood scores were entered as predictors of energy intake during 3.7 years (because there was a goal to continue reduction in energy intake during the entire weight-loss phase). A large portion of the variance in energy intake (75%) was also accounted for. Although directionality of those associations could not be assessed, the strong relationships between self-regulation for exercise and self-regulation for eating (r = 0.93, $p < 0.001$), and self-efficacy for exercise and self-efficacy for eating (r = 0.96, $p < 0.001$) supported theoretical propositions concerning carryover effects from exercise to eating behaviors.

Effects on Markers of Health Risks

Physician records during 6.5 years were used to contrast mean values from before the weight-loss phase (September 2005 through November 2007) with mean values from the weight-maintenance phase (post-weight-loss phase: January 2012 through March 2012). Improvements in mean systolic blood pressure (from 129 to 119 mm Hg), diastolic blood pressure (83 to 82 mm Hg), total cholesterol (223 to 205 mg/dL), high-density lipoprotein (HDL) cholesterol (60 to 93 mg/dL), low-density lipoprotein (LDL) cholesterol (144 to 100 mg/dL), triglycerides (145 to 62 mg/dL), and fasting blood glucose (88 to 86 mg/dL) levels were found (Table 1). Improvements in total cholesterol/HDL ratio (3.7 to 2.2) and resting heart rate (95 to 62 bpm) were especially noteworthy.

… strong relationships between self-regulation for exercise and self-regulation for eating, and self-efficacy for exercise and self-efficacy for eating …

Relationships of each of these variables with weight were in the expected direction, with significant correlations found for resting heart rate (r = 0.94, $p < 0.001$) and diastolic blood pressure (r = 0.57, $p = 0.016$), and a marginally significant relationship for systolic blood pressure (r = 0.43, $p = 0.064$). Strong correlations, but with minimal available data, were found between weight and levels of triglycerides (r = 0.92), LDL cholesterol levels (r = 0.72), total cholesterol/HDL ratio (r = 0.97), and fasting glucose levels (r = 0.77). Systolic blood pressure and LDL cholesterol levels changed from high to normal ranges, whereas diastolic blood pressure and total cholesterol levels remained in high ranges.

Effects of Lifestyle Factors

Self-reported consumption of water (r = −0.84, $p < 0.001$; mean = 7.2 glasses/day, SD = 0.9) and time viewing television (r = 0.50, $p = 0.030$; mean = 0.5 hours/day, SD = 0.3), but not sleep (mean = 6.6 hours/day, SD = 0.3), were significantly associated with weight during the weight-loss phase.

Discussion

Although atypically high compliance with energy reduction, exercise, and data recording was demonstrated, this case report indicates relationships between theory-based psychosocial factors, behavioral changes, and weight reduction that may inform the treatment of obesity. The highly successful results

that were observed suggest value in a behavioral theory-based approach to weight-management intervention that emphasizes improvement in use of self-regulatory skills, perceptions of ability to improve health behaviors (self-efficacy), and mood that are forged within an exercise context and carried over to improvements in eating behaviors. Specifically, a loss of 31 kg was demonstrated in the first year, with a total of 59 kg lost in 3.7 years (50% of the initial body weight). After reducing morbid obesity to a healthy weight in slightly more than 3 years, the healthy range was maintained for the additional 1.3 years reported. Exercise was maintained at approximately 1600 kcal/week (the equivalent of approximately 5.5 and 3.5 hours/week of moderate and vigorous walking, respectively), which is consistent with recommendations for weight control given by the National Institutes of Health.[22] Energy intake restriction was never extreme, with sufficient kilocalories always consumed for nutritional requirements to be met.[16] Over the weight-loss phase, weight loss averaged well less than 0.45 kg (1 lb) per week. Consistent with social cognitive and self-efficacy theory, self-reported self-regulation, self-efficacy, and mood predicted both exercise and energy intake, where these improvements led to a gradual, but stable, reduction in weight.

Although water consumption and time viewing television were significantly associated with weight in the expected direction, it was not possible to determine if this was because of a covariance with other variables assessed, or if they were independent determinants. The subject reported that, for her, reducing television time was more associated with less nighttime snacking than increased sleep (which has been frequently hypothesized). As expected, the observed weight reduction was strongly associated with improvements in other health risk factors.

Findings suggest the viability of an alternate tactic to the predictably poor results derived by attempting to educate individuals on the need to eat better and exercise more.[5] Comments about specific aspects of the present approach made by both the wellness professional and the subject suggest its practicality in the "real world." For example, the wellness professional said "[the subject] was able to use the skills and techniques regarding exercise triggers and relate them to her eating. She realized that she had the power to change her negative thoughts about doing exercise, and we transferred this to controlling her eating." The subject said, "I use the dissociation technique from The Coach Approach [for exercise] to help me distance myself from the discomfort of hunger and/or eating when I'm anxious, nervous, sad, bored, etc"; and "The tracking is a way to stay honest, truthful, and correct immediately when I go off course. My mantra is track, weigh, *adjust, adjust,* course correct, back on track, stay on track, repeat." Interviews with the subject at termination of the analyses also provided anecdotal support for key tenets of the process. For example, without prompting, she indicated in her own words that exercise-induced improvements in mood countered emotional eating, ongoing revisions of the behavioral contract facilitated a strong focus on short-term exercise and nutrition goals to be maintained, and self-rewarding (eg, obtaining a haircut or massage) for measured progress reinforced both "feelings of ability" and "commitment."

Conclusion

Within the obesogenic environment that pervades, it now seems abundantly clear that sustained success in weight loss and maintenance requires more innovative behavioral approaches. These include new methods for empowering individuals with self-regulatory skills to adapt to the many barriers to a physically active lifestyle and controlled eating, facilitating confidence in their abilities to reach goals and adopt healthy behaviors over the long-term, and improving mood states that may effectively counter emotional and otherwise uncontrolled eating. Thus, medical professionals who frequently confront diagnoses of obesity in their patients but are limited in their time and resources for behavioral treatment, might consider referral options that adequately address the processes presently reported on. Community-based organizations with a focus on health promotion and following evidence-based behavior-change approaches, such as the one described here, may offer efficient and cost-effective opportunities for such referrals. Such an approach has the advantage of using replicable behavior-change processes that are highly adaptable to an individual's goals, interests, and competencies. Possibly, further assessment and standardization of the approach described in the present case study and in other research[13] will facilitate strategies that can be easily disseminated for intervention of obesity, a disorder increasingly being treated by surgical and other invasive methods. ❖

Disclosure Statement

The author(s) have no conflicts of interest to disclose.

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An Epidemic

According to the surgeon general, obesity today is officially an epidemic; it is arguably the most pressing public health problem we face, costing the health care system an estimated $90 billion a year. Three of every five Americans are overweight; one of every five is obese. The disease formerly known as adult-onset diabetes has had to be renamed Type II diabetes since it now occurs so frequently in children. A recent study in the *Journal of the American Medical Association* predicts that a child born in 2000 has a one-in-three chance of developing diabetes. (An African-American child's chances are two in five.) Because of diabetes and all the other health problems that accompany obesity, today's children may turn out to be the first generation of Americans whose life expectancy will actually be shorter than that of their parents.

— *The Omnivore's Dilemma: A Natural History of Four Meals,* Michael Pollan, b 1955,
American author, journalist, activist, and professor of journalism