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Dietary therapy for obesity

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INTRODUCTION — The optimal management of overweight and obesity requires a combination of diet, exercise, and behavioral modification. In addition, some patients eventually require pharmacologic therapy or bariatric surgery. The risk of overweight to the subject should be evaluated before beginning any treatment program. Selection of treatment can then be made using a risk-benefit assessment ([figure 1](#)). The choice of therapy is dependent on several factors including the degree of overweight or obesity and patient preference.

This topic will review the dietary therapy of obesity. Other aspects of treatment are discussed separately. (See "[Health hazards associated with obesity in adults](#)" and "[Overview of therapy for obesity in adults](#)" and "[Drug therapy of obesity](#)" and "[Behavioral strategies in the treatment of obesity](#)".)

GOALS OF WEIGHT LOSS — It is important to set goals when discussing a dietary weight loss program with an individual patient. An initial weight loss goal of 5 to 7 percent of body weight is realistic for most individuals.

- The first goal for any overweight individual is to prevent further weight gain and keep body weight stable (within 5 percent of its current level).
- The goal of the clinician is to identify and review with the patient a realistic weight-loss goal. Most patients have a weight loss goal of 30 percent or more below current weight, which is well in excess of realistic levels [[1](#)].
- A successful program will lead to a weight loss of more than 5 percent of initial weight [[2](#)]. A weight loss of more than 5 percent can reduce risk factors for cardiovascular disease, such as dyslipidemia, hypertension and diabetes mellitus [[3](#)]. In the Diabetes Prevention Program, a multi-center trial in patients with impaired glucose tolerance, weight loss of 7 percent reduced the rate of progression from impaired glucose tolerance to diabetes by 58 percent [[4](#)]. (See "[Prediction and prevention of type 2 diabetes mellitus](#)", section on 'Weight loss/lifestyle intervention'.)
- Loss of 5 to 7 percent of initial body weight and maintenance of this loss is a good medical result, even if the subject does not reach his or her "dream" weight.
- Although an extremely difficult goal to achieve, a body mass index (BMI) between 20 and 25 kg/m² puts the subject in the lowest risk category ([table 1](#) and [figure 1](#)).

DIETARY ENERGY

Rate of weight loss — The rate of weight loss is directly related to the difference between the subject's energy intake and energy requirements. Reducing caloric intake below expenditure results in a predictable rate of weight loss that is related to the energy deficit [5,6]. However, prediction of weight loss for an individual subject can be difficult because of marked intersubject variability in adherence and energy expenditure [5]. Food records are often inaccurate. Most normal-weight people under-report what they eat by 10 to 30 percent while overweight people under-report by 30 percent or more [7]. In addition, energy requirements are influenced by fidgeting, gender, age, and genetic factors [5,6,8]. As examples:

- Men lose more weight than women of similar height and weight when they comply with eating any given diet because men have more lean body mass, less percent body fat, and therefore higher energy expenditure.
- Older subjects of either sex have a lower energy expenditure and therefore lose weight more slowly than younger subjects; metabolic rate declines by approximately 2 percent per decade (about 100 kcal/decade) [9].
- The importance of genetic factors is illustrated by a study of identical male twin pairs who were overfed to induce weight gain [10]. Twelve twin pairs were overfed by 1000 kcal/day for 84 of 100 days. The degree of weight gain at a constant dietary caloric increment varied widely among the twin pairs (from 4.3 to 13.3 kg), in fact, there was three times the variance for both weight and fat mass among the twin pairs when compared with that within the twin pairs.

Approximately 22 kcal/kg is required to maintain a kilogram of body weight in a normal adult. Thus, the expected or calculated energy expenditure for a woman weighing 100 kg is approximately 2200 kcal/day. The variability of ± 20 percent could give energy needs as high as 2620 kcal/day or as low as 1860 kcal/day. An average deficit of 500 kcal/day should result in weight loss of approximately 0.5 kg/week (1 lb/week).

There are several methods of formally estimating energy expenditure; we suggest using the WHO criteria (table 2). This method allows a direct estimate of resting metabolic rate (RMR) and calculation of daily energy requirement. The low activity level (1.3 x RMR) includes subjects who lead a sedentary life. The high activity level (1.7 x RMR) applies to those in jobs requiring manual labor or patients with regular daily physical exercise programs [11].

Maintenance of weight loss — It is important for the overweight subject to understand that achieving and maintaining weight loss is made difficult by the reduction in energy expenditure that is induced by weight loss (figure 2), which reflects, in part, a decrease in triiodothyronine and leptin [12]. In addition, ghrelin, a hormone produced by the stomach, stimulates appetite and is normally low after eating or in the obese. However, after diet-induced weight loss, serum ghrelin concentrations increase, which may also play a role in the difficulty with

maintaining weight loss. (See "[Overview of therapy for obesity in adults](#)", section on '[Maintenance of weight loss](#)' and "[Pathogenesis of obesity](#)", section on '[Ghrelin](#)'.)

TYPES OF DIETS — The general consensus is that excess intake of calories from any source, associated with a sedentary lifestyle, causes weight gain and obesity. The goal of dietary therapy, therefore, is to decrease energy intake from food. Conventional diets are defined as those below energy requirements but above 800 kcal/day [13]. These diets fall into four groups:

- Balanced low-calorie diets/portion-controlled diets
- Low-fat diets
- Low-carbohydrate diets
- Mediterranean diet
- Fad diets (diets involving unusual combinations of foods or eating sequences)

Commercial weight loss programs and internet-based programs are discussed elsewhere. (See "[Behavioral strategies in the treatment of obesity](#)".)

