

# Effective management of obesity

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## Abstract

Successful treatment of obesity usually requires multiple interventions. The choice of therapies should be guided by the initial assessment of a patient's degree of obesity and comorbid conditions, if present. A variety of interventions can achieve short-term weight loss, but rebound weight gain is common when therapy is stopped. Thus, programs for weight maintenance are critical to ultimate success.

## Key Points

- Diet and exercise coupled with behavioral modification can improve both patient-related and disease-related outcomes in the short term; however, long-term efficacy is lacking (A).
- Drugs such as sibutramine or orlistat may achieve modest, short-term weight loss, but their long-term effectiveness is unproven (A).
- For patients with a BMI >40, gastric bypass procedures can lead to long-term weight loss (B).

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Physician intervention to encourage and assist obese patients to lose weight is warranted, for these reasons:

- **Prevention of adverse outcomes.** Left untreated, obesity is clearly related to the development of many adverse health outcomes, including diabetes mellitus, hypertension, stroke, hyperlipidemia, coronary artery disease, gallstones, osteoarthritis, obstructive sleep apnea, vascular disease, depression, and certain cancers (breast, endometrial, prostate, colon).<sup>1-4</sup>
- **Reduction of morbidity and mortality.** A causal effect between intentional weight loss and mortality has been difficult to prove, but even modest weight loss can reduce the morbidity of obesity-related disease, such as arthritis and obstructive sleep apnea (Strength of recommendation: **A**).<sup>5-7</sup> For those at increased risk of death from cardiovascular disease, such as persons with obesity and diabetes mellitus, intentional weight loss coupled with lifestyle change can significantly reduce mortality (SOR: **C**).<sup>8</sup> Nearly 280,000 deaths per year are attributable to obesity.<sup>9</sup>
- **Cost reduction.** Nearly 25% of American adults are obese, and more than half are overweight.<sup>1,2</sup> Obesity burdens society with significant costs, including more than \$50 billion annually for direct care. With an additional \$30 billion spent each year on weight-loss products and services, this

disease accounts for over 5% of annual health care expenditures in the United States.<sup>5</sup>

## ■ NATURE OR NURTURE?

Excess fat is created when energy intake exceeds cellular energy consumption. The complex relationship between the human body's environment and the development of obesity is poorly understood, but recent genetic investigations have elucidated new mechanisms in the regulation of both satiety and energy expenditure. Using data from heritability studies, some researchers have estimated that up to 70% of the variability in weight among humans can be explained by genetic influences, but it is unlikely that changes in human genes account for the recent change in obesity prevalence.<sup>10</sup>

### Risk factors

Identifiable risks factors for obesity in adulthood include parental history of obesity, low socio-economic background, and a history of high birth weight.<sup>11</sup>

### Prevention

Recently, factors including consumption of sugar-sweetened beverages, lack of breast-feeding, and television viewing have been identified as risk factors for childhood and adolescent obesity.<sup>12-14</sup> Because obesity at a young age can lead to adult obesity, these factors may be targeted to prevent adult obesity.

School-based programs for diet and exercise appear to be ineffective for preventing obesity (SOR: **B**).<sup>15,16</sup> However, most research has been of limited quality. In one recent randomized study, reduction of television viewing (including videotape and videogame use) through school intervention was associated with significant reduction in BMI (SOR: **B**).<sup>14</sup>

## ■ SCREENING RECOMMENDATIONS

The United States Preventive Service Task Force recommends periodic measurement of both height and weight in adults (SOR: **B**). The waist-to-hip ratio is thought to have insufficient evidence for recommendation as a routine screening tool because studies identifying a benefit to screening using only the waist-

As the BMI rises above 25, morbidity and mortality rise proportionately

to-hip ratio have not been completed (SOR: **C**).<sup>17</sup>

## ■ INITIAL DETERMINATION OF OBESITY

Although the standard for body fat measurement is densitometry, which determines the density of a body submerged in water, the cost and technical requirements prohibit routine use in the clinical setting.<sup>18-20</sup> The waist-to-hip ratio and waist circumference are used to identify central (or android) obesity in which adipose tissue in the abdomen is associated with atherosclerosis.<sup>21,22</sup> The waist circumference is found by measuring the circumference around the waist at the level of the iliac crest. Values above 40 inches for men and 35 inches for women are indicative of increased risk of adverse health outcomes.<sup>5,19</sup> The waist-to-hip ratio is calculated by dividing the circumference of the waist at the level of the L3 by the hip circumference measured at the largest area of the gluteal region.<sup>19</sup> For men, waist-to-hip ratios greater than 1.0 are associated with significantly increased risk of cardiovascular events. For women, a ratio greater than 0.85 indicates increased risk.<sup>19</sup>

### Body-mass index calculation

The body-mass index (BMI), also known as the Quetelet index, is the most commonly used measure of obesity.<sup>20</sup> BMI is a patient's weight in kilograms divided by his or her height in meters squared ( $\text{kg}/\text{m}^2$ ).<sup>5,19</sup> A free online BMI calculator is available through the National Heart, Lung and Blood Institute at [www.nhlbisupport.com/bmi/bmicalc.htm](http://www.nhlbisupport.com/bmi/bmicalc.htm).

