An Analytic Review of Current Therapies for Obesity

Michelle D. Holmes, MD, Bernice Zysow, MD, and Thomas L. Delbanco, MD
Boston, Massachusetts

Weight control is a cornerstone objective for many diseases common in medicine. Substantial, prolonged weight loss is difficult to achieve. Nutrition counseling, very low calorie diets, behavior modification, exercise, intragastric balloon, and gastric restriction surgery are interventions that physicians may recommend for obese patients. This paper analyzes the efficacy of these methods with attention to attrition rates, maximum weight loss, long-term maintenance of weight loss, and morbidity. Strategies for intervention for various classes of obese patients are recommended.

The obese adult patient poses a frustrating problem for every physician. Success in achieving sustained weight control is rare, even though attempts at weight loss are cornerstone treatments for many common diseases, such as hypertension, diabetes, heart disease, and degenerative joint disease. Obesity has been referred to as a "serious, prevalent, and refractory disorder," and the cure rate for cancer is higher.[1] In 1985 the National Institutes of Health, in their consensus report, defined obesity as an excess of adipose tissue that frequently results in significant impairment of health. They defined an increase in weight 20% (or more) over ideal body weight as a health hazard; lesser degrees of obesity can be a hazard in the presence of cardiovascular disease or diabetes. For clinical practice or public health studies, the authors recommend quantifying obesity in adults by using tables published by the Metropolitan Life Insurance Company (1959 or 1983 version) or the body mass index (kilograms divided by height in meters squared).[2]

Pessimism with therapy aimed at weight reduction was first voiced in a 1959 landmark paper by Stunkard and McLaren-Hume.[3] Using strict methodological criteria, they studied outpatient treatments available at that time. They found that 25% of the patients studied lost 9.1 kg (20 lb), and only 5% were able to lose 18.2 kg (40 lb). In 1977 Wing and Jeffery[4] reported only slight improvement in the effectiveness of treatment. Currently, health professionals still have difficulty advising patients on the best method to lose weight.

In this paper the most popular, available weight-loss methods are analyzed and recommendations are offered for various categories of obese adult patients.

DIET

The first, and for many the only, intervention prescribed by primary care providers is a low-calorie diet, generally 800 to 1500 kcal/d.

The majority of studies concerned with dietary control of obesity have been performed on metabolic wards and on small numbers of subjects with short-term follow-up only. One study, however, revealed that on a 1200-kcal balanced diet, obese subjects lost 0.45 kg (1 lb) per day for the first 5 days and 0.3 kg (0.7 lb) per day for days 7 through 10.[5] Because of high attrition rates and problems in monitoring and assessing compliance, no studies have been reported that investigated weight loss on a calorically restricted diet administered through a physician's office.

Many physicians prefer to have patients counseled by nutritionists when available. In 1959 Stunkard and McLaren-Hume[3] reported their experience at Cornell Medical Center following 100 patients referred to the nutrition clinic. Routine treatment in that setting was less successful than the clinical outpatient programs also reviewed in that paper. Only 12% were able to lose 9.1 kg (20 lb) and 1% lost 18.2 (40 lb). There was a 40% attrition rate, and 28% never returned to the primary provider or to a clinic. One year later, six of the 12 patients who had lost 9.1 kg (20 lb) maintained that loss, and after 2 years, only

Submitted, revised, February 21, 1989.

From the Division of General Medicine and Primary Care, Department of Medicine, Harvard Medical School, Beth Israel Hospital, the Charles A. Dana Research Institute, and the Harvard-Thorndike Laboratory, Boston, Massachusetts. Requests for reprints should be addressed to Dr. Michelle D. Holmes, Department of Medicine, The Cambridge Hospital, 1493 Cambridge St, Cambridge, MA 02139.

two had maintained it. There have been no more recent data to refute this dismal record.

