Behavioral treatment of severe obesity\textsuperscript{1-3}

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ABSTRACT Behavioral approaches to obesity are usually employed in the context of short-term (10–20 wk) treatment interventions. These programs produce weight losses averaging 10 kg at the end of the program and 6.6 kg at 1-y follow-up. Improvements in long-term results may depend on a shift to a chronic disease model of obesity treatment, in which patients remain in ongoing care for extended periods of time. Highly structured diets and supervised exercise warrant further investigation as components of such a chronic disease approach to the treatment of severe obesity. \textit{Am J Clin Nutr} 1992;55: 545S–51S.

KEY WORDS Behavioral treatment, obesity, very-low-calorie diets, exercise

Introduction

The goal of this manuscript is to summarize the results of behavioral treatments for obesity and the variables associated with successful long-term outcome. The limited research applying behavioral principles to the problem of severe obesity will be discussed.

Overview of behavioral treatments

Behavior modification grew out of learning theory and was first applied to the treatment of obesity in the 1960s by Ferster (1) and Stuart (2). Behavioral approaches are based on the assumption that to lose weight, patients must decrease their caloric intake and/or increase their caloric expenditure. Toward this goal, behavioral approaches try to make patients aware of their current intake and exercise behaviors by having them record their behaviors on a daily basis. Behavioral programs also focus on changing the environmental factors that control behavior, specifically the antecedents or cues in the environment that set the stage for the behavior, and the consequences or reinforcers that come after the behavior and lead to its recurrence (3) (Fig 1). Various techniques are used to help patients modify their environment, including techniques for stimulus control, changing cognitions, problem solving, social support, and self-reinforcement (3, 4).

The goal of a behavioral program is to produce lifelong habit change and hence permanent weight loss. Consequently, behavioral programs incorporate individualized goals, and patients are encouraged to select low-calorie foods that they like and will continue to eat for the rest of their lives, and exercises, such as walking, that can be made a part of their daily routine. Behavioral treatments are usually conducted with weekly meetings over approximately a 20-wk period and all patients progress through the program together. A small-group format is used; the leader provides information about new behavior modification techniques and helps to reinforce progress, but the onus of making the behavior changes and the responsibility for their success is with the patient (3).

Progress during the past 20 y

Behavioral treatments have received extensive empirical investigation, with over 100 controlled studies published in the research literature (5). Notable about these studies is the fact that attrition rates are very low. Over 80% of subjects who enter behavioral treatments complete the program and are available for follow-up. This is an important factor, which should be kept in mind when evaluating alternative approaches to weight loss: patients who drop out of treatment have usually done most poorly; therefore, to determine accurately the effectiveness of a therapeutic approach, it is necessary to follow as close to 100% of the original cohort as possible.

A review (6) of the behavioral weight loss literature shows that between 1970 and 1990 a great deal of progress was made in the weight losses achieved in behavioral treatment programs (Table 1). Whereas in 1974, weight loss averaged 3.9 kg, by 1984 it had almost doubled (averaging 7.0 kg), and by 1986, averaged 10.0 kg. Several studies have achieved weight losses of 11.4–13.6 kg (7-9).

There are several possible explanations for the improvement in weight loss. 1) As shown in Table 1, behavioral programs have increased in length, now averaging 16.7 wk. 2) Patients are heavier, and initial weight has been shown to be significantly related to weight loss in behavioral programs (10). 3) And I think most important, treatment programs have become more intensive. Current behavioral programs often include a period of more severe calorie restriction (8), structured exercise sessions (11), incentive systems (9), and/or training in new techniques, such as relapse prevention (7). Evidence of the importance of these techniques comes from a quantitative review of behavioral programs (12), showing that weight loss is positively associated with treatment duration, hours of therapist contact, therapist

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experience, use of a rigorous diet, practicing exercise at the sessions, and involvement of the patient's family. Weight loss at follow-up has also improved (Table 1). In 1974, subjects were followed for an average of 15 wk and maintained a loss of 4.1 kg. In contrast, in 1986, the average follow-up was 44 wk and subjects maintained a loss of 6.6 kg.