Balanced low-calorie diets — Planning a diet requires the selection of a caloric intake and then selection of foods to meet this intake. It is desirable to eat foods with adequate nutrients in addition to protein, carbohydrate, and essential fatty acids. Thus, weight-reducing diets should eliminate alcohol, sugar-containing beverages, and most highly concentrated sweets, because they rarely contain adequate amounts of other nutrients besides energy.

Breakdown of some protein is to be expected during weight loss. When weight increases as a result of overeating, approximately 75 percent of the extra energy is stored as fat and the remaining 25 percent as lean tissue. If the lean tissue contains 20 percent protein, then 5 percent of the extra weight gain would be protein. Thus, it should be anticipated that during weight loss, at least 5 percent of weight loss will be protein. A desirable feature of any calorie restricted diet, however, is that it results in the lowest possible loss of protein, recognizing that this will not be less than 5 percent of the weight that is lost.

Portion-controlled diets — One simple approach to providing a calorie-controlled diet is to use individually packaged foods, such as formula diet drinks using powdered or liquid formula diets, nutrition bars, frozen food, and pre-packaged meals that can be stored at room temperature as the main source of nutrients.

Frozen low-calorie meals containing 250 to 350 kcal/package can be a convenient and nutritious way to do this. We have often recommended the use of formula diets or breakfast bars for breakfast, formula diets or a frozen lunch entree for lunch, and a frozen calorie-controlled entree with additional vegetables for dinner. In this way it is possible to obtain a calorie-controlled 1000 to 1500 kcal per day diet. In one four-year study this approach resulted in early initial weight loss, which then was maintained [14]. I do not recommend the use of formula diets alone because they do not provide adequate nutritional variety.

Low-fat diets — Low-fat diets are another standard strategy to help patients lose weight, and almost all dietary guidelines recommend a reduction in the daily intake of fat to 30 percent of energy intake or less [15,16]. In a meta-analysis of trials comparing low-fat diets (typically 20 to 25 percent of energy from fats) with a control group consuming a usual diet or a medium fat diet (usually 35 to 40 percent of energy), there was greater weight loss (approximately 3 kg) with low-fat compared with moderate fat diets [17]. In addition, one report noted that people who successfully keep their weight reduced adopt three strategies, one of which is eating a

lower fat diet [18]. (See "[Dietary fat](#)" and "[Etiology and natural history of obesity](#)", section on '[Dietary fat intake](#)'.)

A high-carbohydrate (healthy carbohydrates) and low-fat dietary pattern is not associated with weight gain. This was illustrated by the Women's Health Initiative Dietary Modification Trial of 48,835 postmenopausal women over age 50 years who were randomly assigned to a dietary intervention which included group and individual sessions to promote a decrease in fat intake and increases in fruit, vegetable, and grain consumption (healthy carbohydrates), but did not include weight loss or caloric restriction goals, or a control group which received only dietary educational materials [19]. After an average of 7.5 years of follow-up, the following results were seen:

- Women in the intervention group lost weight in the first year (mean of 2.2 kg) and maintained lower weight than the control women at 7.5 years (difference of 1.9 kg at 1 year, and 0.4 kg at 7.5 years).
- No tendency toward weight gain was seen in the intervention group overall, or when stratified by age, ethnicity, or body mass index.
- Weight loss was related to the level of fat intake and was greatest in women who decreased their percentage of energy from fat the most. A similar, but lesser trend was seen with increased vegetable and fruit intake.

A low-fat diet can be implemented in two ways. First, the dietitian can provide the subject with specific menu plans that emphasize the use of reduced fat foods. As one guideline, if a food "melts" in your mouth, it probably has fat in it. Second, subjects can be instructed in counting fat grams as an alternative to counting calories. Fat has 9.4 kcal/g. It is thus very easy to calculate the number of grams of fat a subject can eat for any given level of energy intake.

Many experts recommend keeping calories from fat to below 30 percent of total calories. In practical terms, this means eating about 33 g of fat for each 1000 calories in the diet. For simplicity, I use 30 g of fat or less for each 1000 kcal. For a 1500-calorie diet, this would mean about 45 g or less of fat, which can be counted using the nutrition information labels on food packages.

Low-carbohydrate diets — Proponents of low-carbohydrate diets have argued that the increasing obesity epidemic may be in part due to low-fat, high-carbohydrate diets. But this may be dependent upon the type of carbohydrates that are eaten, such as energy dense snacks and sugar or high fructose containing beverages.

The carbohydrate content of the diet is an important determinant of short-term (less than two weeks) weight loss. Low (60 to 130 grams of carbohydrates) and very low-carbohydrate diets (0 to <60 grams) have been popular for many years [13]. Restriction of carbohydrates leads to glycogen mobilization and, if carbohydrate intake is less than 50 g/day, ketosis will develop. Rapid weight loss occurs, primarily due to glycogen breakdown and fluid loss rather than fat loss.