Very Low Calorie Diets

In the late 1970s a number of authors reported remarkable weight reduction in morbidly obese patients using very low calorie diets.[6-9] Initial enthusiasm dampened when resultant widespread unsupervised use of these diets in the form of liquid protein led to a number of deaths. A very low calorie diet contains fewer than 800 kcal/d.[10] A popular form of the very low calorie diet is the protein-sparing modified fast. Its purpose is essentially starvation, while providing enough protein to maintain nitrogen balance and, it is hoped, lean body mass. Uncontrolled studies show weight loss at 1 to 2 kg per week (2.2 to 4.4 lb) for women and 1.5 to 2.5 kg per week (3.3 to 5.5 lb) for men.[10] Programs with a minimum duration of 12 weeks have a mean weight loss of 20 kg (44 lb).[10] This amount of weight loss may be compared with the average loss for conventional diets plus behavior therapy of 5 to 7 kg in 12 weeks, with only 10% achieving a 20-kg loss.[10]

The attrition rate in very low calorie diet programs is 33% to 50%.[10] Maintenance of weight loss has not been studied thoroughly, but results are disappointing. The best results have shown that at 18 to 24 months of follow-up, one third of the original 20.8 kg (45.8 lb) lost had been gained back.[10] Many (22%) of the patients in this study, however, were lost to follow-up. Other studies have found 50% to 78% of the subjects returning to their original weight within 1 to 3 years.[10] Because of the high cost, most of the patients are of high socioeconomic status. The most common adverse side effects include orthostatic hypotension, constipation, hair loss, cold intolerance, and menstrual irregularities. Despite depression and other emotional responses that have been attributed to dieting,[11] psychiatric problems associated with these very low calorie diets have been extremely uncommon.[6,7,10,12]

Properly supervised, low-calorie diets appear safe when compared with liquid-protein diets. The deaths attributed to cardiac arrhythmias (quite likely, *torsade de pointes*) following the liquid-protein diets were probably due to preexisting illnesses, low-quality protein, and no potassium supplementation. Follow-up with short- and long-term electrocardiographic monitoring for those treated with very low calorie diets have shown no arrhythmias. The possibility exists that very low calorie diets may be even safer than diuretics in obese hypertensive patients; the results of the Multiple Risk Factor Intervention Trial suggested that in some hypertensive patients diuretic therapy may have contributed to increased cardiovascular mortality.[13]

BEHAVIOR MODIFICATION THERAPY

Over the last 20 years, behavior modification therapy has become the dominant therapeutic approach to weight control. Treatment assumes that obesity is the consequence of overeating, an abnormal behavior that can be unlearned. Stunkard and Berthold[14] have reported on the elements of a typical behavior-modification program: stimulus control, eating behavior (eg, putting fork down between mouthfuls, leaving some food on the plate, no reading or watching television while eating), reward, self-monitoring, nutrition education, physical activity, and cognitive restructuring. In most structured programs, participants meet weekly for about 1 hour in a group format. The length of the program is variable and can last from 6 weeks to 6 months, with an average of 10 to 12 weeks.

Of the hundreds of clinical behavioral therapy trials reported, many have lacked control groups, but results are remarkably consistent[15-18]:

1. In the best programs, attrition rates are approximately 15%.
2. Weight loss is only moderately successful (average is 5 kg or 11 lb) and represents a fraction of the goal.
3. Further weight loss does not occur after active intervention ends.
4. Weight loss is maintained for 1 year, but, after that, slow weight gain is the rule.
5. Although significantly greater weight loss can be achieved over a longer period of therapy, rate of loss diminishes over time.
6. Results are extremely variable and cannot be predicted by demographics or patient characteristics.
7. There have been no negative side effects associated with behavioral therapy.

Behavior-modification therapy is often used as an adjunct to therapies such as exercise, low-calorie diets, and anorectic drugs. This approach has been used in a variety of settings, such as the workplace, and by nonprofit and commercial self-help groups.

Behavior Modification in the Work Setting

Virtually all weight control programs in the work setting have been behavior therapy programs.[19-22] Results, at best, have been similar to clinical behavior therapy programs, with the average participant losing about 0.5 kg (1 lb) per week. Many programs achieve only one-half that.[23] Maintenance of weight loss in worksite programs has also been similar to that of clinical programs; however, no experience has been reported with a follow-up of longer than 1 year. Attrition rates average about 50%, and Brownell et al[23] postulate that the reasons for this high rate might include (1) low cost to the participant, (2) too convenient, (3) social pressure from management to enroll, and (4) lower socioeconomic status of worksite participants.

