BEHAVIOR MODIFICATION FOR OBESITY

Updated: March 1, 2002

Authors: Deborah F. Tate, Ph.D. and Rena R Wing, PhD.

INTRODUCTION

The treatment of choice for overweight and obese patients is the combination of diet, exercise, and behavior modification [1]. In carefully selected patients, these modalities may be supplemented by pharmacotherapy or weight loss surgery. Since behavior modification is a key component of all weight loss approaches, this chapter will provide the reader with an overview of behavioral approaches to obesity. Throughout the chapter, we have indicated Internet sites that provide further information on given topics or resources for specific patients.

THEORETICAL PREMISE OF A BEHAVIORAL APPROACH

Behavioral approaches to obesity are based on two assumptions: first, that eating and exercise behaviors are related to body weight and secondly, that behaviors can be modified by changing both the antecedents, or cues in the environment, that come before the behavior and lead to its occurrence, and the consequences, or reinforcers, that come after the behavior and increase its frequency [2].

Based on these premises, there are three main components to a behavioral approach, designed to assess the behaviors and to change the antecedents and consequences controlling the behaviors.

Monitoring the behaviors

In order to determine the behaviors that need to be changed and to assess progress in making these changes, it is necessary to find a way to monitor behavior. In weight loss programs, eating and exercise behaviors are typically monitored by self-report. Patients are asked to write down all foods consumed and the calories and fat grams in those foods and all recreational physical activities that are performed. Although these reports may underestimate intake or overestimate activity [3], they can be used by the patients and therapist to identify particular problem areas

(e.g. is the participant consuming large portion sizes, selecting high fat choices, etc.), and to gauge progress.

Changing antecedents

Behavioral approaches assume that the environment is an important determinant of behavior. Most notably, the physical environment, including the sight and smell of food, can trigger feelings of hunger and influence what types of foods are selected. Other types of environmental cues can also be important. Eating and exercise behaviors can be influenced by social cues (the behaviors or attitudes of others around the patient) and by cognitive cues (thoughts and feelings about eating, exercise and body weight). Thus behavioral approaches include techniques to change physical, social, and cognitive cues.

Changing consequences/reinforcers

The third key component of a behavioral program is increasing reinforcers for new, appropriate behaviors. Patients are taught to recognize small positive changes in their behavior and to reward themselves verbally and with small tangible rewards for this progress. Therapist praise and social support from others in the treatment program are also used as reinforcers.

BRIEF HISTORY OF BEHAVIORAL APPROACHES

Behavioral approaches were first applied to the problem of obesity in the late 1960′s and early 1970′s [2, 4]. Initial programs were 10-weeks in length, directed at mildly overweight individuals, and tended to focus on behaviors such as the time of day and location of eating episodes, rather than the actual calories consumed. These programs produced average weight losses of approximately 4.5 kg during the 10-week program. Over time, treatment programs have been lengthened to 20-24 weeks; maintenance interventions have been added; there has been increased emphasis on physical activity; and both diet and activity have been viewed in terms of their contribution to calorie balance. With these newer programs, weight loss has increased to approximately 9-10 kg at 6 months. Patients maintain about 60-70% of their weight loss (or 5.6 kg) at 1-year follow-up. Table 1 documents the progress over time.

Although modest, the weight losses achieved in behavior modification program are sufficient to improve cardiovascular risk factors and reduce the risk of developing diabetes [5, 6]. Positive mood changes have also been observed in participants in behavioral weight loss programs [7].

Table 1. History of Treatment Outcomes in Behavioral Weight Loss Studies

	1970′s	**1980′s**	**1990′s**
Length of Treatment (wks)	10	14	27
Weight Loss (kg)	4.0	7.6	9.7
Length of Follow-up (wks)	22	53	64
Loss at Follow-up	4.0	4.8	5.6

(kg)			

Adapted from Wing [1] and Wadden [4]

FORMAT OF CURRENT BEHAVIORAL TREATMENT PROGRAMS

Behavioral programs are typically conducted in groups; approximately 15 patients start and complete the program together. Programs are often led by two co-therapists, with multidisciplinary backgrounds, such as psychologists, nutritionists, or exercise physiologists. Programs usually include weekly treatment meetings for 6 months and biweekly or monthly meetings for the remainder of the year to two years. Behavioral programs that have included weekly meetings for a full year have been quite successful, but decreased attendance over time limits the usefulness of this approach [8, 9].