Low and very low-carbohydrate diets are more effective for short-term weight loss than low-fat diets, although probably not for long-term weight loss. A meta-analysis of five trials found that the difference in weight loss at six months, favoring the low carbohydrate over low fat diet, was not sustained at 12 months [20]. (See '[Comparison trials](#)' below.)

Low-carbohydrate diets may have some other beneficial effects with regard to risk of developing type 2 diabetes mellitus, coronary heart disease, and some cancers, particularly if attention is paid to the type as well as the quantity of carbohydrate. A low-carbohydrate diet can be implemented in two ways, either by reducing the total amount of carbohydrate or by consuming foods with a lower glycemic index or glycemic load ([table 3](#)). Glycemic index and load are reviewed separately. (See "[Dietary carbohydrates](#)", section on '[Glycemic index](#)'.)

If a low-carbohydrate diet is chosen, healthy choices for fat (mono- and polyunsaturated fats) and protein (fish, nuts, legumes, and poultry) should be encouraged because of the association between saturated fat intake and risk of coronary heart disease. During 26 years of follow-up of women in the Nurses' Health Study and 20 years of follow-up of men in the Health Professionals' Follow-up Study, low carbohydrate diets in the highest versus lowest decile for vegetable proteins and fat were associated with lower all-cause mortality (HR 0.80, 95% CI 0.75-0.85) and cardiovascular mortality (HR 0.77, 95% CI 0.68-0.87) [[21](#)]. In contrast, low carbohydrate diets in the highest versus lowest decile for animal protein and fat were associated with higher all-cause (HR 1.23, 95% CI 1.11-1.37) and cardiovascular (HR 1.14, 95% CI 1.01-1.29) mortality (See "[Dietary fat](#)" and "[Overview of primary prevention of coronary heart disease and stroke](#)", section on '[Healthy diet](#)'.)

High protein diets — Some popular books recommend high protein diets [[22](#)]. In one trial, low-fat diets with 12 percent and 25 percent protein content were compared. Weight loss over six months was greater with the higher protein diet (9 versus 5 kg), but the difference was no longer significant at 12 and 24 months [[23](#)].

Higher protein diets may improve weight maintenance, as illustrated by the results of a study of 60 subjects randomly assigned to a low fat, high protein versus low-fat, high-carbohydrate diet after completing a four week very low calorie diet [[24](#)]. Among the subjects who completed the three-month study (n=48), the high protein diet group had significantly better weight maintenance (between group difference of 2.3 kg).

High dietary protein intake, due to its acid-producing load, increases urinary calcium excretion (with potential risk for bone loss and calcium stone formation) [[25](#)]. Urinary calcium excretion does appear to increase when dietary intake of protein increases [[25-27](#)], and this could pose a long-term risk for nephrolithiasis. (See "[Risk factors for calcium stones in adults](#)", section on '[Dietary risk factors](#)'.) However, two small randomized trials that looked at bone metabolism found evidence that increased dietary protein may decrease bone resorption [[26,27](#)]. One of the trials found that increased intestinal absorption of calcium was primarily responsible for the increased urinary excretion of calcium, and that the excreted calcium was not coming from bone [[27](#)].

Mediterranean diet — The term Mediterranean diet refers to a dietary pattern that is common in olive-growing areas of the Mediterranean area. Although there is some variation in Mediterranean diets, there are some common components that include a high level of monounsaturated fat relative to saturated, moderate consumption of alcohol, mainly as wine, a high consumption of vegetables, fruits, legumes, and grains, a moderate consumption of milk and dairy products, mostly in the form of cheese, and a relatively low intake of meat and meat products.

A meta-analysis of 12 studies involving eight cohorts found that a Mediterranean diet was associated with improved health status and reductions in overall mortality, cardiovascular mortality, cancer mortality, and incidence of Parkinson's disease and Alzheimer's disease [[28](#)].

(See "[Prudent diet](#)", section on '[Mediterranean diet](#)'.)

Very low-calorie diets — Diets with energy levels between 200 and 800 kcal/day are called "very low-calorie diets," while those below 200 kcal/day can be termed starvation diets. The basis for these diets was the notion that the lower the calorie intake the more rapid the weight loss, because the energy withdrawn from body fat stores is a function of the energy deficit. Starvation is the ultimate very low calorie diet and results in the most rapid weight loss. Although once popular, starvation diets are now rarely used for treatment of obesity.

Very-low calorie diets have not been shown to be superior to conventional diets for long-term weight loss. In a meta-analysis of six trials comparing very low-calorie diets with conventional low-calorie diets, short-term weight loss was greater with very low-calorie diets (16.1 versus 9.7 percent of initial weight), but there was no difference in long-term weight loss (6.3 versus 5.0 percent) [29].

As with all diets, very low-calorie diets initially result in substantial protein loss that diminishes with time. Other expected effects include reduction in blood pressure and improvement in hyperglycemia in diabetic patients.

- Subjects adhering to very low-calorie diets usually have a fall in blood pressure, especially during the first week. Antihypertensive drugs, especially calcium channel blockers and diuretics, should usually be discontinued when a very low calorie diet is begun unless moderate to severe hypertension is present.
- Most diabetic patients eating very low-calorie diets have marked improvement in hyperglycemia. Blood glucose concentrations fall within the first one to two weeks, and remain lower as long as the diet is continued. Those patients taking less than 50 units of insulin or an oral hypoglycemic drug will usually be able to discontinue therapy [30].