BEHAVIORAL AND OTHER THERAPIES IN SELF-HELP AND LAY GROUPS

Throughout the years, numerous for-profit and nonprofit self-help and lay groups for weight control have arisen in

the community. Although as private organizations they have the advantage of being able to reach large numbers of people, little objective information is available. TOPS (Take Off Pounds Sensibly) is a nonprofit group designed after the principles of Alcoholics Anonymous. Group sessions consist of weighing in, public praise or censure for weight loss or gain, group discussion, and singing. From 1969 to 1970, Garb and Stunkard[24] studied 21 local chapters and found mean weight loss between 6.4 and 6.8 kg (14 to 15 lb). They also found very high attrition rates of 47% at 1 year and 70% at 2 years. Volkmar et al[25] studied commercial weight control programs. These too had high attrition rates, 50% at 6 weeks and 70% at 12 weeks. In the most effective commercial group studied, the average weight loss for participants was 7.1 kg (15.6 lb) in 12 weeks; however, no long-term follow-up was reported.[25]

Ashwell and Garrow[26] in the United Kingdom found similar results in 1974 in three weight control organizations whose programs consisted basically of dietary advice. Attrition rates were 59% after 6 months, 77% after 1 year. Participants in Weight Watchers lost significantly more than those in the other two groups (11.8 kg vs 8.6 kg vs 7.3 kg).

In 1974, Levitz and Stunkard[27] showed that the addition of behavior therapy to some community-based TOPS chapters significantly decreased attrition rates to approximately 40% at 1 year. Initial weight loss was greater compared with controls, and at a 12-month follow-up, program enrollees had continued to lose, while those in control groups had gained over their pretreatment weights. After these results were known, many commercial groups were quick to add a behavioral modification component to their programs. TOPS, however, did not keep the behavioral modification component and reverted back to its old program.

EXERCISE

There is substantial evidence that exercise is beneficial to those suffering from obesity, diabetes, and hypertension. Although it is clear that obese people are much less active, relatively little attention has been paid to methods that promote energy expenditure in the obese. The pessimistic attitude toward exercise derives from the finding that energy expenditure in even very vigorous training programs is quite low, compared with the amount of kilocalories contained in 1 kg of adipose tissue.[28] Exercise programs have high attrition rates (70% to 80%) in the first 1 to 2 years, in spite of participants viewing them as a positive experience.[28] These data come from studies of cardiac rehabilitation programs, not from studies of programs directed principally toward the obese. It appears difficult for these cardiac patients to incorporate exercise into their everyday lives. It is not clear whether that conclusion can be generalized to the obese population.

Exercise alone can cause weight loss in obese subjects. Weight loss obtained through exercise may be difficult to compare with weight loss obtained through other methods, however, because exercisers may preferentially lose adipose tissue and preserve, or even increase, lean body mass.[28,29] Nonexercising dieters lose both adipose tissue and lean body mass. In a study comparing a 700-kcal diet, nutrition and health education, behavior treatment, and exercise, successful weight loss was defined as 16 kg (35 lb).[30] The best predictor of success was exercise. Exercise added to behavior therapy can cause greater weight loss than either therapy alone.[31]

Walking is favored for obese, unconditioned patients. Few patients (and even providers) are aware of the commitment required to obtain results. While 22 dropped out of the study, Gwinup[29] was able to follow 11 women who walked at least 30 minutes each day for 1 year without any dietary restrictions. Weight loss paralleled the amount of time spent exercising per day, with most occurring in those who exercised more than 3 hours per day. Average loss was 10 kg (22 lb), but those who discontinued exercise had rapid weight gain. Weight loss was always slow. Skinfold decrease was much greater than expected for the amount of weight loss, suggesting that weight loss involved fat and was accompanied by some increase in muscle mass.

Seventy-two mildly obese (average was 121% ideal body weight) Boston police officers were treated with an 800-kcal diet. Some performed aerobic exercise and attained 70% to 85% maximal heart rate for 22 to 46 minutes three times a week, and some did not exercise.[32] At the end of 8 weeks, both groups had lost a clinically significant amount of weight, 11.8 kg (26 lb) in the exercise groups 9.2 kg (20.2 lb), but the composition of weight loss was different. Those who exercised did not lose any lean body mass (determined by total body potassium-40 measured in a body counter), while in the nonexercising group 36% of the weight loss was lean body mass.

According to these studies, it appears that the typical amount of weight loss attributable to aerobic exercise programs is 10 to 12 kg (22 to 26 lb). Long-term follow-up greater than 1 year has not been documented.