Few studies have followed patients beyond 1 y. Kramer and colleagues (13) reviewed 13 studies (10 published, 3 unpublished) with follow-ups beyond 1 y. Based on these limited data, it appears that subjects regain weight for the initial years of follow-up but then plateau and maintain their losses (Table 2). Average weight losses for sequential years of follow-up were 79%, 69%, 49%, 33%, and 47% of the weight loss achieved initially. The interpretation of these long-term data is difficult, however, because of the paucity of studies with extended follow-up and the lack of data on either untreated control groups of obese patients or patients treated in nonbehavioral programs.

Criteria for judging the effectiveness of treatment

Having presented the average results of behavioral treatment, one can easily recognize that behavioral treatments do not usually restore obese patients to normal weight. However, such a goal may not be necessary for the majority of patients. There is substantial evidence that modest weight losses may be sufficient to have a significant impact on cardiovascular risk factors. For example, in a behavioral weight loss program that we recently completed with obese type II diabetic patients, we found that 78 of 93 patients who entered the program completed a full year of therapy (R. Wing, unpublished observation, 1991). Of these, 27% had a weight loss of ≥ 18.2 kg and another 27% maintained a loss of 9.1–18.2 kg. These modest weight losses produced marked improvement in glycemic control and lipids. Subjects who lost ≥ 18.2 kg reduced their fasting glucose from 13.0 mmol/L at baseline to 7.0 mmol/L at the 1-y follow-up and 76% obtained fasting blood sugar (FBS) < 7.7 mmol/L. HbA1c decreased from 9.7% to 7.1%. Moreover, whereas 18 of 21 subjects were on diabetes medication at baseline, only 1 was on medication at 1-y. Effects of modest weight loss on other coronary heart disease (CHD) risk factors in these diabetic subjects are shown in Table 3.

Data from the Framingham Study (14) also suggest the importance of modest weight loss. For every 10-unit change in relative weight in men, Ashley and Kannel (14) reported an 0.28 mmol/L change in cholesterol, a 6.6 mm Hg change in systolic blood pressure, and a 0.14 mmol/L change in glucose. Based on these changes in risk factors, Ashley and Kannel (14) concluded that a 10% reduction in percent overweight should produce a 20% reduction in coronary incidence. Thus, modest weight losses may be an appropriate goal for weight-loss programs.

Another important criteria for judging the success of treatment is the patients’ quality of life. However, there has been little research on this topic within the behavioral literature, with the exception of several studies of changes in depressive symptom-
atology in obese patients treated in behavioral weight-loss programs (15-17). These studies have shown that patients in behavioral treatments experience significant decreases in depressive symptomatology. These improvements in mood are correlated with magnitude of weight loss, but even those patients who fail to lose weight or experience weight gain show small improvements in mood state—not worsening (16). Thus, judging from the low attrition rates found in behavioral treatments and the improvements in mood state, it appears that behavioral programs are contributing positively to patients’ quality of life.

Behavioral treatment for severely obese patients

It is often stated that behavioral treatments are most appropriate for those with mild-to-moderate obesity because weight losses obtained are modest. However, I do not necessarily agree with this statement for several reasons. First, a strong predictor of weight loss in behavioral programs is initial weight; heavier patients lose more weight than lighter ones (10). Thus, more severely overweight patients may actually be the ones who will do best in behavioral programs. Second, severely obese patients do not appear to require greater weight losses to obtain improvement in physiological parameters. In our own research with type II diabetic subjects, we find that weight loss is associated with improvements in glycemic control, but the magnitude of improvement is not dependent on the initial weight of the subject. Thus, a 20-kg weight loss may be of just as much benefit to a 125-kg subject as to a 90-kg subject.