The side effects of very low-calorie diets include hair loss, thinning of the skin, and coldness. These diets are contraindicated for lactating and pregnant women, and in children who require protein for linear growth. As with all diets, there is increased cholesterol mobilization from peripheral fat stores, thus increasing the risk of gallstones.

Very low-calorie diets should be reserved for subjects who require rapid weight loss for a specific purpose such as surgery. The weight regain when the diet is stopped is often rapid, and it is better to take a more sustainable approach than to use a method that cannot be sustained.

Comparison trials — The impact of specific dietary composition on weight change remains uncertain. When energy from dietary carbohydrates decreases, energy from fat sources tends to increase. The reverse is also true; when energy from dietary fats decreases, energy from carbohydrate sources tends to increase. The debate has mainly centered on whether low-fat or low-carbohydrate diets can better induce weight loss and sustain it over the long-term.

Weight loss diets — Initial trials evaluating the effect of type of diet (predominantly low-carbohydrate versus low-fat) on weight loss and other outcomes showed that weight loss at six months was approximately 4 kg greater in the very low-carbohydrate group than in the low-fat group [31-33]. Trials lasting for one year, however, did not find a significant difference in weight loss [32,34,35].

A meta-analysis of five trials (including one study not referenced above) found that the

difference in weight loss at six months, favoring the low carbohydrate over low fat diet, was not sustained at 12 months [20]. In one study, this convergence was mainly due to regain of weight in the low-carbohydrate group [32]; in another, the convergence was due to ongoing weight loss in the low-fat group (figure 3) [34].

Some of these initial comparison trials of different dietary regimens had important limitations [20]. These included high dropout rates (21 to 48 percent), suboptimal dietary compliance, and limited long-term follow-up.

Subsequent trials are larger, of longer duration (lasting one to two years), and have conflicting results with regard to the impact of macronutrient composition on weight loss [36-39]. In contrast, all trials found that dietary adherence is an important determinant of weight loss, independent of macronutrient composition. The following observations illustrate the range of findings in these trials:

- In one trial, 322 moderately obese subjects (86 percent men) were randomly assigned to a low-fat (restricted calorie), Mediterranean (moderate-fat, restricted calorie, rich in vegetables, low in red meat), or low-carbohydrate (non-restricted-calorie) diet for two years [36]. Adherence rates were higher than those reported in previous trials (95.4 and 84.6 percent at one and two years, respectively). Weight loss was greater with the Mediterranean and low-carbohydrate diets than the low-fat diet (mean weight loss 4.4, 4.7, and 2.9 kg, respectively).

The most favorable effect on lipids (increased HDL and decreased triglycerides and ratio of total cholesterol to HDL) was seen in the low-carbohydrate group. Among subjects with type 2 diabetes, the greatest improvement in glycemic control occurred with the Mediterranean diet. Among all groups, weight loss was greater for those who completed the two year study than for those who withdrew.

- Another randomized trial compared four different diets in 311 overweight and obese premenopausal women: very low-carbohydrate (Atkins); macronutrient balance controlling glycemic load (Zone); general calorie restriction, low-fat (LEARN); and very low-fat (Ornish) [37]. In the intention-to-treat analysis at one year, mean weight loss was greater in the Atkins diet group compared with the other groups (4.7, 1.6, 2.2, and 2.6 kg, respectively). Pairwise comparisons showed a significant difference only for Atkins versus Zone.

The most favorable effect on triglycerides and HDL-C was seen in the Atkins group. Dietary adherence rates (77 to 88 percent) were similar among the groups and better than in previous trials. Within each group, adherence was significantly associated with weight loss [40].

- In the largest trial to date, 811 overweight and obese adults were randomly assigned to one of four diets based upon macronutrient content: low or high fat (20 to 40 percent), which provided carbohydrate at 35, 45, 55, or 65 percent, and high or average protein (15 to 25 percent) [38]. After two years, weight loss (3 to 4 kg) was similar in all groups. Many participants had trouble attaining target levels of macronutrients. Subjects who attended the greatest number of group sessions (most adherent) lost the most weight.

Thus, any diet that is adhered to will produce modest weight loss, but adherence rates are low with most diets. Although a low-carbohydrate diet may be associated with greater short-term weight loss, superior weight loss in the long-term has not been established. The optimal mix of macronutrients likely depends upon individual factors [41]. A principal determinant of weight loss appears to be the degree of adherence to the diet, irrespective of the particular macronutrient composition [35,37,38,40,42]. Thus, we suggest choosing a macronutrient mix based upon patient preferences, which may improve long-term adherence.

Behavioral modification to improve dietary compliance with any type of diet may have the greatest impact on long-term weight loss. (See "[Behavioral strategies in the treatment of obesity](#)".)

Lipids — The observed effects on blood lipids were similar for trials comparing low fat and very low carbohydrate diets [20,31-34,43]; the low-carbohydrate/high-fat diets caused slight increases in HDL, and greater decreases in fasting triglycerides. At 12 to 24 months, however, the favorable effects on HDL persisted [32,34,35,39], while triglyceride levels were either reduced [32,34] or returned to baseline [35].

