

Weight Loss Maintenance

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Successful long-term weight loss maintenance can be achieved by various means. A combination of dietary and physical activity interventions, along with one or more behavioral approaches, has proven successful in some persons, as documented by the National Weight Control Registry, but is limited by adherence to a consistent weight loss regimen. Successful approaches to weight loss maintenance include consulting with a physician, nutritionist, or another support source; adhering to a stable diet with a limited variety of food; monitoring weight; eating breakfast; and exercising regularly. Long-term pharmacologic treatments for weight loss maintenance have been studied and were found to have modest success, with some weight regain typically reported. Sibutramine and orlistat are the two medications approved by the U.S. Food and Drug Administration with the potential to help patients achieve long-term weight loss maintenance. Bariatric surgery is another modality for accomplishing successful long-term weight loss maintenance in patients with morbid or complicated obesity. Its success is due in large part to better weight loss outcomes, more successful long-term weight loss maintenance, and remission of comorbid medical conditions. (*Am Fam Physician*. 2010;82(6):630-634. Copyright © 2010 American Academy of Family Physicians.)

► Patient information:

A handout on weight loss maintenance, written by the authors of this article, is provided on page 637.

Obesity is now recognized as a serious chronic disease.¹ Approximately 65 percent of adults in the United States are overweight or obese.² Almost one half of the adult population is trying to lose weight at any given time.³ Although losing weight can be very difficult, the real challenge often is maintaining the weight loss. Many dietary patterns and programs have demonstrated successful short-term weight loss. However, successful weight loss maintenance is not so widespread. Research has shown that approximately 20 percent of overweight or obese persons are successful at long-term weight loss.⁴

Successful weight loss maintenance is defined as losing at least 10 percent of one's initial body weight and maintaining the loss for at least one year.^{1,4} Reviewing the key aspects of this definition, intentionality is important because unintentional weight loss is often the harbinger of other disease conditions, the causes of which have been summarized elsewhere.⁵ The 10 percent threshold was initially suggested because weight loss of this magnitude can lead to statistically significant improvements in lipid ratios, blood glucose homeostasis, and risk of heart disease, all of which have been well-documented.²

However, this 10 percent threshold is not always used by researchers in determining successful weight loss when other comorbidities (e.g., type 2 diabetes mellitus) are present.^{6,7} The one-year criterion for the definition of successful weight loss maintenance was selected based on criteria from the Institute of Medicine,⁸ and using this criterion may stimulate research on how persons who have maintained their weight loss for one year can continue to maintain it for longer intervals.⁴

Lifestyle Factors

Long-term adherence to a diet and exercise program is the key to success.⁹ Many well-known weight loss authors and researchers have studied this particular issue, yet few have published data in support of their unique dietary recommendations. The well-known Atkins diet (i.e., the prototype high-fat, low-carbohydrate diet) has its own maintenance-phase diet plan, promoting reintroduction of "good" carbohydrates back into the diet.¹⁰ The South Beach Diet has a similar maintenance phase.¹¹ Few, if any, large and randomized controlled trials (RCTs) exist that demonstrate a 10 percent weight loss and maintenance over a one-year period for these or any other

SORT: KEY RECOMMENDATIONS FOR PRACTICE

<i>Clinical recommendation</i>	<i>Evidence rating</i>	<i>References</i>	<i>Comments</i>
Weight loss strategies using dietary modification, physical activity, or behavioral interventions can produce and maintain weight loss for longer than one year.	B	4, 25	RCT and retrospective reviews
Sibutramine (Meridia) and orlistat (Xenical) were only modestly effective in reducing weight and maintaining weight loss in trials of one year or longer.	A	32	Cochrane review of RCTs
Successful long-term weight loss maintenance can be achieved with gastric bypass surgery in patients who are morbidly obese.	A	33, 36	Cochrane review of RCTs and retrospective reviews

RCT = randomized controlled trial.

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to <http://www.aafp.org/afpsort.xml>.

commercial-based diets.^{12,13} One study confirmed that a very-low-calorie diet (i.e., less than 800 calories per day) did not outperform a self-guided dietary approach in achieving weight loss maintenance.¹⁴

The National Weight Control Registry (NWCR) is the longest prospective compilation of data and information from persons who have successfully lost weight and maintained their weight loss.¹⁵ The NWCR is tracking more than 5,000 persons who have lost significant amounts of weight and kept it off for at least one year. Detailed questionnaires and annual follow-up surveys are used to examine the behavioral and psychological characteristics of weight maintainers, as well as the strategies they use to maintain their weight loss.