Although the BMI estimates total body fat and compares well with densitometry, it may be less accurate in selected populations (eg, the elderly, certain ethnic groups, and persons with large muscle mass).<sup>19</sup>

Generally, when BMI exceeds 25, the greater the BMI, the greater the obesity-related morbidity and mortality.<sup>5,19,20,23</sup> **Table 1** shows the classification of obesity based on BMI, and **Table 2** shows the BMI for combinations of height and weight in inches and pounds.<sup>5</sup>

## ■ EVALUATION OF DOCUMENTED OBESITY

In history taking and physical examination, look for reversible causes of obesity (including medications and endocrine disorders), consider the degree of obesity, and determine whether comorbid conditions are present, to help estimate prognosis. Evaluate the patient's dietary and exercise habits, as well as willingness to modify these habits if necessary.<sup>1,5</sup> Finally, review the patient's weight history and any attempts at weight loss.

Medications associated with weight gain include psychotropic drugs, anticonvulsant agents, steroid hormones, insulin, and many oral hypoglycemic agents.<sup>1</sup>

Endocrine disorders such as Cushing's syndrome and hypothyroidism may also contribute to obesity, but only rarely. Physical findings that increase the likelihood of Cushing's syndrome, and their respective positive likelihood ratios (LR+)—the higher the value, the greater the likelihood of disease—include: hypertension (2.3), moon facies (1.6), thin skinfold (115.6), ecchymoses (4.5), and acne (2.2).<sup>19</sup> Findings, and their likelihood ratios,

associated with hypothyroidism include coarse skin (5.6), cool/dry skin (4.7), bradycardia (4.1), enlarged thyroid (2.8), and hoarse voice (5.4).<sup>19</sup> The very high LR for skinfold thickness was determined for women of childbearing age who had elevated risk of having Cushing's syndrome because of a history of both menstrual irregularities and hirsutism. Skinfold thickness is determined by using calipers on an area of minimal subcutaneous fat (eg, back of the hand). For women of reproductive age, skinfold thickness is normally greater than 1.8 mm.<sup>19</sup>

Laboratory assessment of the obese patient will rarely find a cause of weight gain (eg, hypothyroidism), but the addition of selected diagnostic tests will aid in the determination of prognosis. An abnormal fasting glucose level or impaired glucose tolerance is a major risk factor for cardiovascular disease. Abnormal lipid profiles heighten that risk for obese patients. All patients with documented obesity should undergo assessment for abnormal lipids and impaired glucose tolerance<sup>5</sup> (SOR: D).

TABLE 1

### Body mass index (BMI) and degrees of obesity

BMI	Category	Therapeutic options
<18.5	Underweight	
18.5–25.9	Normal weight	Reinforce positive lifestyle
25.0–29.9	Overweight	Diet, exercise, behavior modification
30.0–34.9	Obese (Class I)	Diet, exercise, behavior modification; consider pharmacologic therapy*
35.0–39.9	Obese (Class II)	Diet, exercise, behavior modification; consider pharmacologic therapy
≥ 40.0	Obese (Class III or "Morbid Obesity")	Consider surgical management

\*For patients with multiple cardiovascular risk factors (eg, diabetes, hyperlipidemia), BMI >27 may be an indication for pharmacologic intervention at; at BMI >37, patients may be considered candidates for surgical therapy.

From the National Institutes of Health. Clinical guidelines on the identification, evaluation, and treatment of obesity in adults: the Evidence Report. Bethesda, Md: US Department of Health and Human Services, 1998.

