

Meal Replacement Shakes and Nutrition Bars: Do They Help Individuals With Diabetes Lose Weight?

Jacqueline Craig, MS, RD, LD, CDE

Type 2 diabetes is a significant health concern in the United States. Approximately 95% of people with diabetes have type 2 diabetes.¹ The majority of people with type 2 diabetes are overweight or obese.

Weight loss has been established as an important therapeutic goal for overweight or obese patients with diabetes. Meal replacement shakes and nutrition bars are simple and effective weight loss tools for overweight or obese people with diabetes. These products have shown advantages over self-selective weight loss diets.

This article outlines some of the advantages of using meal replacement shakes and nutrition bars as weight loss tools. In addition, it offers a brief review of the literature on the use of these products in overweight and obese people with type 2 diabetes.¹

The National Weight Control Registry (NWCR) is a program tracking > 10,000 individuals who have lost a significant amount of weight and kept it off for at least 1 year. The NWCR identifies and investigates the characteristics of individuals who have succeeded at long-term weight loss. Obesity researchers track the lifestyle habits of successful weight losers and the behavioral strategies they use to maintain their weight.²

Behavioral strategy tools are important to help participants stay motivated and on a successful path to weight loss and maintenance. Food diaries, pedometers, smaller dinner plates, and meal replacement shakes and nutrition bars are examples of weight loss tools.²

Meal replacement shakes and nutrition bars provide a mixture of

protein, carbohydrate, and fat, along with added vitamins and minerals. The shakes come in liquid ready-to-drink or powder formulas that require mixing. They are designed to mimic a low-calorie meal or snack and to be easy and quick to consume. Meal replacement shakes and nutrition bars have grown in popularity and variety in recent years and have proven to be a viable option to support weight loss.³

There are many benefits to using shakes and nutrition bars in weight management. They provide individuals with a premeasured amount of food with a known calorie level, thus negating the need to measure or weigh meals or to estimate portion sizes. They are easy to transport and prepare and require no clean-up. Many individuals prefer to use these simple, convenient preparations instead of devoting time and energy to planning, preparing, and cleaning up after meals. Meal replacement shakes and nutrition bars allow dieters to have reduced contact with calorie-dense foods and involve less decision-making (e.g., consuming a shake or bar during a lunch break at work is easier than going to a restaurant and making a healthy food choice in the recommended portion size to meet weight loss goals).⁴ Additionally, such shakes and bars may further support weight loss via sensory-specific satiety. Sensory-specific satiety refers to the decreasing pleasure of tasting, smelling, or eating the same food or beverage until full or satisfied. Using monotonous meals or snacks (such as shakes or bars) triggers sensory-specific satiety, which may help

individuals further decrease their caloric intake.⁵

The American Diabetes Association (ADA) nutrition recommendations for diabetes acknowledge that meal replacement products when used once or twice a day to replace usual meals may result in significant weight loss. These recommendations caution, however, that to maintain weight loss, meal replacement therapy must be sustained indefinitely.⁶

Keeping an accurate food diary is a recognized component of comprehensive weight loss programs.² Several studies have found that obese individuals are more likely to underreport calorie intake when keeping records.⁷ Lichtman et al.⁸ found that obese individuals underreported actual food intake by an average of 47%. Overweight and obese adolescents underreport calorie intake to a similar degree.⁹ Meal replacement shakes and nutrition bars may help dieters not only follow a weight control eating pattern, but also report more accurate calorie intake in their food diary.

Ditschuneit et al.¹⁰ assessed the long-term effects of an energy-restricted diet combined with one or two daily meal replacements on body weight and biomarkers of disease risk in 100 obese patients. Participants were randomly assigned to one of two dietary treatments. Both groups consumed 1,200–1,500 calories per day. One group was prescribed a diet in which all meals and snacks were prepared from self-selected, conventional foods. The other group was prescribed similar self-selected diets, except that two of the three main meals (breakfast, lunch, and dinner) were replaced with one of three meal replacement options (shakes, hot chocolate, or soup).

The researchers found that participants who replaced two out of three meals with meal replacement options and snacks with nutrition bars lost more weight than the comparison group choosing a self-selected, isocaloric eating plan using conventional foods. At 3 months, the group consuming meal replacement options and bars lost 7.8% of their initial body weight, whereas the

group eating conventional foods lost 1.5% of their initial body weight.