The NWCR participants have achieved long-term weight loss by a variety of means (Table 1).¹⁵ More than one half (55.4 percent) of registry participants reported

receiving some type of help with weight loss (e.g., commercial weight loss program, physician, dietitian or nutritionist), whereas the other participants (44.6 percent) reported losing weight entirely on their own.⁴ The most common dietary strategies for weight loss were to restrict certain foods (87.6 percent), limit food quantities (44 percent), and count calories (43 percent). Regardless of the diet employed, the strategy for successful weight loss maintenance usually entailed dietary modification plus physical activity.⁴

Corroboration of the NWCR findings regarding diet and exercise as the foundation for successful weight loss maintenance is replete in the scientific literature. Research has determined that certain strategies, such as weighing oneself, planning meals, tracking fat and calories, exercising at least 30 minutes daily, and adding physical activity into one's daily routine, are important in successful weight loss maintenance.³ Barriers to exercise (e.g., being too tired, having no time or no one with whom to exercise, finding it too hard to maintain an exercise routine) were associated with being unsuccessful at losing weight.³ Thus, time pressure and lack of social support seem to be important hindrances in achieving exercise-related goals. Reducing consumption of fast foods can also assist persons in keeping weight off.¹⁶

In another study, researchers analyzed more than 2,000 NWCR participants' variety of foods consumed within different food groups via a food-frequency questionnaire.¹⁷ The findings suggest that successful weight loss maintainers consume a diet with limited variety in all food groups. Therefore, restricting variety within all food groups may help with consuming a low-calorie diet and maintaining long-term weight loss.¹⁷ Dieting

Table 1. Weight Loss Strategies of Participants in the National Weight Control Registry

- 98 percent modified their food intake in some way to lose weight
- 94 percent increased their physical activity, with walking being the most commonly reported form of activity
- 90 percent exercise about one hour per day, on average
- 78 percent eat breakfast every day
- 75 percent weigh themselves at least once a week
- 62 percent watch less than 10 hours of television per week

Information from reference 15.

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consistency and a low frequency of dieting also seem to enhance successful weight loss maintenance. Thus, persons who maintain a stable day-to-day diet and do not appreciably change their diet on weekends, holidays, or special occasions tend to experience less weight regain over the subsequent year and are 1.5 times more likely to maintain their weight loss.^{18,19}

Just as there are predictors of weight loss maintenance, there are predictors of weight regain. The single best predictor of increased regain risk among NWCR participants was how long they had successfully maintained their weight loss. Persons who had kept their weight off for at least two years were far more likely to maintain their weight over the following year.⁴

Another predictor of success or failure among NWCR participants was their level of dietary disinhibition (i.e., loss of restraint).⁴ Akin to a temporary loss of control of eating, dietary disinhibition facilitates periods of overeating or overindulgence. Dietary disinhibition has been measured using the Eating Inventory (i.e., Three-Factor Eating Questionnaire), which assesses three aspects of eating behavior: cognitive restraint, uncontrolled eating, and emotional eating.^{20,21} Before treatment, higher restraint scores were associated with lower body weights ($P = .02$), whereas higher disinhibition scores were associated with greater binge eating severity ($P < .0001$). Weight loss treatment was associated with statistically significant increases in restraint ($P < .0001$) and decreases in disinhibition and hunger ($P < .0001$). Greater increases in restraint during treatment were associated with larger weight losses ($P < .0001$).^{20,21}

Behavioral issues are important to the discussion of weight loss maintenance. Brief, monthly personal contact between patient and physician or patient and educator has been shown to be more effective in accomplishing weight loss maintenance than other methods of interaction, including Web-based technology.^{22,23} Physicians can assist their patients with maintaining weight loss by reinforcing healthy dietary and exercise habits; regularly monitoring weight, body mass index (BMI), and waist circumference; encouraging additional support from nutrition counseling and cognitive behavior therapy, when indicated; and addressing other risk factors for weight regain.²⁴

Social support, better coping strategies, and the ability to handle life stressors are factors associated with successful weight loss maintenance.²⁵ Disinhibited eating, binge eating, more intense hunger, eating in response to negative emotions and stress, passive reactions to problems, and less assumption of responsibility in life are all factors posing a risk of weight regain. On the other hand, strong internal motivation to lose weight, self-efficacy

(defined as greater confidence in achieving successful weight loss), and a sense of autonomy contribute to successful weight loss maintenance.²⁵ Food journaling is an additional proven strategy for short-term weight loss and successful weight loss maintenance.²⁵ A summary of behavioral strategies contributing to successful weight loss maintenance is shown in *Table 2*.²⁵