TABLE 2

## Body mass indexes for various height and weight combinations

Weight (lbs)	Height (inches)									
	58	60	62	64	66	68	70	72	74	76
100	20.9	19.6	18.3	17.2	16.2	15.2	14.4	13.6	12.9	12.2
110	23.0	21.5	20.2	18.9	17.8	16.8	15.8	14.9	14.2	13.4
120	25.1	23.5	22.0	20.6	19.4	18.3	17.3	16.3	15.4	14.6
130	27.2	25.4	23.8	22.4	21.0	19.8	18.7	17.7	16.7	15.9
140	29.3	27.4	25.7	24.1	22.6	21.3	20.1	19.0	18.0	17.1
150	31.4	29.4	27.5	25.8	24.3	22.9	21.6	20.4	19.3	18.3
160	33.5	31.3	29.3	27.5	25.9	24.4	23.0	21.7	20.6	19.5
170	35.6	33.3	31.2	29.2	27.5	25.9	24.4	23.1	21.9	20.7
180	37.7	35.2	33.0	31.0	29.1	27.4	25.9	24.5	23.2	22.0
190	39.8	37.2	34.8	32.7	30.7	28.9	27.3	25.8	24.4	23.2
200	41.9	39.1	36.7	34.4	32.3	30.5	28.8	27.2	25.7	24.4
210	44.0	41.1	38.5	36.1	34.0	32.0	30.2	28.5	27.0	25.6
220	46.1	43.1	40.3	37.8	35.6	33.5	31.6	29.9	28.3	26.8
230	48.2	45.0	42.2	39.6	37.2	35.0	33.1	31.3	29.6	28.1
240	50.3	47.0	44.0	41.3	38.8	36.6	34.5	32.6	30.9	29.3
250	52.4	48.9	45.8	43.0	40.4	38.1	35.9	34.0	32.2	30.5
260	54.5	50.9	47.7	44.7	42.1	39.6	37.4	35.3	33.5	31.7

overweight  
 obese

## ■ TREATMENT

The most important step in treating obesity is to establish a calorie deficit. The deficit can be achieved by increasing energy expenditure or by reducing energy intake or absorption. On average, a caloric deficit of 500 kilocalories per day will result in a weight loss of 1 pound per week.<sup>5</sup> Reasonable expectations of therapy include weight loss of 1–2 pounds a week and a loss of 10% of total body weight in 5 months.<sup>5</sup>

Interventions for weight loss fall into 4 categories: lifestyle modifications (diet, exercise, and behavioral modification), drug therapy, complementary or alternative measures, and surgery. **Table 3** summarizes the levels of evidence to support each intervention.

### Lifestyle modifications

Management of obesity in every case should include dietary changes, exercise, and behavioral modification.

**Dietary changes.** Diets create a caloric deficit by reducing the intake of calories. Average weight loss with low-calorie diets is approximately 8% at 3–12 months (SOR: **A**),<sup>5</sup> with most of the loss occurring in the first 3–5 months.<sup>24</sup> There are many kinds of diets for weight loss, including low calorie, very-low calorie, low fat, very low fat, and low carbohydrate, but long-term compliance with all types of dietary interventions is a significant problem. When diet alone is used as therapy, between one third and one half of weight loss will not be maintained.<sup>24</sup> Emerging strategies to help improve dietary compliance include behavioral modification (see below) and meal substitutes. Recent reports of interventions such as meal-replacement shakes indicate that long-term weight loss can be significantly improved (SOR: **B**).<sup>25–27</sup>

Examples of low-calorie, nutritionally balanced diets are Weight Watchers, Jenny Craig, Nutrisystem, the National Cholesterol Education Program Step I and Step II diets, and the Dietary Approaches to Stop Hypertension (DASH) diet. Low-calorie diets provide 800–1500 kilocalories per day.<sup>5,28,29</sup> Very-low-calorie diets (400–500 kilocalories per day) may increase rates of weight loss initially, but at 1 year, results are similar to those of low-calorie diets (SOR: **A**).<sup>5,30</sup>

A low-fat diet (fat content 10%–19%) without a decrease in total calorie intake does not promote weight loss (SOR: **A**).<sup>5,31</sup> Very-low-fat diets containing less than 10% fat have been described by such authors as Ornish and Pritikin.<sup>25</sup> Obese patients using either the low-fat or very-low-fat diet can lose body weight and body fat, but only if calories are also decreased (SOR: **A**).<sup>5,28</sup>

Low-carbohydrate diets, such as Dr Atkin's diet, are associated with modest (approximately 5 kg, or 11 lbs) weight loss (SOR: **C**).<sup>28,32</sup> Improved study design is required to further evaluate the effectiveness and safety of low-carbohydrate diets in the clinical setting.