DRUGS

In 1972 the Federal Drug Administration (FDA)[33] published an analysis evaluating the effectiveness of anorectic drugs in over 200 double-blind studies and 10,000 subjects. It concluded that weight loss attributable to drugs was trivial (less than 1 kg per week) compared with the risks involved. In 1973 the FDA severely limited the use of amphetamines and other anorectics for treating obesity because of multiple side effects, the potential for addiction, and widespread abuse.

Phenylpropanolamine, an active ingredient in many diet pills sold over the counter, is a sympathomimetic also present in many nasal decongestants. Although one study (using placebo and controls) showed weight loss over a 4-week period with this drug, long-term effectiveness has never been studied.[34] Several reports tell of untoward side

effects, including hypertensive crises and psychotic episodes, in those using these over-the-counter preparations.[35,36]

Benzocaine, usually incorporated into a candy, is a relatively safe topical anesthetic that purports to dull the taste buds and thus curb the appetite. One placebo-controlled study found short-term weight loss of 3.2 kg (7 lb), but another obtained mixed results.[37,38]

Since it does not affect the noradrenergic system, fenfluramine is an anorectic with a mechanism of action different from other drugs. Fenfluramine can cause weight loss.[39] A recent trial, however, showed that although subjects using fenfluramine plus a diet lost more weight than subjects using diet alone at 3 months, this difference disappeared at 6 months.[40] Craighead et al[41] published a large-scale, controlled trial comparing fenfluramine with behavior therapy and concluded that therapy with fenfluramine produced more rapid regaining of weight and interfered with long-term benefits of behavior therapy.

SURGERY

Payne, DeWind, and others[42,43] pioneered clinical trials using jejunoileal bypass to treat morbid obesity. Theirs and a number of other studies documented impressive weight loss, but, unfortunately, jejunoileal bypass has many postoperative complications, including liver fibrosis in 5% of patients. In 1% of all patients, this fibrosis leads to fatal cirrhosis.[44-46]

Because of the morbidity associated with jejunoileal bypass, various forms of gastric-restriction procedures have been developed. Gastric bypass was first performed by Mason and Ito in 1967.[47] Operative mortality rates, similar to those for jejunoileal bypass, average 4%, ranging from 0% to 6%.[48] In contrast, however, serious postoperative complications such as reflux gastritis and marginal ulcerations are relatively rare. Nausea and vomiting are minor complications reported by a majority of patients in the immediate postoperative period. Weight loss, averaging 2 to 2.5 kg per month (4.4 to 5.5 lb),[49] usually ceases after 20 to 26 months. Average total weight loss is between 40 and 70 kg (88 to 154 lb).

Studies of bilateral truncal vagotomy in a small number of patients have shown average weight loss of 20 to 30 kg (44 to 66 lb) in a 4- to 24-month follow-up.[50-51] Side effects include foul-smelling eructations, diarrhea, and fatigue. The hypothesis is that weight reduction may (1) be due to alterations in vagally mediated central and peripheral mechanisms for appetite regulation, and (2) reflect delayed gastric emptying.

JAW WIRING

Jaw wiring, known also as maxillomandibular fixation or dental splinting, is another means of weight reduction in the morbidly obese. The Adelaide Obesity Group reported a median weight loss of about 40% of excess weight over 6 months.[52] Kark[53] reported on 14 morbidly obese patients followed over a period of 2 years. Patients were encouraged to limit their diet to 800 kcal of fluids and liquidized soft foods. The mean duration of wiring was 8.6 months, with average weight loss of 29.8 kg (65.5 lb). Only one of the patients had maintained the weight loss at the end of the 2-year study, and there was a 50% attrition rate. Some centers have achieved more satisfactory results by first using jaw wiring, with attendant rapid early weight loss, and then performing gastric bypass surgery.[53] The purpose is to make the abdominal surgery less hazardous technically.

INTRAGASTRIC BALLOON

This experimental technique has been likened to an artificial bezoar, a large intragastric mass of foreign material. It can be tolerated for long periods with few symptoms except for weight loss. The balloon is a soft, plastic cylinder inserted into the stomach using endoscopy in an outpatient procedure that takes about 30 minutes. The FDA recommends that the device be removed after 4 months.