In some situations, behavioral treatments are offered individually to patients or using a combination of group and individual approaches. A recent study [10] suggested that group intervention was more effective than individual intervention even among patients who expressed a preference for individual therapy. Group treatment is also clearly less expensive to provide.

Continued contact is an important component of the maintenance program. In a program that provided 6-months of weekly treatment and then no further contact over the subsequent year, patients retained a weight loss of 4.5 kg, whereas patients in programs that continued to provide biweekly meetings throughout the year, maintained weight losses of 13.6 kg [11]. Efforts to provide on-going contact through phone calls, rather than face-to-face meetings have had inconsistent effects [12-14]; results may depend on the nature of the calls and specifically on the amount of therapist involvement and problem solving that is conducted.

Recently there have been efforts to deliver behavioral treatment programs via television or the Internet. Two studies of televised behavioral programs suggest that this approach may be as effective as face-to-face programs [15, 16]. Tate et al. [17] conducted a randomized controlled trial of an Internet behavior therapy program. Patients in the Internet education group (control group) were helped to identify appropriate web sites related to diet, exercise, and weight management. For patients in the Internet behavior therapy program, this educational material was supplemented by treatment lessons, weekly e-mail contact between patients and the therapist (patients submitted a diary of their weekly calorie intake, exercise, and weight and the therapist provided supportive feedback) and a bulletin-board for sharing of information. The Internet education group lost 1.6 kg at 6 months, compared to 4.1 kg in the Internet behavior therapy group.

CONTENT OF BEHAVIORAL TREATMENT PROGRAMS

The content of behavioral treatment programs has become relatively standardized. Group sessions typically include an individual, private weigh-in, review of self-monitoring records, and then a presentation of the lesson for the week. Participants are given specific assignments to

complete over the subsequent week, which are then reviewed at the following lesson. Table 2 identifies some of the topics typically addressed in a behavioral program.

Table 2. Standard Behavioral Treatment Sessions	
Getting Started	Presents an overview of behavioral approach. Prescribes a 1-2 lb/week weight loss goal and an individual calorie goal to achieve this weight loss.
Self-Monitoring	Teaches the importance of recording immediately and, honestly. Helps patients learn to find calorie values by using a reference book and reading food labels.
Modifying Diet	Emphasizes the importance of restricting dietary fat intake. Teaches common sources of dietary fat and strategies to lower fat.
Increasing Physical Activity	Introduces the importance of physical activity for energy balance and prescribes activity goals that gradually increase over the course of the program.
Stimulus Control	Teaches patients to remove cues for inappropriate behaviors and increase cues for appropriate behaviors.
Changing the Act of Eating	Stresses the importance of eating slowly, eating in designated locations, and eating a variety of different foods. Often incorporates discussion of the food guide pyramid.
Problem Solving	Teaches patients to identify problem areas or barriers related to eating or exercise, to brainstorm solutions to their problems, and then select one to implement.
Social Support	Helps patients to learn to ask others for the type of support they need to change their behaviors.
Restaurant Eating	Presents strategies for managing eating away from home.
Changing Cognitions	Teaches patients to recognize their negative thoughts and counter them with positive re-framing.
Managing Stress	Helps patients learn to identify sources of stress in their lives, examine the association between stress and eating, and develop new strategies for dealing with stress.
Motivational	Teaches patients to develop motivational strategies to help them maintain their habit changes long-term.
Relapse Prevention	Presents the Malatt and Gordon Relapse

	Prevention Model [18]. Teaches patients to recognize high risk situations, plan for these situations, and to keep lapses from leading to relapse.

SETTING WEIGHT LOSS GOALS

The NHLBI Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults-The Evidence Report [1] recommends that individuals with a BMI >25 (overweight) and those with a BMI >30 (obese) be counseled on the importance of weight management. Cardiovascular risk factors should be assessed, and weight loss recommended in those with a BMI >30 or a BMI 25-29.9 or waist circumference >80 cm (F) or > 102 cm (M) AND > 2 risk factors.

Web Resources: Body Mass Index Calculate body mass index by typing weight in pounds and selecting height.

- http://www.nhlbisupport.com/bmi/bmicalc.htm

View or print the body mass index table.