**Exercise.** Most studies of exercise are based on 30–50 minutes of moderately intense aerobic exercise, repeated 3–7 times per week.<sup>5</sup> When it is the only prescribed therapy, exercise can be

expected to produce modest weight loss only (SOR: **A**).<sup>5,33</sup> Exercise combined with dietary intervention, however, increases weight lost (SOR: **A**), and exercise by itself may prevent weight gain (SOR: **C**).<sup>5</sup>

**Behavioral Modification.** Behavioral modification has been evaluated in combination with diet or exercise, and has been shown to increase compliance and weight loss for durations of 1 year or less (SOR: **A**).<sup>5,34</sup> Weight gain is common when therapy is discontinued, and at 5 years, there is no difference between those who received behavioral therapy and those who were in control groups (SOR: **A**).<sup>5</sup>

## Medications

Medications for treatment of obesity act through 1 or more of 3 mechanisms:

- Appetite suppression (eg, sibutramine, antidepressants such as fluoxetine)
- Increased metabolic activity (eg, stimulants such as ephedra with caffeine,  $\beta$ -3 agonists)
- Decreased absorption of caloric load (orlistat)

For mild-to-moderate obesity (BMI >30 and <40), medications can be beneficial (SOR: **A**), but long-term weight loss beyond 2 years has not been studied.<sup>35</sup> Pharmacologic intervention without lifestyle intervention actually decreases a person's ability to lose weight (SOR: **B**).<sup>36</sup>

Two medications are approved by the United States Food and Drug Administration for long-term obesity management: sibutramine and orlistat. Both drugs reduce weight modestly (SOR: **A**).<sup>37–39</sup> Both medications have similar indications for use: BMI >30, or BMI >27 with the presence of other cardiovascular risk factors (ie, diabetes or hyperlipidemia). Both should be used in conjunction with reduced-calorie diet and exercise (SOR: **B**).<sup>36</sup>

*Sibutramine* is usually started at 10 mg once a day, given with or without food. The dose may be titrated to a maximum of 15 mg/d after 4 weeks if weight loss has been inadequate.<sup>1</sup> Sibutramine is known to increase pulse rate and blood pressure in a significant number of patients; because of this, regular



evaluation of vital signs is required. At present, long-term use of sibutramine cannot be recommended, and safety data are unavailable beyond 1 year of use. Sibutramine should be avoided if these conditions are present: hypertension, coronary heart disease, congestive heart failure, an arrhythmic condition, pregnancy, renal impairment, concomitant use of MAOI, or a history of stroke.

*Orlistat* is started at 120 mg three times a day, and is taken with meals that contain fat. It may still be effective if taken up to one hour after eating. Orlistat may be avoided if the meal contains no fat. This drug may interfere with the absorption of some fat-soluble vitamins, and it is therefore recommended that patients take a multivitamin that has fat-soluble vitamins at least 2 hours before or after ingesting orlistat. Orlistat is not absorbed into the body and, at this time, no laboratory follow-up is needed. Regular evaluation of weight is needed to assess the efficacy of treatment. Orlistat should be avoided by those who have cholestasis or malabsorptive disorders or by those taking cyclosporine.<sup>40</sup>

Other medications that have been used include phentermine, ephedra, dexfenfluramine, phenylpropranolamine (PPA), and mazindol.<sup>1,2</sup> All of these medications produce significant weight loss in the short term (SOR: **A**), but they are not indicated for long-term use.<sup>2</sup> In fact, phenylpropranolamine and dexfenfluramine are no longer available because of their severe side effects.<sup>2</sup> Antidepressants do not yield a consistent benefit in well-designed studies of obesity management.<sup>2</sup>

**Table 3** summarizes the effects of medications on weight loss.

## Surgery

Surgical management of obesity is reserved for extremely obese persons because of the significant morbidity and mortality associated with the interventions. Currently, gastric bypass procedures result in less than 1% perioperative mortality and about 10% perioperative morbidity.<sup>41</sup> Patients with a BMI >40 (or >37 with weight-related comorbidities) are candidates for surgery.<sup>42</sup>

It has been estimated that, for these patients, the

With a BMI >40 (or >37 with comorbidities), cost per pound lost may be less with surgery than with drugs

cost per pound lost is less with surgery than with medications.<sup>43</sup> In most series, the average morbidly obese patient can expect to lose 50% of excess body weight at 5 years after bypass surgery, and 50% of excess weight will be lost even 10 years post-operatively (SOR: **B**).<sup>44</sup>

Several options are available for surgical management of obesity. While the technical aspects of surgery are beyond the scope of this article, some generalizations can be made. Procedures may reduce the size of the stomach to decrease the volume of intake (gastroplasty), or may create a malabsorption condition (intestinal bypass) to decrease absorption of calories. The combination of a restrictive procedure with malabsorption (Roux-en-Y gastric bypass) is superior to a restrictive procedure alone (SOR: **B**).<sup>44</sup>

The surgical management of morbid obesity improves quality of life for patients,<sup>43</sup> but no published studies to date have been able to evaluate the effect of the surgical management on mortality in the morbidly obese patient.