After the initial intervention, both groups were asked to continue to follow a 1,200- to 1,500-calorie eating plan and to replace one meal with a meal replacement option and one snack with a bar each day. After 4 years, the initial meal replacement option/snack bar intervention group lost a mean 8.4% of their body weight, whereas the group initially selecting conventional foods lost 3.2% of their body weight.¹¹ Both groups saw improvements in blood glucose and insulin levels, and the replacement option/snack bar group also had significant improvements in triglycerides and systolic blood pressure compared to baseline.¹¹

A meta- and pooling analysis of six randomized controlled trials (RCTs)³ showed that using meal replacement shakes for one to two meals per day during the weight loss phase and one meal per day during the maintenance phase produced a weight loss efficacy equivalent to or significantly greater than conventional reduced-calorie diets. Two of the six studies included subjects with type 2 diabetes. There was no difference in weight loss at 3 months between the individuals with diabetes and those without, although, at the 1-year follow-up, subjects with diabetes did not maintain their weight loss as well as their counterparts without diabetes. Despite experiencing less weight loss at 1 year, participants with type 2 diabetes decreased their A1C levels and reduced their need for diabetes medications. It was reported that participants who had a longer duration of diabetes and who used insulin lost less weight.

An RCT¹² of 77 patients with diabetes compared the use of a soy-based meal replacement shake product for one to three meals per day to an individualized meal plan using ADA Exchange Lists. For both groups, a calorie target goal was based on subtracting 500 calories per day from estimated individual calorie needs. Fasting plasma glucose levels of the individuals randomized to the meal replacement plan were significantly reduced at 6 months,

but not at 12 months, compared to participants on the individual diet plan. A1C levels were significantly lower and weight loss was significantly greater in the meal replacement group at 3 months, although there were no significant differences between groups at 1 year. Both groups maintained weight loss at 12 months, with a mean weight loss of 2.36 kg in the individual meal plan group and 4.35 kg in the meal replacement group.

The Look AHEAD (Action for Health in Diabetes) study¹³ is a 14-year multicenter RCT to assess whether weight reduction combined with physical activity can reduce cardiovascular disease morbidity and mortality in overweight or obese individuals with type 2 diabetes. More than 5,000 participants were randomly assigned to either an intensive lifestyle intervention or a usual care control group. The intensive lifestyle intervention was modeled on the landmark Diabetes Prevention Program (DPP).¹⁴ However, Look AHEAD set a more ambitious individual goal of losing $\geq 10\%$ of initial body weight at year 1 (vs. 7% in the DPP) and ≥ 175 minutes of moderate-intensity physical activity per week (vs. ≥ 150 minutes per week in the DPP).¹⁵

The control group received three group sessions per year with general information. The intervention group received weekly group or individual counseling on weight control for the first 6 months. For the remainder of the year, the intervention group continued to meet with a lifestyle counselor monthly and attended two group sessions per month. The nutrition intervention strategies focused on self-monitoring of food intake by calorie-counting and fat-gram goals along with aggressive use of meal replacements (mainly beverages and bars provided at no charge to participants) during the first 4 months. During months 5–12, participants were encouraged to continue to replace one meal and one snack per day with a meal replacement product.¹⁶ At 1 year, the intensive group lost 8.6% of their initial weight, whereas the control group lost only 0.7%. Greater self-reported physical

activity was the strongest correlate of weight loss, followed by treatment attendance and consumption of meal replacements.¹⁶

A study by Berkowitz et al.¹⁷ found similar results in healthy, overweight, and obese adolescents (80% female, 62% African American) in a 12-month RCT. Adolescents who were randomized to the intervention group and their parents attended group meetings for 4 months and were assigned to follow a 1,300- to 1,500-calorie meal plan of either conventional foods or three meal replacement shakes per day, along with a frozen prepackaged meal and five servings of fruits and vegetables. From month 4 to month 12, the intervention group consumed two meal replacements, five servings of fruits and vegetables, and a conventional meal daily, within the 1,300- to 1,500-calories-per-day limit. The meal replacement group lost significantly more weight at 4 months, but the benefits of the meal replacement plan were not maintained at the 12-month follow-up.