- http://www.nhlbi.nih.gov/guidelines/obesity/bmi_tbl.htm

The initial goal of therapy should be to achieve a 10% reduction in body weight. Patients should be encouraged to lose 1-2 lb/week and thus should be able to achieve 10% reduction within the first 6 months of treatment. Subsequently, efforts should be directed at maintaining the weight loss.

Recent studies suggest that patients often desire to achieve much greater weight losses than this 10% goal [19]. What patients report as a “dream” weight would be accomplished by a 38% reduction in body weight; a weight that would make them happy, would be accomplished by a 31% reduction in weight; a weight that would be “acceptable” would be accomplished by a 25% weight loss, and a weight that they would be disappointed to achieve would be accomplished by a 15.7% weight loss. Since currently even our most effective behavioral weight loss programs achieve outcomes below this level, it is important to counsel patients on achievable weight losses and attempt to reduce the discrepancy between the desired and the achievable outcomes.

Self-monitoring Weight

Behavioral weight control programs typically weigh patients at every group meeting and record this information. In addition, patients are instructed to weight themselves at home at regular intervals, either daily or at least once a week. Data from the National Weight Control Registry suggest that successful weight losers monitor their weight quite closely [20]. Forty-five percent of registry participants weigh themselves at least daily and 31% report weighing themselves at

least once a week. This frequent monitoring allows them to promptly take steps to correct any small increases in weight that they observe.

MODIFYING DIETARY INTAKE

Dietary prescriptions in behavioral programs

Behavioral programs attempt to change energy balance by influencing both calorie intake and calorie expenditure. Most programs emphasize decreasing overall calorie intake and restricting fats specifically. At the start of the program, participants are assigned a calorie goal designed to produce a 1-2 lb/week weight loss. This may be done on an individual basis, by estimating current calorie intake and then subtracting 500 to 1000 kcal/day. In some studies current intake is estimated by multiplying the patients' weight in pounds by 12, and in others resting energy expenditure is estimated and an adjustment made for the patients' activity level. Alternatively in many programs, participants are simply assigned a calorie goal depending on their initial body weight (e.g. patients < 200 lb may be asked to eat 1000-1200 kcal/day and those > 200 lb may be asked to eat 1500 kcal/day).

Web Resources: Energy Deficit Calculation One pound per week loss: Calculation based on estimation of resting energy expenditure and age

http://www.shapeup.org/profcenter/download/app3.pdf (requires Adobe Acrobat Reader)

Very low calorie diets, which are diets of <800 kcal/day, were extremely popular in the 1980′s [21]. These diets are usually consumed as liquid formula or lean meat, fish and fowl. Patients were found to lose an average of 9 kg in 12 weeks on these regimens. However, after stopping the diet, regain was common. Therefore, several studies were designed to examine the combination of very low calorie diets and behavior modification, reasoning that VLCD might increase initial weight loss and the behavioral strategies might improve maintenance of weight loss [8, 9]. This reasoning was supported in part; the combination of behavior modification plus VLCD was found to be more effective than VLCD alone. However, behavior modification plus VLCD was not more effective than behavior modification with a low calorie diet (1200-1500 kcal/day). Combining behavior modification with a VLCD increased initial weight loss, but despite the behavioral training, these patients still regained large amounts of weight over the year of follow-up so that at the end of the study (2-year follow-up), weight losses of patients treated with VLCD did not differ from patients with low calorie diets. Given these results, along with concern about health consequences of rapid weight loss, the expense of using VLCDs, and the evidence that weight losses are comparable on liquid diets of 400, 600 and 800 kcal/day, most weight loss programs now use higher calorie levels (>800 kcal/day).

Many behavioral programs encourage patients not only to reduce their overall calories, but also to lower their fat intake to 20-30% of their calories in order to improve weight loss and lipid responses to weight loss. The combination of restricting dietary fat and calories has been shown to be more effective then fat restriction alone [22] or calorie restriction alone [23, 24]. Moreover, reducing fat intake and decreasing consumption of specific high fat food (beef, hot dogs,

cheese, French fries, sweets) have been shown to be related to maintenance of weight loss [25, 26]. For simplicity, participants are given a fat goal in grams of fat/day (e.g. participants on a 1200 kcal diet are instructed to consume 27-40 grams of fat for a diet of 20% – 30% fat).