Garren[54] reported on 100 morbidly obese patients who received this type of treatment along with behavior modification therapy, nutritional counseling, and individualized low-calorie diets of about 1000 kcal/d. Balloons were replaced every 4 months; the longest treatment period was 1 year. Mean cumulative weight loss was 18.2 kg (40 lb) over a 6-month period, and 34.8 (76.5 lb) over a 10-month period. Complications included balloon deflation in 9% of cases, with consequent increase in hunger. The device then either passed without pain in the stool or was removed endoscopically. One balloon deflated and caused partial gastric-outlet obstruction, and another required surgical removal after lodging in a site of prior surgery that contained an adhesion. The majority of patients developed nausea, cramping, and vomiting during the first 3 days, but symptoms responded to antiemetic and antispasmodic medications. Gastric ulcerations developed in four patients.

Long-term maintenance of weight loss has yet to be demonstrated.[54,55] Recent reports of complications, including esophageal rupture, small-bowel obstruction, and difficulty deploying the device from the introducer, may dampen initial enthusiasm for this treatment.[56-59] Several controlled trials are ongoing at present, and their results will be important in determining the future of this device.

RECOMMENDATIONS

This paper does not address the problem of childhood obesity. Nor does it address the controversy over whether being moderately overweight contributes to increased mortality; this issue has been discussed elsewhere.[2] One should note also that few studies have investigated potential ill effects of obesity in specific groups such as minorities,

TABLE 1. CURRENT THERAPEUTIC APPROACHES TO OBESITY AND THEIR OUTCOMES

METHOD	ATTRITION RATE	MEAN MAXIMUM WEIGHT LOSS	% LOSING 9.1 KG(20 LB)	6 MONTH FOLLOW-UP	1 YEAR FOLLOW-UP	2 YEAR FOLLOW-UP	MORBIDITY	COMMENTS
NUTRITIONAL COUNSELING	40%		12%		6% MAINTAIN WEIGHT LOSS	2% MAINTAIN WEIGHT LOSS	WEAKNESS, IRRITABILITY, FATIGUE, NAUSEA, PSYCHIATRIC DISTURBANCE (RARE)	-1% LOST 18.2KG (40LB) -28% NEVER RETURNED TO THE REFERRING PROVIDER
BEHAVIOR MODIFICATION -CLINICAL PROGRAMS	15%	5KG (11 LB)			NEARLY 100% MAINTAIN WEIGHT LOSS	40% OF WEIGHT LOST IS REGAINED	NONE	
-WORKSITE PROGRAMS	50%	2.3-4.5KG (5-10LB)						
-COMMUNITY RUN BEHAVIORAL PROGRAMS (WITHOUT BEHAVIORAL COMPONENT)	40% (UP TO 70%)	1-10KG (2-22LB)			13% MAINTAIN WEIGHT LOSS			
EXERCISE	70-80%	10-12KG (22-26LB)			10-12 KG MAXIMUM WEIGHT LOSS OCCURS AFTER APPROXIMATELY 1 YEAR		MUSCULOSKELETAL INJURIES	-ATTRITION RATE NEVER ADEQUATELY DETERMINED IN OBESE SUBJECTS -PROMOTES RETENTION OF LEAN BODY MASS
VERY LOW CALORIE DIET	35-50%	20KG (44LB)				BEST RESULTS 30% OF WEIGHT LOST IS REGAINED	LITTLE, WHEN MEDICALLY SUPERVISED -ORTHOSTATIC HYPOTENSION, HAIR LOSS, MENSTRUAL IRREGULARITY	HIGH COST
GASTRIC RESTRICTION SURGERY	0%	40-70KG (88-154LB)				40-70KG MAXIMUM WEIGHT LOSS OCCURS AFTER APPROXIMATELY 2 YEARS	-4% OPERATIVE MORTALITY -REFLUX GASTRITIS, ULCERS, NAUSEA, VOMITING	
MAXILLO-MANDIBULAR FIXATION	50%	30KG (66LB)				7% MAINTAIN WEIGHT LOSS	2.4% COMPLICATION RATE -DENTAL INFECTION, CARIES, ASPIRATION, TRANSIENT LIMITATION OF JAW MOVEMENT AFTER WIRE REMOVED	
GASTRIC BALLOON	22%	34.5KG (76LB)		18.2KG (40LB) LOST AFTER 6 MONTHS OF TREATMENT	34.5KG (76LB) LOST AFTER 10 MONTHS OF TREATMENT		-BALLOON DEFLATION 10% -ULCERS 1-4% -OBSTRUCTION 2%	

women, and the elderly, and that conclusions based on other populations may not be applicable.[60] It is clear, however, that obesity worsens many common diseases, such as diabetes and hypertension, and weight loss can be one of the most important treatments for these conditions.[61-64] Morbid obesity, defined as 45.5 kg or 100 lb overweight or 200% of ideal body weight, particularly in the young adult, doubles the risk of mortality above that of the general population.[65] Given this information, morbidity caused by invasive methods of weight control becomes more acceptable as physicians and patients balance individual risks.