## Complementary and alternative therapies

In addition to the traditional methods of weight loss, acupuncture and hypnosis have been studied in the treatment of obesity. Acupuncture does not appear to have any benefit greater than placebo (SOR: **B**).<sup>45</sup> Hypnosis has also been reviewed and likely adds little, if any, benefit beyond that of placebo (SOR: **B**).<sup>45</sup> Most studies of both acupuncture and hypnosis suffer from the difficulties of performing adequate control groups, and meta-analyses have demonstrated mixed results.<sup>45,46</sup>

## ■ MAINTENANCE PROGRAMS

There is significant evidence that when patients discontinue effective weight loss interventions (eg, diet or behavioral modification) they will return to their baseline weight. Because of this, it is important to consider maintenance programs as part of overall

TABLE 3

### Efficacy of weight-loss interventions

SOR*	Intervention	Weight loss		Comments
		Short-term	Long-term	
<b>Diet, exercise, and behavioral modification</b>				
A	Low/very-low-calorie diet	8% average weight loss from 3–12 months	Weight nears baseline in studies >24 months	Very-low-calorie diets may require laboratory assessment of metabolic function High rate of noncompliance
A	Low/very low fat with reduced calories	Similar to low-calorie with moderate fat	Weight nears baseline in studies >24 months	No known side effects
A	Exercise	Less weight loss than diet therapy	Likely no significant weight loss	Improved cardiovascular fitness May be effective in preventing weight gain
A	Low-calorie diet + exercise	Increased weight loss vs. diet or exercise alone	Weight nears baseline in long-term studies	Improved cardiovascular fitness Compliance a major problem
B	Behavior modification	Increases effectiveness of diet, exercise	No significant effect at 5 years	No reported harms Only studied when used with other methods
C	Low-carbohydrate diet	Not significant if calories are not reduced	No long-term data available	No known side effects, but creates nutritional imbalance and ketosis Needs additional study
<b>Medication</b>				
A	Sibutramine	~ 4 kg for trials less than 1 year	Modest weight loss when used for >1 year	Can elevate blood pressure Number needed to treat (NNT) for 5% weight loss at 1 year = 3 NNT for 10% weight loss at 1 year = 5
A	Orlistat	~ 2–3 kg for trials less than 1 year	~ 3 kg at 2 years	GI side effects common, possible vitamin deficiencies NNT for 5% weight loss at 1 year = 5 NNT for 10% weight loss at 1 year = 7
<b>Surgery</b>				
B	Roux-en-Y Gastric bypass	~ 50 kg (110 lbs) at 1 year	~ 50 kg (110 lbs) at up to 4 years	Significant operative risk and post-operative GI side effects Nadir for weight loss occurs at 12–24 months
B	Gastric banding	~ 30 Kg (66 lbs) at one year	10–15% of initial weight lost may be regained long-term	Significant operative risk and post-operative GI side effects Generally considered less effective than gastric bypass

CONTINUED

TABLE 3 CONTINUED

Efficacy of weight-loss interventions				
Weight loss				
SOR*	Intervention	Short-term	Long-term	Comments
<b>Complementary/alternative medicine</b>				
B	Hypnosis	Minimal reduction	No statistically significant difference	Studied in combination with cognitive behavioral therapy Systematic reviews reveal significant heterogeneity of low-quality randomized controlled trials
B	Acupuncture	No significant difference	No significant difference	Systematic review reveals poor quality RCTs, which limits ability to determine effect
* Strength of recommendation A = Systematic review of randomized controlled trials (RCT) (with homogeneity) or individual RCT with narrow confidence interval B = Systematic review of cohort studies (with homogeneity), individual cohort studies or low-quality RCT, individual case-control study or SR of case-control studies (with homogeneity) C = Case series and poor quality cohort and case control studies				

treatment and to imbue in patients the expectation that treatment will be lifelong. Examples of an approach to maintenance therapy include attendance at regular exercise or therapy sessions even after achieving weight-loss goals, or continued participation at commercial weight-loss program meetings or support groups.

#### ACKNOWLEDGEMENTS

The author was supported by grant 1 D45 PE 50175 -01, "Faculty Development in Family Medicine" funded by Health Resources and Services Administration (HRSA). The author wishes to thank Bill Hueston, MD, Peter Carek, MD, Arch Mainous III, PhD, and Lori Dickerson, PharmD, for their help with manuscript review. The author wishes to thank Tara Hogue for her help with the preparation of this manuscript.

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