Dietary Intake in Successful Weight Losers

The National Weight Control Registry is a registry of over 3,000 individuals who have lost at least 30 lb (mean = 66 lb) and kept it off at least 1 year (mean = 6 years). These individuals are asked to complete questionnaires about their diet, exercise, and general weight control behaviors. Although these individuals report having lost weight in a variety of ways (50% lost weight on their own and 50% lost weight with the help of a program, physician, or counselor), there seem to be certain commonalties in their weight maintenance behaviors [20, 27]. Of particular interest is the fact that these individuals report that they continue to eat a diet that is low in calories (1380 kcal/day) and low in fat (24% of calories from fat). Almost 80% of participants report eating breakfast every day during the week and only 4% reported never eating breakfast. Despite the recent popularity of diets recommending low carbohydrate intake, less than 1% of registry participants reported consuming <24% of their diet as carbohydrate (< 90 g of carbohydrate on a 1500 kcal regimen).

Strategies for Modifying Dietary Intake

Self-Monitoring Calorie and Fat Intake. Participants in behavioral programs are instructed to record all food and beverages they consume and the calories and fat grams in those foods. By tallying their fat and calorie intake after each meal, participants can gauge the amount remaining for later meals. Such self-monitoring is prescribed daily for the first 6 months of the program and at least one week per month subsequently. Continued self-monitoring of intake is one the strongest predictors of maintenance of weight loss [28, 29].

Web Resources: Food Diaries"Keeping a Food Diary" includes tips to increase patient accuracy and a sample diary

- http://familydoctor.org/handouts/299.html

Food diary that allows patients to record servings or exchanges rather than calories.

- http://www2.womansday.com/shape_up/1200shape_diary.htm

Very Simple Eating Log for Patients from the American Heart Association

- http://www.deliciousdecisions.org/ff/eee_habits_eat.html

Improving the quality of foods selected. Patients in behavioral weight loss programs are encouraged to select foods that will provide the greatest nutritional benefit for the fewest calories. The emphasis in on decreasing overall intake of fat. Strategies are provided for improving quality of foods consumed at home and when eating out. For example, patients are

taught to substitute lower calorie items for higher calorie alternatives, to restrict use of fat in cooking and flavoring of foods, and to modify favorite recipes for healthier eating.

Web Resources: Selecting Healthier Food Alternatives Eating Out in Restaurants

- http://www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/dine_out.htm

Fast Food Restaurant Calorie Information

- http://www.olen.com/food/

- http://www.fatcalories.com/

Lower calorie, lower fat alternative foods

- http://www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/lcal_fat.htm

Common food exchanges based on the American Dietetic Association Exchange List

- http://www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/fd_exch.htm

Providing Increased Structure Regarding Diet. There have been several recent studies suggesting that providing structure to patients on what they should eat, and thereby simplifying choices, preparation time, etc., can be very helpful in promoting dietary adherence [30-32]. Patients who were given a box of food containing exactly what they should eat for 5 breakfasts and 5 dinners each week had better weight losses at 6, 12 and 18 months (10.1, 9.1, 6.4 kg, respectively) than patients who were given the comparable calorie and fat goals for these meals but selected the foods on their own (7.7, 4.5, and 4.1 kg, respectively) [30]. Providing patients with a specific meal plan, indicating exactly what should be eaten for each meal and a grocery list to purchase these items, was also more effective than simply allowing patients to self-select their diet [31]. Providing such meal plans or the actual food to patients appears to remove some of the barriers to dietary adherence, promotes more regular meal consumption and fewer snacks, and positively affects the types of foods stored in the home. Similar positive results have been obtained using prepackaged entrees for all or part of the diet and using Slimfast [33]. In all of these regimens, patients are eating 900-1500 kcal/day suggesting that it is the structure, rather than an extremely low calorie level that makes these approaches effective.

Web Resources: Structured Menus From the National Heart Lung and Blood Institute, this interactive menu planner is designed to guide daily food and meal choices based on one day's calorie allowance. It may be used in advance to plan a meal, or at the end of a day to add up total calories

- http://hin.nhlbi.nih.gov/menuplanner/menu.cgi

Sample1200 and 1500 calorie menus based on ~ 25% calories from fat

- http://www.cooperwellness.com/menu.asp

Structured menus for a variety of calorie levels

- http://www.cyberdiet.com/meal_modules/start.html

MODIFYING PHYSICAL ACTIVITY

There have been a large number of randomized controlled trials comparing the effects on weight loss of diet only, exercise only, and the combination [1, 34]. These studies suggest that exercise alone has very small effects on body weight, and that adding exercise to a diet program increases initial weight loss by approximately 2 kg. These modest effects of exercise may well be due to the low dose of exercise used in many of these trials and the short duration of the studies. The greatest benefits of exercise are seen in the maintenance of weight loss. Of 6 studies that have examined long-term weight losses in diet only versus diet plus exercise, all 6 found that the latter had better outcomes, although in many of these studies the difference was not statistically significant [34]. Correlational data are even stronger in suggesting the benefits of long term physical activity for maintenance of weight loss [35].