There is some concern among the general public that the carbohydrate (sugar) content of meal replacement shakes and bars may cause postprandial glucose excursions when consumed by people with diabetes, contributing to increased glucose variability. Postprandial glucose excursions have been linked to cardiovascular disease.¹⁸ Therefore, effective management of diabetes should also include control of peak postprandial glucose levels to the current target recommendation of ≤ 180 mg/dl.¹⁹

Two small studies have examined the postprandial effects of meal replacement shakes.^{20,21} Fonda et al.²⁰ evaluated the use of three meal replacement shakes in people with type 2 diabetes who were not taking insulin or insulin secretagogues. Various formulations of shake products were compared, including a diabetes-specific formula, a soy-based weight loss formula, and a fiber-containing formula. The volume of beverages was adjusted to include 50 g of carbohydrate. Subjects consumed each of the beverages after an overnight fast in random

Table 1. Tips for Counseling Patients Who Would Like to Use Meal Replacement Shakes or Nutrition Bars for Weight Loss

- Inquire about patients' motivation and confidence for behavior change.
- Ask patients about their current eating habits. What kinds of foods and beverages do they eat in a typical day? Explore serving sizes and how foods are prepared.
- Assist patients in identifying healthier replacement foods or beverages instead of dietary choices that are high in calories, sugar, fat, or sodium; shakes and nutrition bars may be good options as replacement foods.
 - Remind patients that meal replacement shakes and nutrition bars must be used as replacements for other foods or beverages—not as additions—to reduce calorie intake and help to achieve weight loss.
- Partner with patients to identify specific behavior-change goals they are willing to make during the next month or several months. Ask questions such as, “What kind of food or beverage changes are you willing to start with?” or “How can I be the most help to you?”

Table 2. Selecting Meal Replacement Shakes and Nutrition Bars^{19,22}

- Examining the Nutrition Facts labels and product ingredient lists on product packages will help patients and health care providers discern whether specific meal replacement shakes or nutrition bars can fit into patients' diabetes weight loss meal plan.
- Check the Nutrition Facts label for serving size. It is important to remind patients that the nutrition information listed on a product label is based on the serving size shown.
- Look at the listing for calories per serving. Is the product consistent with weight loss goals? Will the shake or bar be used as a meal or as a snack? Most shakes and bars range from 150 to 250 calories per serving. For example, a 250-calorie bar may work as a meal replacement, but not necessarily as a snack.
- Examine the listing for saturated fat content. ADA recommends a diet that contains $< 7\%$ of calories from saturated fat. Select shakes or bars with ≤ 2 g of saturated fat to help meet this recommendation.
- Find the listing for trans fat content. Intake of trans fat should be minimized. Look for products containing 0 g of trans fat and that do not list hydrogenated fats or oils as one of their first three ingredients.
- Sodium intake is a consideration for people with diabetes. The 2010 Dietary Guidelines²¹ recommend that people with diabetes consume $\leq 1,500$ mg/day of sodium. This is a difficult goal for patients to meet. The sodium content of shakes and bars must be counted in their total sodium intake for the day.
- Review the product's listing for total carbohydrate per serving to find out whether a shake or bar meets individual goals for carbohydrate intake. The amount of carbohydrate in the product is a key determinant whether the shake or bar may be used in a patient's weight loss plan.

sequence, 1 week apart, before taking any oral diabetes medications.

The study found that the increase in postprandial glucose was significantly different with the diabetes-specific shake, which had the largest quantity of sugar alcohol. This product yielded the lowest mean rise in blood glucose and smallest percentage of subjects above the recommended postprandial glucose

upper limit 2 hours after consuming the shake. The other two formulations had less favorable postprandial profiles. It was proposed that the shake with a higher sugar alcohol content may be absorbed more slowly than sucrose and, therefore, may have resulted in a slower increase in postprandial glucose levels.

Another study²¹ randomly assigned 57 subjects with type 2

diabetes to either a meal replacement shake containing lactose, fructose, and sucrose; a shake product containing lactose and oligosaccharides; or an individualized reduced-calorie eating plan of regular food for 12 weeks. Individuals following the two shake plans were instructed to replace two meals per day with shakes and to eat one sensible, portion-controlled meal per day. Weight loss was greater in the shake groups (6.4 and 6.7% of body weight, respectively) than in the conventional diet group (4.9% of body weight). Fasting glucose, LDL cholesterol, and total cholesterol levels were significantly reduced in the meal replacement groups compared to the conventional diet group.