Pharmacotherapy

Pharmacologic treatment may be considered as an adjunct to lifestyle changes in patients who have not lost at least 1.11 lb (0.5 kg) per week after three to six months of implementing lifestyle changes alone.²⁴ Orlistat (Xenical) and sibutramine (Meridia) are the only medications approved by the U.S. Food and Drug Administration for long-term use in treating obesity. Several RCTs confirm the utility of these medications in helping maintain weight loss.²⁶⁻³² Indications for pharmacotherapy are a BMI of at least 30 kg per m², or a BMI of at least 27 kg per m² in patients with weight-related comorbidities.²⁴

SIBUTRAMINE

In the Sibutramine Trial of Obesity Reduction and Maintenance, 500 participants who lost more than 5 percent of their initial body weight (mean weight loss = 25.11 lb [11.3 kg]; range of 10.0 to 72.2 lb [4.5 to 32.5 kg]) were treated with 10 mg of sibutramine or placebo in the weight maintenance phase, which lasted for 18 months.²⁶

Table 2. Behavioral Factors Pertaining to Weight Loss Maintenance

Factors associated with successful weight loss maintenance

- Establish a social support network
- Limit or avoid disinhibited eating
- Avoid binge eating
- Avoid eating in response to negative emotions and stress
- Be accountable for one's decisions
- Foster a strong sense of autonomy, internal motivation, and self-efficacy toward weight loss maintenance

Risk factors associated with weight regain

- Disinhibited eating
- Binge eating
- Periods of excessive hunger
- Eating in response to negative emotions and stress
- Passive reactions to problems
- Less assumption of responsibility in life

Information from reference 25.

Sibutramine was titrated upward to 20 mg in those who began regaining weight. In the treatment groups, weight regain started at 12 months of follow-up; at the end of 18 months, more than 80 percent of lost weight was maintained ($P < .001$).²⁷ In contrast, the placebo group regained weight two months into follow-up, and they regained nearly 80 percent of their weight loss by month 18. The overall rate of responders, keeping in mind the high dropout rate in both arms, was 43 percent in the treatment group versus 19 percent in the placebo group. An additional study showed that more than 80 percent of the weight loss achieved with the use of very-low-calorie diets was maintained at months 6, 12, and 18 by 70, 51, and 30 percent of sibutramine-treated patients, respectively ($P \leq .03$), compared with 48, 31, and 20 percent of patients in the placebo group.²⁸

ORLISTAT

In a four-year, double-blind, prospective European study ($n = 3,305$), 26.2 percent of patients taking orlistat who did not discontinue treatment kept off 10 percent of their initial body weight after four years, compared with 16 percent of patients in the placebo group ($P < .001$).²⁹ Similarly, a three-year study concluded that orlistat was superior to placebo in maintaining initial weight loss after the use of very-low-calorie diets.³⁰ A two-year RCT found that participants treated with orlistat maintained two thirds of their weight loss ($P < .001$).³¹

Bariatric Surgery

The scientific literature strongly supports that successful long-term weight loss maintenance can be achieved with bariatric surgery.³³ As early as the mid 1990s, gastric bypass was clearly shown to result in long-term weight loss.³⁴ In 2002, a review was published on the varying degrees of weight loss maintenance success with different types of bariatric surgeries, concluding that “bariatric surgery offers the best treatment to produce sustained weight loss in patients who are morbidly obese.”³⁵ Additional studies also have found that gastric bypass (Roux-en-Y procedure) is the best surgical option for inducing weight loss and maintaining long-term weight loss in morbidly obese patients.³⁶ Better weight loss outcomes and remission of several comorbid medical conditions are more common following bariatric surgery.³⁷⁻³⁹ Bariatric surgery may be considered if other weight loss attempts have failed, bearing in mind the postsurgical necessity of lifelong medical monitoring. To be considered for surgery, a patient needs to meet BMI criteria for being morbidly obese,²⁴ which, according to an updated classification system,⁴⁰ includes

patients with a BMI of at least 40 kg per m² (obesity class III), or at least 35 kg per m² (obesity class II) in the presence of comorbidities.

Despite the positive surgical results, RCTs comparing surgical and nonsurgical approaches are lacking. A recent prospective case-control comparison of surgical and nonsurgical methods in NWCR participants demonstrated no statistical difference between either method in achieving weight loss maintenance.⁴¹ This suggests that behavioral changes can achieve the same results as surgical interventions when patients are sufficiently motivated and supported.

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Bariatric surgery leads to the best weight loss maintenance in morbidly obese patients.