Third, intensive treatment programs, which involve ongoing behavioral treatment, may be effective for severely obese patients. Most notable is a study by Bjorvell and Rossner (18), which was conducted at the Karolinska Institute. These authors studied 107 obese patients who at entry had an average body mass index of 41. Patients were treated in one of two treatment programs: a behavior-modification program or a program that also included jaw-wiring. The behavioral program included a 6-wk in-hospital period (with a 2511-kJ/d diet), exercise, and training in behavior modification. Follow-up was provided for the next 4 y, with weekly booster sessions and free weigh-ins. Subjects who relapsed could return to the hospital for 2-wk periods. The jaw-wiring program commenced with a period of jaw fixation and then 2 wk of the in-hospital program described above followed by the maintenance program described above. Figure 2 shows the weight losses obtained in these two programs compared with the weight losses of 16 subjects given a written program only. One hundred four of the 107 who entered the study were traced, but data are presented only for the 74 subjects (69%) who remained in the program. As shown, the jaw wiring produced better initial results, but by the 4-y follow-up, weight losses were comparable, with a 30% decrease in percent overweight. On average, patients maintained a loss of 11.7 kg; 14 (19%) lost ≥ 20 kg, 35 (47%) lost 5-20 kg, and 17 (23%) lost 0-5 kg.

In a recent abstract Bjorvell and Rossner (19) reported 10-y data for the behavioral-treatment group. Patients received no further interventions after the 4-y program, and 71% of the patients in the original behavioral group were followed. Many of the follow-ups were by telephone only so there may be some bias due to self-report. The results are shown in Table 4. As shown, patients successfully maintained their weight loss throughout the 10 y. Weight loss after 4 y correlated $r = 0.50$ with weight loss at 10 y, suggesting that patients who lost the most weight during the initial 4-y program maintained the largest weight losses at 10 y. Thus, this study presents important evidence that severely obese patients treated in a long-term behavioral treatment program can successfully reduce their weight and maintain it at a lower level.

Predictors of weight loss and maintenance

Outcome in behavioral treatment programs is variable, and thus numerous studies have attempted to determine what types of patients do best in these programs. Unfortunately, efforts to find predictors of weight loss have been largely unsuccessful. The demographic characteristics that have been related to weight loss include weight and gender, with heavier subjects losing more weight than lighter ones and men losing more weight than women (even after adjusting for initial weight) (20). However, men also appear to be more likely than women to regain their weight loss (13). Patients who report problems with binge eating have been shown to regain weight more rapidly than age- and weight-matched patients who do not binge eat (21).

Treatment components that have been related to weight loss include regular self-monitoring of intake (22), reduction in calories consumed (23), and increased exercise (24, 25). Consistently, the best predictor of long-term weight loss appears to be the long-term maintenance of exercise. For example, Kayman

![FIG 2. Comparison of behavior modification and jaw wiring. The jaw-wired patients (O — — O) lost more weight initially, but after 48 mo the individuals treated with behavior modification (A — — A) and those treated with jaw wiring followed by behavioral therapy had maintained the same 30% reduction in the degree of overweight and both lost more than untreated control subjects (Δ — — Δ). Reprinted with permission from reference 18.)](image-url)
and colleagues (24) interviewed women who had lost weight and maintained their losses for ≥ 2 y and compared these successful losers to women who had lost weight, but regained it. Ninety percent of the maintainers reported regular exercise compared with only 34% of the regainers.

**Intensification of behavioral treatment approaches**

As noted above, improvements in behavioral weight-loss programs seem to be related to an intensification of the behavioral program. It has become increasingly apparent that obesity can not be treated with an acute-care model, in which patients attend treatment meetings for 10 wk and then are supposed to be able to maintain their new behavioral skills forever, on their own. Rather, obesity must be viewed as a chronic disease, requiring ongoing clinical care. Behavioral treatments have thus become longer, now averaging 20–24 wk in length, and several investigators are studying 40–50-wk programs (26). There is also interest in the combination of behavioral techniques with other weight loss strategies, such as pharmacologic agents (27, 28), very-low-calorie diets (VLCDs), and structured exercise programs. The latter approaches will be discussed below.