Prescribing exercise in a behavioral weight loss program

Participants in behavioral weight loss programs are encouraged to increase their physical activity slowly, in order to avoid injury, and to check with their physician before undertaking strenuous activity. The goal for physical activity varies across programs, but often participants are instructed to gradually increase their activity until they achieve a level of at least 1000 kcal/week. Participants are able to choose exactly what types of exercise they enjoy, but most use walking for the majority of their activity. A good rule of thumb is that walking 1 mile will burn approximately 150 kcal (heavier patients will burn more calories). Calories from other types of activities are available in many textbooks, patient guides and on the Internet. Alternatively patients may be assigned a goal of achieving at least 150 minutes/week of physical activity, using brisk walking or activities of similar intensity to brisk walking.

There have been two recent studies comparing programs that involve home-based physical activity and those that include supervised exercise programs [36, 37]. In these studies, all patients received the same diet and behavioral instruction and the same exercise goals, but the programs differed in the format used to achieve the physical activity. Both studies found no differences in short-term weight loss, but the maintenance of weight loss was better with home-based exercise than with supervised activity. The advantage of the former may be the freedom to exercise whenever, wherever, and however the participant chooses.

Web Resources: Estimating Energy Expenditure American Heart Association Physical Activity Calorie Use Chart

- http://www.americanheart.org/presenter.jhtml?identifier=756

Chart depicting the calories used by a 150 lb person in 20 minutes of various activities

- http://www.nhlbi.nih.gov/chd/Tipsheets/cal-physactivity.htm

Table depicting moderate amounts of physical activity in different activities

- http://www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/phy_act.htm

The focus in behavioral programs is typically aerobic exercise, but Wadden and colleagues recently examined resistance training and the combination of resistance training and aerobic exercise [38, 39]. These investigators found no difference in weight losses achieved with the various types of exercise. Again selecting activities that patients enjoy and combining a variety of different types of exercise is recommended.

Physical Activity in Successful Weight Losers

Data from the National Weight Control Registry, described above, highlights the importance of physical activity for weight loss maintenance [20]. In the NWCR, 91% of individuals report that physical activity was one aspect of their maintenance of weight loss. On average, women in the registry report expending 2545 kcal/week in exercise and men report 3293 kcal/week. These data suggest that successful weight losers are exercising over an hour a day.

Physical Activity Goals

The high exercise level reported by NWCR members has raised the question of whether participants in weight loss programs should be encouraged to achieve higher activity levels, than typically recommended, e.g. 2500 kcal/week, rather than the usual 1000 kcal/week goal. This suggestion is supported by several other studies. Jakicic et al. [40] reported better weight loss maintenance in patients who exercised > 200 minutes per week and Jeffery and Wing [41] found that patients in the highest quartile of exercise, who expended over 2500 kcal/week, had better weight loss maintenance then those with lower levels of activity. A randomized controlled trial [42] comparing 1000 kcal/week and 2500 kcal/week prescriptions is currently ongoing; at month 18, weight loss in the high exercise condition were significant by greater than the low exercise condition (6.7 kg vs. 4.1 kg). Thus, while the initial goal of behavioral programs should be 1000 kcal/week (or 150 minutes/week), it is recommended that patients progress to higher goals over time.

Strategies to Modify Physical Activity

Self-Monitoring Physical Activity. Participants in behavioral programs are instructed to record all activities they complete. To simplify recording, they are usually instructed to focus only on exercise bouts that last at least 10 minutes. Patients record either calories used in activity or minutes of activity.

Increasing Lifestyle Activity. Modern civilization has evolved to a point where there are many

devices designed to save energy expenditure, most notably automobiles, remote controls, and escalators. Patients in behavioral weight loss programs are helped to identify these energy saving devices and to plan ways in which they can expend more energy in their daily activities, e.g. parking further from the store, using stairs, getting off the bus one stop earlier. Although these lifestyle behavior changes can add up over time to significant increases in energy expenditure, they are difficult to quantify and hard to record in self-monitoring diaries. Therefore such lifestyle activities are viewed as a supplement to a longer, more structured activity/exercise bouts.