In a meta-analysis of trials comparing low-carbohydrate and low-fat diet groups, LDL levels were increased in the low-carbohydrate group [20]. There was no clear benefit of either low-fat or low-carbohydrate diet on cardiovascular risks. Favorable changes in HDL cholesterol and triglycerides should be weighed against potential unfavorable changes in LDL cholesterol.

Side effects — Very low-carbohydrate diets may be associated with more frequent side effects than low-fat diets. In one of the trials noted above, a number of symptoms occurred significantly more frequently in the low-carbohydrate compared to the low-fat diet group [31]. These included constipation (68 versus 35 percent), headache (60 versus 40 percent), halitosis (38 versus 8 percent), muscle cramps (35 versus 7 percent), diarrhea (23 versus 7 percent), general weakness (25 versus 8 percent), and rash (13 versus 0 percent) [31]. Despite the higher rate of symptoms, dropout rates in clinical trials have been similar for low-carbohydrate and low-fat diets [32-34].

Some have raised the concern about ketosis that occurs with very low-carbohydrate diets. There is one case report of an obese patient who presented in severe ketoacidosis, having lost 9 kg in one month on the Atkins diet, with intake restricted to meat, cheese and salads [44]. Aside from her diet and possible mild dehydration due to gastroenteritis, no other cause for her ketoacidosis was identified.

Weight maintenance diets — Although many individuals have success losing weight with diet, most subsequently regain the lost weight. Maintaining weight loss is made difficult by the reduction in energy expenditure that is induced by weight loss. In addition, long-term adherence to restrictive diets is difficult. Exercise and behavioral interventions may help individuals maintain weight loss. These strategies are reviewed in detail elsewhere. (See "[Role of physical activity and exercise in obesity](#)", section on 'Maintenance of weight loss' and "[Behavioral strategies in the treatment of obesity](#)", section on 'Maintenance of weight loss'.)

There is little consensus on the optimal mix of macronutrients to maintain weight loss. The satiating effects of diets high in protein and low in glycemic index have generated interest in manipulating protein composition and glycemic index in weight maintenance diets. (See '[High protein diets](#)' above and "[Dietary carbohydrates](#)", section on 'Effect of glycemic index/glycemic load'.) In a multicenter trial of five ad libitum diets to prevent weight regain over 26 weeks, 773 adults who had successfully lost 8 percent of their body weight on a low calorie diet (800

to 1000 kcal/day), were randomly assigned in a two-by-two factorial design to a high or low-protein (25 versus 13 percent of total calories), high or low-glycemic index, or to a control diet (moderate protein content) [45]. All diets had a moderate fat content (25 to 30 percent). The achieved protein content was 5 percentage points higher in the high versus low protein groups, and the mean glycemic index was five units lower in the low-glycemic versus high-glycemic index groups.

In the intention-to-treat analysis, weight regain during the trial was modestly but significantly greater in the low versus high-protein groups (mean difference 0.93 kg) and in the high versus low-glycemic index groups (mean difference 0.95 kg). Only subjects in the high-protein, low-glycemic index diet group continued to lose weight (mean change -0.38 kg). The trial was limited by the high dropout rate (29 percent) and short-term follow-up (six months). Whether a low glycemic index, high protein diet is associated with long-term weight maintenance is unknown. As discussed above, long-term adherence to a weight maintaining diet is probably the most important determinant of success, and therefore the optimal weight maintaining diet will depend upon preference and individual factors.

Role of dietary counseling — Dietary counseling may produce modest, short-term weight losses. This was illustrated in a meta-analysis of 46 trials comparing dietary counseling-based weight loss programs to usual care or minimal counseling interventions such as general dietary advice given at baseline [46]. At 12 months, dietary counseling interventions resulted in a net loss of approximately 2 BMI units (4.5 to 6.5 kg) when compared with control interventions. However, the differences between the groups decreased significantly over the subsequent four years. This analysis was limited by high rates of missing data, and heterogeneity across trials in patient populations and interventions.

Prolonged caloric restriction and longevity — Prolonged caloric restriction improves longevity in rodents and non-human primates [47], but it is not known if the same is true in humans. It is hypothesized that the antiaging effects of caloric restriction are due to reduced energy expenditure resulting in a reduction in production of reactive oxygen species (and therefore a reduction in oxidative damage). In addition, other metabolic effects associated with caloric restriction, such as improved insulin sensitivity, might also have an antiaging effect. In one trial of 48 sedentary, overweight men and women, six months of caloric restriction, with or without exercise, resulted in significant weight loss as expected [48]. In addition, caloric restriction-mediated reductions in fasting insulin concentrations, core body temperature, serum T3 levels, and oxidative damage to DNA (as reflected by a reduction in DNA fragmentation) were seen, suggesting a possible antiaging effect of the prolonged caloric restriction.

INFORMATION FOR PATIENTS — Educational materials on this topic are available for patients. (See "[Patient information: Diet and health](#)" and "[Patient information: Weight loss treatments](#)" and "[Patient information: Weight loss surgery](#)".) We encourage you to print or e-mail these topic reviews, or to refer patients to our public web site, www.uptodate.com/patients, which includes these and other topics.

SUMMARY AND RECOMMENDATIONS

- An initial weight loss goal of 5 to 7 percent of body weight is realistic for most individuals. (See '[Goals of weight loss](#)' above.)
- Many types of diets produce modest weight loss. Options include balanced low-calorie,

low-fat low-calorie, moderate-fat low calorie, and low-carbohydrate diets. Dietary adherence is an important predictor of weight loss, irrespective of the type of diet. (See 'Types of diets' above.)