**Behavioral treatments used in combination with VLCDs**

Behavior modification techniques are usually used in combination with a low-calorie (5022–6277 kJ/d), low-fat diet. However, these strategies can also be combined with other more stringent diets, such as VLCDs. VLCDs, defined as diets of < 3348 kJ/d, are designed to produce maximal weight loss while sparing lean body mass. To accomplish this, VLCDs usually include a minimum of 1 g of protein daily per kilogram ideal body weight. VLCDs have been found to be safe when used with appropriate patients and with careful medical monitoring and produce excellent weight losses, averaging 1.36 kg/wk in females and 1.82 kg/wk in males for 12–16 wk (29). However, when VLCDs are used alone, without training in behavioral techniques, the weight is often rapidly regained (8). Therefore, several investigators have examined whether the combination of behavior modification and a VLCD produces a more effective long-term intervention than either approach used alone.

Stunkard (8) compared a behavior therapy program (BT), VLCD, and the combination of BT plus VLCD. The VLCD component of this study involved 8 wk of lean meat, fish, or fowl. Figure 3 shows that the combination of BT plus VLCD produced the best initial results: an average weight loss of 19.1 kg at 6 mo (compared with 13.95 kg in VLCD alone and 14.13 kg in BT alone). However, the rate of regain was greater in subjects given the VLCD, so that at 18 mo, weight losses of BT alone did not differ significantly from BT plus VLCD (9.40 vs 12.78 kg, respectively). Both did much better than the VLCD-alone group, which maintained a loss of only 4.6 kg. Thus, behavior modification appeared to have an important role, both in helping to maintain weight losses produced by VLCDs and as a treatment in and of itself.

When examined at a 3-y follow-up, average weight losses were 3.76 kg for VLCD, 4.76 kg for BT, and 6.53 kg for BT plus VLCD (30). These results did not differ significantly among the three groups. A 5-y follow-up likewise showed no significant differences between groups (31). Many patients had sought other treatment over the 5 y, making it very difficult to determine the long-term effectiveness of the interventions.

A similar study, conducted in Japan by Miura and colleagues (32), found that weight losses at the 2-y follow-up were significantly better for patients treated with VLCD plus BT, averaging 12 kg at the 2-y follow-up (Fig 4).

Recently, Wing and colleagues (33) compared a BT program with the combination of BT plus a VLCD in a sample of obese type II diabetic subjects. The weight-loss results paralleled those reported by Stunkard (8). Patients randomly assigned to the combination of BT + VLCD lost 18.6 kg at the end of the 20-wk treatment compared with 10.1 kg lost in the BT-alone group (P < 0.003). However, the combination group regained more weight over the year of follow-up, such that when subjects were restudied at 1-y follow-up, overall weight losses of BT (−6.8 kg) did not differ significantly from BT plus VLCD (−8.6 kg).
More interesting, however, was the finding that the combination of BT + VLCD improved long-term glycemic control. For subjects in the BT group, FBS averaged 12.5 mmol/L at baseline, 9.18 mmol/L at the end of the 20-wk treatment, and 13.2 mmol/L at 1 y. Subjects in the BT + VLCD had similar baseline FBS (13.9 mmol/L); however, they achieved significantly greater reductions in FBS at the end of the 20-wk program (7.6 mmol/L) and at 1-y follow-up (10.2 mmol/L). Thus, the combination of behavioral modification and VLCD may be effective in promoting long-term glycemic control in type II diabetic patients.

Based on these studies, it appears that the use of VLCDs in combination with BT may not enhance long-term weight loss over that which can be achieved in a standard behavioral program. However, VLCDs are well tolerated by patients, produce clearly superior initial weight losses, and may improve long-term glycemic control. Therefore, further research is needed to explore various approaches to utilizing VLCDs within the context of extended behavioral treatment programs.