Web Resources: Exercise Diaries Sample log for recording physical activity (also includes place to record diet on same log).

- http://www.sasked.gov.sk.ca/docs/health/health6-9/pg153.pdf (requires Adobe Acrobat Reader)

Food and Physical Activity Diary from the National Heart Lung and Blood Institute

- http://www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/diaryint.htm

Dividing exercise into multiple short bouts. The number one barrier to exercise is lack of time. To address this problem, patients may find it easier to exercise for multiple 10-minute bouts rather than one 40-minute bout. Several studies have examined this issue [40, 43]. In a study by Jakicic et al. [40], patients were randomly assigned to exercise in one 40-minute bout/day, 5 days/week or to complete four 10-minute bouts on each of the 5 days. All other aspects of the weight loss programs were identical in the two conditions. The short-bout program produced better initial adherence and comparable long-term changes in weight and cardiovascular fitness to the long-bout program [40]. Thus, exercising in multiple bouts may be a useful option for some participants.

Decreasing sedentary activities such as TV time. There have been several studies in children that show that decreasing the number of hours/week of sedentary activities (TV, computer games) may be an effective approach to weight control [44, 45]. Epstein and colleagues [44]compared the effects of increasing physical activity, decreasing sedentary behavior, and the combination of the two in a study of overweight children aged 8-12. The children who were asked to decrease sedentary time had the best long-term weight control outcome, and comparable improvements in fitness to the other conditions. These results suggest that as the children decreased sedentary activities they adopted other more physically active pursuits (and thus improved fitness). It is not known whether this approach would be as effective with adults as it was with children.

Decreasing barriers for physical activity. Maintenance of physical activity is key for long-term weight loss [34, 35], but it is difficult to motivate patients to continue to be physically active long-term. Behavioral programs teach patients strategies for dealing with common barriers to exercise, e.g. exercising in hot weather or cold weather; appropriate stretching exercises to prevent injuries. Motivation for physical activity is increased by encouraging patients to do a variety of different activities that they enjoy and helping patients recognize the improvements in

fitness that occur with regular exercise.

Web Resources: Improving, Maintenance of Physical Activity Tips for getting Started with Exercise and overcoming common Barriers

- http://www.diabetes.org/main/health/exercise/start/start_exercise.jsp

Exercise Intensity and Target Heart Rates

- http://www.justmove.org/myfitness/lowarticles/lowframes.cfm?Target=hartrates.html

Stretching Exercises

- http://www.womensheartfoundation.org/content/Exercise/stretching_exercise.asp

CONCLUSIONS

Behavioral approaches are used to help patients make long-term changes in their eating and exercise behaviors. To accomplish this, behavioral approaches stress monitoring of dietary intake and physical activity and modifying the cues and reinforcers in the environment. Better results have been achieved in behavioral programs that provide longer periods of treatment contact, more structured approaches to modifying dietary intake and higher goals for physical activity.

References

1. NHLBI: Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults-The evidence report. Obes Res 6:51S-210S, 1998.

2. Wing, RR, Behavioral approaches to the treatment of obesity, in Handbook of Obesity, G. Bray, C. Bouchard, and P. James, Editors. 1993, Marcel Dekker, Inc.: New York. p. 855-873.

3. Lichtman, SW, Pisarska, K, Berman, ER, Pestone, M, Dowling, H, Offenbacher, E, Weisel, H, Heshka, S, Matthews, DE, Heymsfield, SB: Discrepancy between self-reported and actual caloric intake and exercise in obese subjects. N Engl J Med 327:1893-1898, 1992.

4. Wadden, TA, The treatment of obesity: an overview, in Obesity Theory and Therapy, A.J. Stunkard and T.A. Wadden, Editors. 1993, Raven Press, Ltd.: New York. p. 197-218.

5. Wing, RR, Koeske, R, Epstein, LH, Nowalk, MP, Gooding, W, Becker, D: Long-term effects of modest weight loss in type II diabetic patients. Arch Int Med 147:1749-1753, 1987.

6. Wing, RR, Venditti, EM, Jakicic, JM, Polley, BA, Lang, W: Lifestyle intervention in overweight individuals with a family history of diabetes. Diabetes Care 21:350-359, 1998.