- We suggest tailoring a diet that reduces energy intake below energy expenditure to individual patient preferences, rather than focusing on the macronutrient composition of the diet (**Grade 2B**). (See 'Comparison trials' above.)
- If a low-carbohydrate diet is chosen, healthy choices for fat (mono and polyunsaturated) and protein (fish, nuts, legumes, and poultry) should be encouraged. If a low-fat diet is chosen, the decrease in fat should be accompanied by increases in healthy carbohydrates (fruits, vegetables, whole grains).

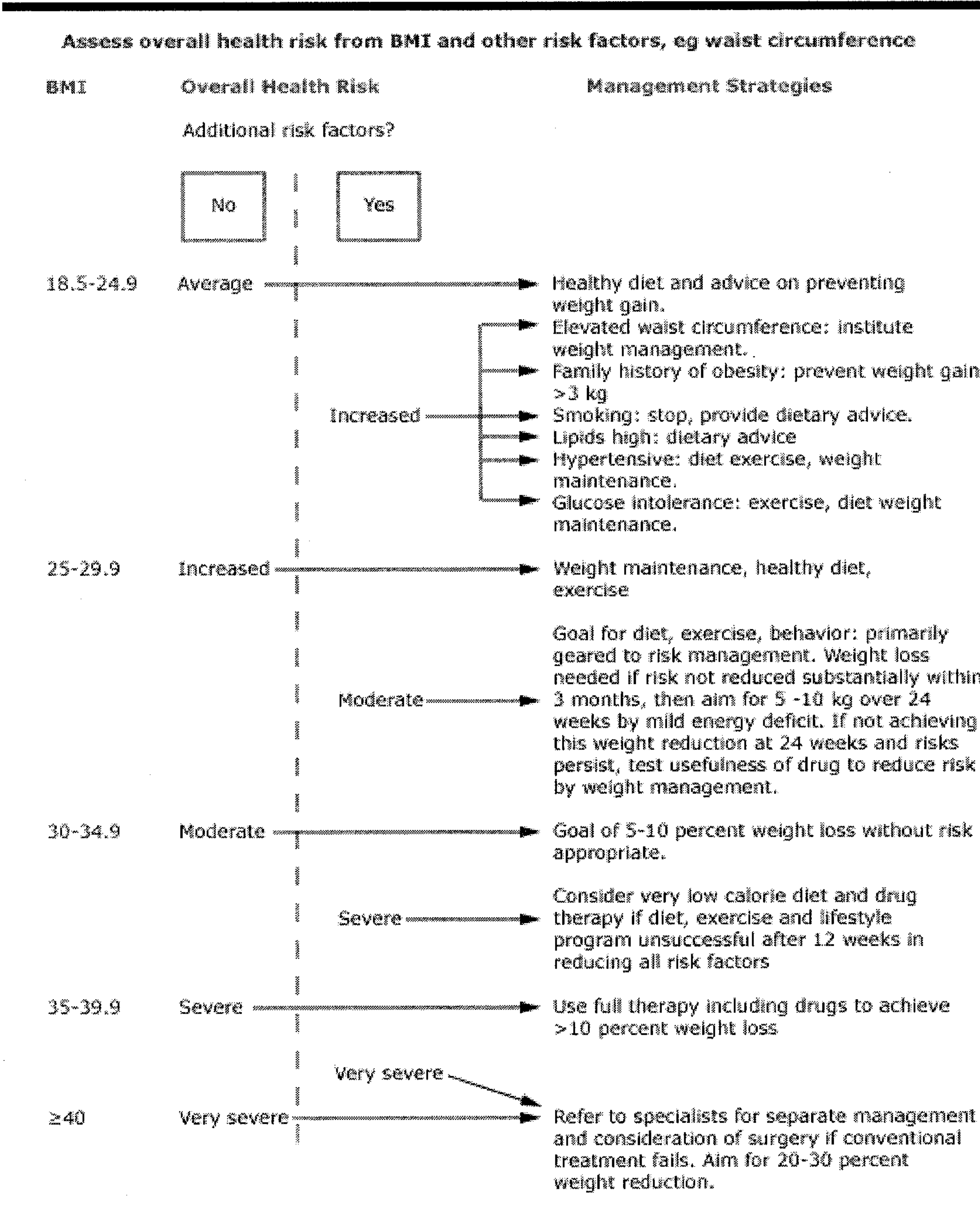
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GRAPHICS

A systematic approach to management based on BMI and other risk factors



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Classification of overweight and obesity by BMI, waist circumference, and associated disease risk

	BMI kg/m ²	Obesity class	Disease risk* relative to normal weight and waist circumference	
			Men ≤102 cm (≤40 in)	>102 cm (>40 in)
			Women ≤88 cm (≤35 in)	>88 cm (>35 in)
Underweight	<18.5		-	-
Normal•	18.5-24.9		-	-
Overweight	25.0-29.9		Increased	High
Obesity	30.0-34.9	I	High	Very High
	35.0-39.9	II	Very High	Very High
Extreme Obesity	≥40	III	Extremely High	Extremely High