Behavioral approaches plus structured exercise

There is also evidence to suggest that the use of a structured exercise program may enhance weight loss. Several (but not all) studies comparing diet only, exercise only, and the combination have suggested that programs combining diet plus exercise produce the best long-term results (34–36). Wing and colleagues (36) showed that type II diabetic subjects treated with diet and exercise lost more weight during a 20-wk program than patients treated with diet only and maintained a significantly better weight loss at 1 y (Fig 5). Pavlou et al (37) compared several diets, differing in prescribed calorie intake (low-calorie diet vs VLCD), administered with and without structured exercise. Weight losses at the 3-y follow-up in one study and 18-month follow-up in another were not affected by the type of dietary program utilized; however, the inclusion of structured exercise led to improved maintenance.

A recent study showed that subjects who exercise with the therapy group do better then those who are told to exercise on their own (11). Moreover, weight losses achieved by exercise may be easier to maintain then those produced by diet alone (38).

As noted above, the hallmark of these studies with superior weight losses appears to be the intensity of the intervention. Subjects are seen for longer periods of time, have more structured diets, and have more structured exercise programs. The same variables seem to affect maintenance. In a study by Perri and colleagues (7), all groups received an identical behavioral weight-loss program but differed in their maintenance program (Fig 6). The BT group received no further treatment over the 18-mo follow-up. The BT + C + A + S group, on the other hand, received an elaborate maintenance program, including biweekly contact (C), increased aerobic exercise (A), and social influence (S). With these maintenance procedures, subjects who lost 13.67 kg at the end of treatment, maintained a loss of 13.54 kg at the 18-mo follow-up.

These studies suggest that long-term weight loss can be achieved with intensive behavioral approaches, involving long-term ongoing care, and structured diet and exercise interventions.

Use of behavioral techniques for the prevention of adult obesity

Epstein and colleagues (39) have recently provided evidence that one of the major roles for behavioral techniques may be in the treatment of overweight children and in the prevention of adult obesity. These investigators studied 76 obese children, 6–12 y of age, who were treated in a behavioral weight-loss program. Children and their overweight parents were randomized to one of three groups: child and parent reinforced for behavior change, child only reinforced for behavior change, or a control group where the families were reinforced for attendance. Children in the child plus parent group showed significantly greater reductions in percent overweight at 5- and 10-y follow-up (−11.2% and −7.5%) than children in the nonspecific group (+7.9% and +14.3%), respectively (Fig 7). The child-alone group showed increases in percent overweight of 2.7% at year 5 and 4.5% at year 10, midway between the other two groups. In contrast to the excellent long-term results in the obese children, there were no effects for parents; by 5 y, parents had returned to their base-
treat obesity. There has been tremendous progress in the application of behavior modification to the treatment of obesity over the last 2 decades, resulting in improved treatment outcomes. It is becoming increasingly apparent that obesity must be considered a chronic disease, requiring long-term treatment. Thus, intervening in children may be an important direction to pursue. The study by Epstein et al (39) also raises the possibility that behavioral intervention may be particularly important in the prevention of weight gain and in the prevention of disorders related to obesity (such as diabetes), rather than focusing on the treatment of those who are already affected.

Conclusions

It is important to remember that it has only been 20 years since the first study was done using behavioral techniques to treat obesity. There has been tremendous progress in the application of behavior modification to the treatment of obesity over this time. It is becoming increasingly apparent that obesity must be considered a chronic disease, requiring long-term treatment. Research is needed that moves away from 10-20 wk intervention programs to long-term models of behavioral treatment such as that used by Bjorvell and Rossner (18). Other more intensive behavioral approaches, where perhaps exercise and intake are structured for the patient, may be of benefit. With these more intensive programs it may be possible to produce better long-term results. Identifying subgroups of the obese population, such as obese patients who binge eat, and developing specific interventions targeting these subgroups, should also be explored. Finally, additional research is needed to understand the variables that influence food consumption, exercise behavior, and the failure to maintain long-term behavior change and weight loss.

References