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REFERENCES

1. Wing RR, Hill JO. Successful weight loss maintenance. *Annu Rev Nutr*. 2001;21:323-341.
2. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report. National Institutes of Health [published correction appears in *Obes Res*. 1998;6(6):464]. *Obes Res*. 1998;6(suppl 2):51S-209S.
3. Kruger J, Blanck HM, Gillespie C. Dietary and physical activity behaviors among adults successful at weight loss maintenance. *Int J Behav Nutr Phys Act*. 2006;3:17.
4. Wing RR, Phelan S. Long-term weight loss maintenance. *Am J Clin Nutr*. 2005;82(1 suppl):222S-225S.
5. Grief SN. Involuntary weight loss. In: Taylor RB, Paulman PM, Paulman AA, Harrison JD, eds. *Taylor's Manual of Family Medicine*. 3rd ed. Philadelphia, Pa.: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2008:47-50.
6. Wadden TA, West DS, Neiberg RH, et al.; Look AHEAD Research Group. One-year weight losses in the Look AHEAD study: factors associated with success. *Obesity (Silver Spring)*. 2009;17(4):713-722.

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- Knowler WC, Barrett-Connor E, Fowler SE, et al.; Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med*. 2002; 346(6):393-403.
- Thomas PR. *Weighing the Options: Criteria for Evaluating Weight-Management Programs*. Washington, DC: National Academy Press; 1995.
- Balady GJ, Williams MA, Ades PA, et al. Core components of cardiac rehabilitation/secondary prevention programs: 2007 update: a scientific statement from the American Heart Association Exercise, Cardiac Rehabilitation, and Prevention Committee, the Council on Clinical Cardiology; the Councils on Cardiovascular Nursing, Epidemiology and Prevention, and Nutrition, Physical Activity, and Metabolism; and the American Association of Cardiovascular and Pulmonary Rehabilitation. *Circulation*. 2007;115(20):2675-2682.
- Atkins RC. *Dr. Atkins' New Diet Revolution*. New York, NY: Harper Collins; 1992.
- Agatston A. *The South Beach Diet: The Delicious, Doctor-Designed, Foolproof Plan for Fast and Healthy Weight Loss*. New York, NY: St. Martin's Griffin; 2003.
- Dansinger ML, Gleason JA, Griffith JL, Selker HP, Schaefer EJ. Comparison of the Atkins, Ornish, Weight Watchers, and Zone diets for weight loss and heart disease risk reduction: a randomized trial. *JAMA*. 2005;293(1):43-53.
- Sacks FM, Bray GA, Carey VJ, et al. Comparison of weight-loss diets with different compositions of fat, protein, and carbohydrates. *N Engl J Med*. 2009;360(9):859-873.
- Marinilli Pinto A, Gorin AA, Raynor HA, Tate DF, Fava JL, Wing RR. Successful weight-loss maintenance in relation to method of weight loss. *Obesity (Silver Spring)*. 2008;16(11):2456-2461.
- The National Weight Control Registry. <http://www.nwcr.ws/>. Accessed February 8, 2010.
- Kruger J, Blanck HM, Gillespie C. Dietary practices, dining out behavior, and physical activity correlates of weight loss maintenance. *Prev Chronic Dis*. 2008;5(1):A11.
- Raynor HA, Jeffery RW, Phelan S, Hill JO, Wing RR. Amount of food group variety consumed in the diet and long-term weight loss maintenance. *Obes Res*. 2005;13(5):883-890.
- Gorin AA, Phelan S, Wing RR, Hill JO. Promoting long-term weight control: does dieting consistency matter? *Int J Obes Relat Metab Disord*. 2004;28(2):278-281.
- Vogels N, Diepvens K, Westerterp-Plantenga MS. Predictors of long-term weight maintenance. *Obes Res*. 2005;13(12):2162-2168.
- Foster GD, Wadden TA, Swain RM, Stunkard AJ, Platte P, Vogt RA. The Eating Inventory in obese women: clinical correlates and relationship to weight loss [published correction appears in *Int J Obes Relat Metab Disord*. 1999;23(1):106]. *Int J Obes Relat Metab Disord*. 1998;22(8):778-785.
- Karlsson J, Persson LO, Sjostrom L, Sullivan M. Psychometric properties and factor structure of the Three-Factor Eating Questionnaire (TFEQ) in obese men and women. Results from the Swedish Obese Subjects (SOS) study. *Int J Obes Relat Metab Disord*. 2000;24(12):1715-1725.