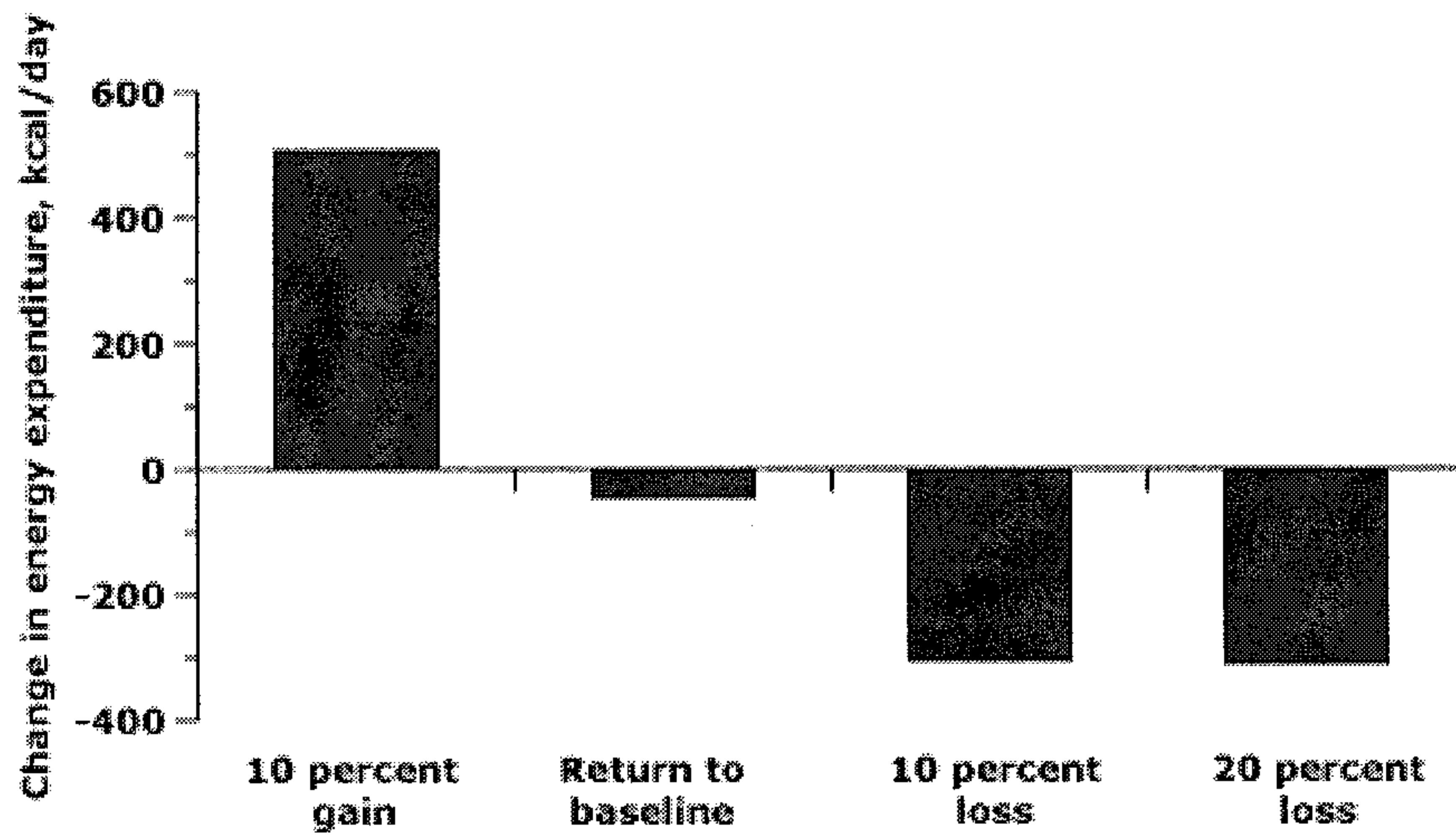
* Disease risk for type 2 diabetes, hypertension, and CVD.

• Increased waist circumference can also be a marker for increased risk even in persons of normal weight. *Reproduced from: Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults--The Evidence Report. National Institutes of Health. Obes Res 1998; 6:515.*

Revised World Health Organization equations for estimating energy expenditure

Step 1: Estimate basal metabolic rate	
Men 18 to 30 years = $(0.0630 \times \text{actual weight in kg} + 2.8957) \times 240 \text{ kcal/day}$	
Men 31 to 60 years = $(0.0484 \times \text{actual weight in kg} + 3.6534) \times 240 \text{ kcal/day}$	
Women 18 to 30 years = $(0.0621 \times \text{actual weight in kg} + 2.0357) \times 240 \text{ kcal/day}$	
Women 31 to 60 years = $(0.0342 \times \text{actual weight in kg} + 3.5377) \times 240 \text{ kcal/day}$	
Step 2: Determine activity factor	
Activity level	Activity factor
Low (sedentary)	1.3
Intermediate (some regular exercise)	1.5
High (regular activity or demanding job)	1.7
Step 3: Estimate total energy expenditure	
Total energy expenditure = Basal metabolic rate x activity factor	