Table 1 is a summary of the current therapeutic approaches to obesity and their outcomes, with respect to expected maximum weight loss, rates of attrition, long-term efficacy, and morbidity. Given the varied alternatives for therapy, the benefits and, for some, the risks, how should the office-based physician manage adult patients with obesity? Training of physicians in behavior modification techniques might prove beneficial. These techniques, however, have most often been applied in group settings, and the average intervention has been very time-intensive (1 hour per week for 10 to 12 weeks). Most physicians have neither the time nor training to provide such services in the office. As there are no formal studies on the impact of diet counseling in the physician's office, and given the poor record of diet counseling by more formally trained nutritionists, there is little to suggest that physicians can expect more than occasional success. Courses that combine behavior modification and nutrition information are increasingly available in the community, sponsored by work sites, self-help organizations, or private consultants. Physicians should become aware of the resources and their quality in their community. Beyond diet and behavior modification, the high-risk obese patient requires specialty consultation focusing increasingly on surgical interventions.

Recommendations for patients at various levels of weight and risk are summarized in Table 2. These recommendations are based on the amount of desired weight loss and applying the least morbid intervention that can be reasonably expected to give that amount of weight loss. Expected outcomes for these interventions are based on the analysis in this review. Clearly, validation of these recommendations by direct, prospective comparison would be optimal. In particular, the paucity of information on the long-term efficacy of weight loss interventions should make this aspect a research priority. Considering the sobering results of interventions, inquiry must focus on prevention. Such risk factors as stress, depression, poverty, poor basic understanding of nutrition, and a strong family history of obesity should be warning signs for the patient

TABLE 2. RECOMMENDATIONS FOR VARIOUS WEIGHT CATEGORIES

Desired Weight Loss	Intervention
Less than 9.1 kg (20 lb)	Diet counseling plus behavior therapy community-run or worksite programs
	Exercise program Aerobic exercise for 30 min at least 3 times per wk Walking for 30 min at least 7 times per wk
9.1 to 45.5 kg (20 to 100 lb)	Medically supervised very low calorie diet Behavior therapy, diet counseling, and exercise
More than 45.5 kg (100 lb)	Surgical intervention; gastric restriction
	Prior to surgery, consider very low calorie diet, gastric balloon, behavior therapy, diet counseling, and exercise

and physician. Education and simple warnings of risk before obesity occurs may prove to be the best intervention, considering the understanding physicians have of this puzzling and tenacious illness at this time.

Acknowledgment

This paper was supported in part by grants from the Health Resources and Services Administration, Department of Health and Human Services, and the Harvard-Ryoichi Sasakawa International Fellowship Program in Primary Care.