- Svetkey LP, Stevens VJ, Brantley PJ, et al.; Weight Loss Maintenance Collaborative Research Group. Comparison of strategies for sustaining weight loss: the weight loss maintenance randomized controlled trial. *JAMA*. 2008;299(10):1139-1148.
- Wing RR, Tate DF, Gorin AA, Raynor HA, Fava JL. A self-regulation program for maintenance of weight loss. *N Engl J Med*. 2006;355(15):1563-1571.
- Lau DC, Douketis JD, Morrison KM, Hramiak IM, Sharma AM, Ur E; Obesity Canada Clinical Practice Guidelines Expert Panel. 2006 Canadian clinical practice guidelines on the management and prevention of obesity in adults and children [summary]. *CMAJ*. 2007;176(8):S1-S13.
- Elfhag K, Rössner S. Who succeeds in maintaining weight loss? A conceptual review of factors associated with weight loss maintenance and weight regain. *Obes Rev*. 2005;6(1):67-85.
- Hansen D, Astrup A, Toubro S, et al. Predictors of weight loss and maintenance during 2 years of treatment by sibutramine in obesity. Results from the European multi-centre STORM trial. Sibutramine Trial of Obesity Reduction and Maintenance. *Int J Obes Relat Metab Disord*. 2001;25(4):496-501.
- James WP, Astrup A, Finer N, et al. Effect of sibutramine on weight maintenance after weight loss: a randomised trial. STORM Study Group. Sibutramine Trial of Obesity Reduction and Maintenance. *Lancet*. 2000; 356(9248):2119-2125.
- Mathus-Vliegen EM; Balance Study Group. Long-term maintenance of weight loss with sibutramine in a GP setting following a specialist guided very-low-calorie diet: a double-blind, placebo-controlled, parallel group study. *Eur J Clin Nutr*. 2005;59(suppl 1):S31-S38.
- Torgerson JS, Hauptman J, Boldrin MN, Sjöstrom L. XENical in the prevention of Diabetes in Obese Subjects (XENDOS) study: a randomized study of orlistat as an adjunct to lifestyle changes for the prevention of type 2 diabetes in obese patients [published correction appears in *Diabetes Care*. 2004;27(3):856]. *Diabetes Care*. 2004;27(1):155-161.
- Richelsen B, Tonstad S, Rössner S, et al. Effect of orlistat on weight regain and cardiovascular risk factors following a very-low-energy diet in abdominally obese patients: a 3-year randomized, placebo-controlled study. *Diabetes Care*. 2007;30(1):27-32.
- Davidson MH, Hauptman J, DiGirolamo M, et al. Weight control and risk factor reduction in obese subjects treated for 2 years with orlistat: a randomized controlled trial [published correction appears in *JAMA*. 1999;281(13):1174]. *JAMA*. 1999;281(3):235-242.
- Padwal R, Li SK, Lau DC. Long-term pharmacotherapy for obesity and overweight. *Cochrane Database Syst Rev*. 2004;(3):CD004094.
- Colquitt JL, Picot J, Loveman E, Clegg AJ. Surgery for obesity. *Cochrane Database Syst Rev*. 2009;(2):CD003641.
- Pories WJ, Swanson MS, MacDonald KG, et al. Who would have thought it? An operation proves to be the most effective therapy for adult-onset diabetes mellitus. *Ann Surg*. 1995;222(3):339-350.
- Brolin RE. Bariatric surgery and long-term control of morbid obesity. *JAMA*. 2002;288(22):2793-2796.
- Tice JA, Karliner L, Walsh J, Petersen AJ, Feldman MD. Gastric banding or bypass? A systematic review comparing the two most popular bariatric procedures. *Am J Med*. 2008;121(10):885-893.
- Buchwald H, Avidor Y, Braunwald E, et al. Bariatric surgery: a systematic review and meta-analysis [published correction appears in *JAMA*. 2005;293(14):1728]. *JAMA*. 2004;292(14):1724-1737.
- Dixon JB, O'Brien PE. Changes in comorbidities and improvements in quality of life after LAP-BAND placement. *Am J Surg*. 2002;184(6B):515-545.
- Wilson JB, Pories WJ. Durable remission of diabetes after bariatric surgery: what is the underlying pathway? *Insulin*. 2010;5(1):46-55.
- National Heart, Lung, and Blood Institute; National Institutes of Health; Department of Health and Human Services. Classification of overweight and obesity by BMI, waist circumference, and associated disease risks. http://www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/bmi_dis.htm. Accessed August 24, 2010.
- Bond DS, Phelan S, Leahey TM, Hill JO, Wing RR. Weight-loss maintenance in successful weight losers: surgical vs non-surgical methods. *Int J Obes (Lond)*. 2009;33(1):173-180.