Changes in energy expenditure minimize changes in weight



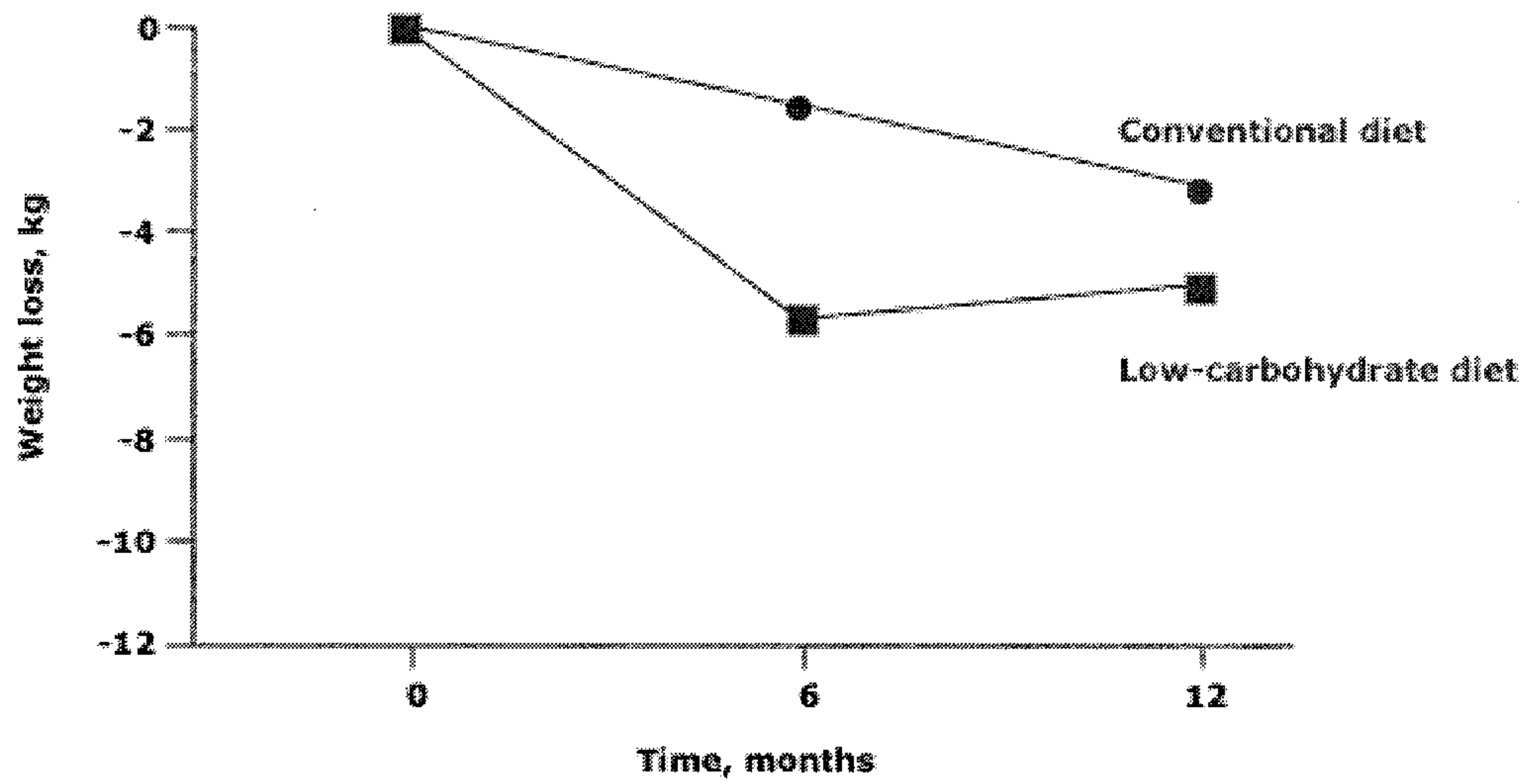
Observed minus predicted energy expenditure in subjects studied during food-induced weight gain and diet-induced weight loss. Changes in weight were associated with parallel changes in total energy expenditure, thereby making further alterations in weight more difficult. *Data from Leibel, RL, Rosenbaum, M, Hirsch, J. N Engl J Med 1995; 332:621.*

Glycemic index of foods

Food	Glycemic index
Baked russet potato	135
Cornflakes	119
White bread	100
Whole meal bread	99
Brown rice	96
Raisins	93
White rice	83
Banana (raw)	79
All-Bran	73
Sweet potato	70
Spaghetti (white)	66
Spaghetti (whole wheat)	61
Baked beans (tinned)	60
Ice cream, yogurt, whole milk, apple (raw)	49-53
Red lentils	43
Soya beans (tinned)	20

Glycemic content of an assortment of foods, with white bread representing the standard value of 100. Values below 100 will produce a lesser rise in the blood glucose (for the same level of carbohydrate intake) than white bread. *Data from: Jenkins, DJ, Wolever, TM, Jenkins, AL, et al, Lancet 1984; 2:388.*

Weight loss with conventional versus low carbohydrate diet



Comparison of mean weight loss in kg between subjects on a conventional diet (red circles) and a low-carbohydrate diet (blue squares). The difference in weight loss was no longer significant at one year. *Data from: Stern, L, Iqbal, N, Seshadri, P, et al. The effects of low-carbohydrate versus conventional weight loss diets in severely obese adults: one-year follow-up of a randomized trial. Ann Intern Med 2004; 140:778.*