References

1. Brownell KD: Obesity: Understanding and treating a serious, prevalent, refractory disorder. J Consult Clin Psychol 1982; 50:820–840
2. National Institutes of Health Consensus Development Conference statement. Health implications of obesity. Ann Intern Med 1985; 103:1073–1077
3. Stunkard A, McLaren-Hume M: The results of treatment of obesity. Arch Intern Med 1959; 103:79–85
4. Wing RR, Jeffery RW: Outpatient treatments of obesity: A comparison of methodology and clinical results. Int J Obesity 1979; 3:261–279
5. Yang M-U, Van Itallie TB: Composition of weight loss during short-term weight reduction: Metabolic responses of obese subjects to starvation and low-calorie ketogenic and nonketogenic diets. J Clin Invest 1976; 58:722–730
6. Bistrian BR: Clinical use of protein sparing modified fast. JAMA 1978; 240:2299–2302
7. Vertes V, Genuth SM, Hazelton IM: Supplemental fasting as a large scale outpatient program. JAMA 1977; 32:2579–2586
8. Genuth S: Supplemental fasting in the treatment of obesity and diabetes. Am J Clin Nutr 1979; 238:2151–2153
9. Genuth SM, Castro JH, Vertes V: Weight reduction in obesity by outpatient semistarvation. JAMA 1974; 230:987–991
10. Wadden T, Stunkard AJ, Brownell KD: Very low calorie diets: Their efficacy, safety, and future. Ann Intern Med 1983; 99:675–684
11. Stunkard AJ, Rush J: Dieting and depression reexamined: A critical review of reports of untoward responses during weight reduction for obesity. Ann Intern Med 1974; 81:526–533
12. Palgi A: Multidisciplinary treatment of obesity with a protein sparing modified fast: Results in 688 outpatients. Am J Public Health 1985; 75:1190–1184
13. Multiple Risk Factor Intervention Trial Research Group (MRFIT). Risk factor changes and mortality results. JAMA 1982; 248:1465–1477
14. Stunkard AJ, Berthold HC: What is behavior therapy? A very short description of behavioral weight control. Am J Clin Nutr 1985; 41:821–823
15. Foreyt JP, Goodrick GK, Gotto AM: Limitations of behavioral treatment of obesity: Review and analysis. J Behav Med 1981; 4:159–174
16. Jeffery RW, Wing RR, Stunkard AJ: Behavioral treatment of obesity: The state of the art in 1976. Behav Ther 1978; 9:189–199
17. Stunkard AJ: Behavioral management of obesity. Med J Austr 1985; 142(suppl):S13–S20
18. Wilson GT, Brownell KD: Behavior therapy for obesity: An evaluation fo the treatment outcome. Adv Behav Res Ther 1980; 3:49–86
19. Foreyt JP, Scott LW, Gotto AM: Weight control and nutrition education programs in occupational settings. Pub Health Rep 1980; 95:127–136
20. Abrams DB, Follick MJ: Behavioral weight loss intervention at the worksite: Feasibility and maintenance. J Consult Clin Psychol 1983; 51:226–233
21. Stunkard AJ, Brownell KD: Worksite treatment for obesity. Am J Psychiatry 1980; 137:252–253
22. Brownell KD, Stunkard AJ, McKeon PE: Weight reduction at the worksite: A promise partially fulfilled. Am J Psychiatry 1985; 142:47–52
23. Brownell KD, Cohen RY, Stunkard AJ, et al: Weight loss competitions at the worksite: Impact on weight, morale and cost-effectiveness. Am J Public Health 1984; 74:1283–1285
24. Garb JR, Stunkard AJ: Effectiveness of self-help groups in obesity control. Arch Intern Med 1974; 134:716–720
25. Volkmar FR, Stunkard AJ, Woolston JW, Bailey RA: High attrition rates in commercial weight reduction programs. Arch Intern Med 1981; 141:426–428
26. Ashwell M, Garrow JS: A survey of 3 slimming and weight control organizations in the UK. Nutrition 1974; 29:347–356
27. Levitz LS, Stunkard AJ: A therapeutic coalition for obesity: Behavior modification and patient self-help. Ann Psychiatry 1974; 131:423–427
28. Bjorntorp P: Exercise and obesity. Psychiatry Clin N Am 1978; 1:691–696
29. Gwinup G: Effect of exercise alone on the weight of obese women. Arch Intern Med 1975; 135:676–680
30. Miller PM, Sims KL: Evaluation and component analysis of a comprehensive weight control program. Int J Obesity 1981; 5:57–66
31. Dahlkoetter J, Callahan EJ, Linton J: Obesity and the unbalanced energy equation: Exercise vs eating habit change. J Consult Clin Psychol 1979; 47:898–905
32. Pavlou KN, Steffee WP, Lerman RH, et al: Effects of dieting and exercise on lean body mass, oxygen intake, and strength. Med Sci Sports Exerc 1985; 17:466–471
33. Anorectics have limited use in treatment of obesity. FDA Drug Bull, Dec 1972, unpaged
34. Griboff SI, Berman R: A double-blind clinical evaluation of a phenylpropanolamine-caffeine-vitamin combination and a placebo in the treatment of exogenous obesity. Curr Ther Res 1975; 17:535–543
35. Dietz WH: Amphetamine-like reactions to phenylpropanolamine. JAMA 1981; 245:601–602
36. Horowitz JD, Lang WJ, Howes LG, et al: Hypertensive responses induced by phenylpropanolamine in anorectic and decongestant preparations. Lancet 1980; 1:60–61
37. McClure CW, Brusch CA: Treatment of oral syndrome obesity with nontraditional appetite control plan. JAMA 1973; 28:238–248
38. Collipp PJ: The treatment of exogenous obesity by medicated benzocaine candy: A double-blind placebo study. Obes Bariat Med 1981; 10:123–125
39. Hudson KD: The anorectic and hypotensive effect of fenfluramine in obesity. J R Coll Gen Pract 1977; 27:497–501
40. Sensi S, DellaLoggia F, DelPonte A, et al: Long-term treatment with fenfluramine in obese subjects. Int J Clin Pharmacol Res 1985; 5:247–253