7. Wing, RR, Marcus, MD, Blair, EH, Burton, LR: Psychological responses of obese type II diabetic subjects to very-low-calorie diet. Diabetes Care 14:596-599, 1991.

8. Wing, RR, Blair, E, Marcus, M, Epstein, LH, Harvey, J: Year-long weight loss treatment for obese patients with Type II diabetes: Does inclusion of an intermittent very low calorie diet improve outcome? Am J Med 97:354-362, 1994.

9. Wadden, TA, Foster, GD, Letizia, KA: One-year behavioral treatment of obesity: Comparison of moderate and severe caloric restriction and the effects of weight maintenance therapy. J Consult Clin Psychol 62:165-171, 1994.

10. Renjilian, DA, Perri, MG, Nezu, AM, McKelvey, WF, Shermer, RL, Anton, SD: Individual versus group therapy for obesity: Effects of matching participants to their treatment preferences J Consult Clin Psychol 69:717-721, 2001.

11. Perri, MG, McAllister, DA, Gange, JJ, Jordan, RC, McAdoo, WG, Nezu, AM: Effects of four maintenance programs on the long-term management of obesity. J Consult Clin Psychol 56:529-534, 1988.

12. Perri, MG, Sears, SF, Clark, JE: Strategies for improving maintenance of weight loss: Toward a continuous care model of obesity management. Diabetes Care 16(1):200-210, 1994.

13. Perri, MG, Shapiro, RM, Ludwig, WW, Twentyman, CT, McAdoo, WG: Maintenance strategies for the treatment of obesity: an evaluation of relapse prevention training and posttreatment contact by mail and telephone. J Consult Clin Psychol 52:404-413, 1984.

14. Wing, RR, Jeffery, RW, Hellerstedt, WL, Burton, LR: Effect of frequent phone contacts and optional food provision on maintenance of weight loss. Ann Behav Med 18:172-176, 1996.

15. Meyers, A, Graves, T, Whelan, J, Barclay, D: An evaulation of a television-delivered behavioral weight loss program: are the ratings acceptable? J Consult Clin Psychol 64:172-178, 1996.

16. Harvey-Berino, J: Changing health behavior via telecommunications technology: Using interactive television to treat obesity. Behav Ther 29:505-519, 1998.

17. Tate, DF, Wing, R.R., Winett, R.A.: Using internet technology to deliver a behavioral weight loss program. JAMA 285:1172-1177, 2001.

18. Marlatt, GA, Gordon, JR, Relapse prevention: Maintenance strategies in addictive behavior change. 1985, New York: Guilford.

19. Foster, GD, Wadden, T, Phelan, S, Sarwer, DB, Swain-Sanderson, R: Obese patients' perceptions of treatment outcomes and the factors that influence them. Arch Intern Med 161:2133-2139, 2001.

20. Klem, ML, Wing, RR, McGuire, MT, Seagle, HM, Hill, JO: A descriptive study of individuals successful at long-term maintenance of substantial weight loss. Am J Clin Nutr 66:239-246, 1997.

21. National Task Force on the Prevention and Treatment of Obesity: Very low-calorie diets JAMA 270(8):967-974, 1993.

22. Schlundt, DG, Hill, JO, Pope-Cordle, J, Arnold, D, Virts, KL, Katahn, M: Randomized evaluation of a low fat ad libitum carbohydrate diet for weight reduction. Int J Ob 17:623-629, 1993.

23. Pascale, RW, Wing, RR, Butler, BA, Mullen, M, Bononi, P: Effects of a behavioral weight loss program stressing calorie restriction versus calorie plus fat restriction in obese individuals with NIDDM or a family history of diabetes. Diabetes Care 18(9):1241-1248, 1995.

24. Viegener, BJ, Perri, MG, Nezu, AM, Renjilian, DA, McKelvey, WF, Schein, RL: Effects of an intermittent, low-fat, low-calorie diet in the behavioral treatment of obesity. Behav Ther 21:499-509, 1990.

25. Holden, JH, Darga, LL, Olson, SM, Stettner, DC, Ardito, EA, Lucas, CP: Long-term follow-up of patients attending a combination very-low calorie diet and behaviour therapy weight loss programme. Int J Ob 16:605-613, 1992.