41. Craighead LW, Stunkard AJ, O'Brien RM: Behavior therapy and pharmacotherapy for obesity. Arch Gen Psychiatry 1981; 38:763–768
42. Payne JH, DeWind LT, Commons RR: Metabolic observation in patients with jejunoileal shunts. Am J Surg 1963; 106:273–289
43. Payne JH, DeWind LT: Surgical treatment of obesity. Am J Surg 1969; 118:141–147
44. Bray GA, Greenway FL, Barry RE, et al: Surgical treatment of obesity: A review of our experience and an analysis of published reports. Int J Obes 1977; 1:331–367
45. Phillips RB: Small intestine bypass for the treatment of morbid obesity. Surg Gynecol Obstet 1978; 146:455–468
46. Bray GA: Current status of intestinal bypass surgery in the treatment of obesity. Diabetes 1979; 26:1072–1079
47. Mason EE, Ito C: Gastric bypass in obesity. Surg Clin N Am 1967; 47:1345–1349
48. Printen KJ: The Obese Patient. Philadelphia, WB Saunders, 1976, p 435
49. Buckwaiter JA: A prospective comparison of the jejunoileal and gastric bypass operation for morbid obesity. World J Surg 1977; 1:757–768
50. Kral JG: Vagotomy for treatment of severe obesity. Lancet 1978; 1:307–308
51. Kral JG: Vagotomy as a treatment for morbid obesity. Surg Clin N Am 1979; 59:1131–1138
52. Rodgers S, Burnet R, Closs A, et al: Jaw wiring in the treatment of obesity. Lancet 1977; 1:1221–1222
53. Kark AE: Jaw wiring. Am J Clin Nutr 1980; 33:420–424
54. Simple device promotes safe weight loss. Gastroenterol Observ 1986; 5(2):1–8
55. A gastric balloon for treatment of obesity. Med Lett 1986; 28:77–78
56. Rubio PA: Esophageal rupture secondary to passage of a gastric bubble for weight control, letter. Arch Surg 1988; 123:394–395
57. Boyle TM, Agus SG, Bauer JJ: Small intestinal obstruction secondary to obturation by a Garren gastric bubble. Am J Gastroenterol 1987; 82:51–53
58. Kirby DF, Mills PR, Kellum JM, et al: Incomplete small bowel obstruction by the Garren-Edwards gastric bubble necessitating surgical intervention. Am J Gastroenterol 1987; 82:251–253
59. Fedotin MS, Ginsburg BW: Partial deployment of the Garren gastric bubble: A new complication. Am J Gastroenterol 1987; 82:470–471
60. Andres R, Elahi D, Tobin JD, et al: Impact of age on weight goals. Ann Intern Med 1985; 103 (suppl 6, pt 2):1030–1033
61. Van Itallie TB: Health implications of overweight and obesity in the United States. Ann Intern Med 1985; 103 (suppl 6, pt 2):983–988
62. Dustan HP: Obesity and hypertension. Ann Intern Med 1985; 103 (suppl 6, pt 2):1047–1049
63. Martin L: Effect of weight reduction on normal and raised blood pressure in obesity. Lancet 1952; 2:1051–1053
64. Eliahon HE, Iainz A, Gaon T, et al: Body weight reduction necessary to attain normotension in the overweight hypertensive patient. Int J Obes 1979; 5:157–163
65. Kral JG: Morbid obesity and related health risks. Ann Intern Med 1985; 103 (suppl 6, pt 2):1043–1047