26. Harris, JK, French, SA, Jeffery, RW, McGovern, PG, Wing, RR: Dietary and physical activity correlates of long-term weight loss. Obes Res 2(4):307-313, 1994.

27. Wing, RR, Hill, JO: Successful weight loss maintenance. Ann Rev Nutr 21:323-341, 2001.

28. Guare, JC, Wing, RR, Marcus, MD, Epstein, LH, Burton, LR, Gooding, WE: Analysis of changes in eating behavior and weight loss in type II diabetic patients. Diabetes Care 12:500-503, 1989.

29. Wadden, TA, Letizia, KA, Predictors of attrition and weight loss in patients treated by moderate and severe caloric restriction, in Treatment of the seriously obese patient, T.A. Wadden and T.B. VanItallie, Editors. 1992, The Guilford Press: New York. p. 383-410.

30. Jeffery, RW, Wing, RR, Thorson, C, Burton, LR, Raether, C, Harvey, J, Mullen, M: Strengthening behavioral interventions for weight loss: A randomized trial of food provision and monetary incentives J Consult Clin Psychol 61:1038-1045, 1993.

31. Wing, RR, Jeffery, RW, Burton, LR, Thorson, C, Sperber Nissinoff, K, Baxter, JE: Food provision vs. structured meal plans in the behavioral treatment of obesity. Int J Ob 20:56-62, 1996.

32. Metz, JA, Stern, SS, Kris-Etherton, P, et.al.: A randomized trial of improved weight loss with a prepared meal plan in overweight and obese patients. Arch Int Med V 160:2150-2158, 2000.

33. Ditschuneit, HH, Flechtner-Mors, M, Johnson, TD, Adler, G: Metabolic and weight-loss effects of a long-term dietary intervention in obese patients. Am J Clin Nutr 69:198-204, 1999.

34. Wing, R: Physical activity in the treatment of the adulthood overweight and obesity: current evidence and research issues. Med Sci Sports Exer 31:S547-S552, 1999.

35. Pronk, NP, Wing, RR: Physical activity and long-term maintenance of weight loss. Obes Res 2:587-599, 1994.

36. Perri, MG, Martin, AD, Leermakers, EA, Sears, SF, Notelovitz, M: Effects of group- versus home-based exercise in the treatment of obesity. J Consult Clin Psychol 65:278-285, 1997.

37. Andersen, RE, Bartlett, SJ, Moser, CD, Evangelisti, MI, Verde, TJ: Lifestyle or aerobic exercise to treat obesity in dieting women. Med Sci Sports Exer 29:S46., 1997.

38. Wadden, TA, Vogt, RA, Andersen, RE, Bartlett, SJ, Foster, GD, Kuehnel, RH, Wilk, J, Weinstock, R, Buckenmeyer, P, Berkowitz, RI, Steen, SN: Exercise in the treatment of obesity: Effects of four interventions on body composition, resting energy expenditure, appetite, and mood . J Consult Clin Psychol 65:269-277, 1997.

39. Wadden, TA, Vogt, RA, Foster, GD, Anderson, DA: Exercise and maintenance of weight loss: 1-year follow-up of a controlled clinic trial. J Consult Clin Psychol 66:429-433, 1998.

40. Jakicic, J, Wing, R, Winters, C: Effects of intermittent exercise and use of home exercise equipment on adherence, weight loss, and fitness in overweight women. JAMA 282:1554-1560, 1999.

41. Jeffery, RW, Wing, RR, Thorson, C, Burton, LC: Use of personal trainers and financial incentives to increase exercise in a behavioral weight-loss program. J Consult Clin Psychol 66:777-783, 1998.

42. Jeffery, RW, Wing, RW: The Effects of an Enchanced Exercise Program on Long-term Weight Loss. Obes Res 9:100S, 2001.

43. Jakicic, JM, Wing, RR, Butler, BA, Robertson, RJ: Prescribing exercise in multiple short bouts versus one continuous bout: Effects on adherence, cardiorespiratory fitness, and weight loss in overweight women. Int J Ob 19:893-901, 1995.

44. Epstein, LH, Valoski, AM, Vara, LS, McCurley, J, Wisniewski, L, Kalarchian, MA, Klein, KR, Shrager, LR: Effects of decreasing sedentary behavior and increasing activity on weight change in obese children. Health Psychol 14:109-115, 1995.

45. Robinson, T: Reducing children’s television viewing to prevent obesity. JAMA 282:1561-1567, 1999.