These meal replacement products have some limitations, however. A vital part of a comprehensive weight management program is learning to recognize and eat smaller portions at meals and snacks. Relying on replacement products too heavily may hinder this learning process. Consuming daily meal replacement shakes and nutrition bars over time can become monotonous for individuals who prefer a large variety in food texture and taste. In addition, some individuals may not tolerate shake products that are formulated with sugar alcohols. The most common side effects reported are bloating and diarrhea.

Studies have demonstrated the benefits of using meal replacement shakes and nutrition bars for weight loss. These products can be used safely by individuals with diabetes and may provide options for those desiring weight loss. Health care professionals can advise their patients with diabetes that such meal replacement products may be considered a potentially useful weight management tool to improve outcomes in conjunction with conventional weight loss plans. Tips for successfully counseling patients and assisting them in selecting meal replacement shakes and nutrition bars are included in Tables 1 and 2.

References

- ¹Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion: Diabetes report card, 2012 [article online]. Available from www.cdc.gov/diabetes/pubs/pdf/DiabetesReportCard.pdf. Accessed 1 August 2012
- ²National Weight Control Registry: NWCR facts [article online]. Available from www.nwcr.ws/Research/default.htm. Accessed 1 August 2012
- ³Heymsfield SB, Van Mierlo CA, Van Der Knaap HC, Heo M, Frier HI: Weight management using a meal replacement strategy: meta and pooling analysis from six studies. *Int J Obes* 27:537–549, 2003
- ⁴Tsai AG, Wadden TA: The evolution of very-low-calorie diets: an update and meta analysis. *Obesity* 14:1283–1293, 2006
- ⁵Raynor HA, Niemeier HM, Wing RR: Effect of limiting snack food variety on long-term sensory-specific satiety and monotony during obesity treatment. *Eat Behav* 7:1–14, 2006
- ⁶American Diabetes Association: Nutrition recommendations and interventions for diabetes [Position Statement]. *Diabetes Care* 31:S61–S78, 2008
- ⁷Schoeller DA: How accurate is self-reported dietary energy intake? *Nutr Rev* 48:373–379, 1990
- ⁸Lichtman SW, Pisarska K, Berman ER, Pestone M, Dowling H, Offenbacher E, Weisel H, Heshka S, Matthews DE, Heymsfield SB: Discrepancy between self-reported and actual calorie intake and exercise in obese subjects. *N Engl J Med* 327:1893–1898, 1992
- ⁹Bandini LG, Schoeller DA, Cyr HN, Dietz WH: Validity of reported energy intake in obese and nonobese adolescents. *Am J Clin Nutr* 52:421–425, 1990
- ¹⁰Ditschuneit HH, Flechtner-Mors M, Johnson TD, Adler G: Metabolic and weight loss effects of dietary intervention in obese patients. *Am J Clin Nutr* 69:198–204, 1999
- ¹¹Flechtner-Mors M, Ditschuneit H, Johnson T, Suchard M, Adler G: Metabolic and weight loss effects of long-term intervention in obese patients: four-year results. *Obes Res* 8:399–402, 2000
- ¹²Li Z, Saltsman P, DeShields S, Bellman M, Thames G, Liu Y, Wang H-J, Elashoff R, Heber D: Long-term efficacy of soy-based meal replacements vs. an individual diet plan in obese type 2 DM patients: relative effects on weight loss, metabolic parameters, and C-reactive protein. *Eur J Clin Nutr* 59:411–418, 2005
- ¹³Pi-Sunyer X, Blackburn G, Brancati FL: Reduction in weight and cardiovascular disease risk factors in individuals with type 2 diabetes: one-year results of the Look AHEAD trial. *Diabetes Care* 30:1374–1383, 2007
- ¹⁴Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, Nathan DM; DPP Research Group: Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 346:393–403, 2002
- ¹⁵Delahanty LM, Nathan DM: Implications of the Diabetes Prevention Program and Look AHEAD clinical trials for lifestyle interventions. *J Am Diet Assoc* 108 (Suppl. 1):S66–S72, 2008
- ¹⁶Wadden TA, West DS, Neiberg RH, Wing RR, Ryan DH, Johnson KC, Foreyt JP, Hill JO, Trencle DL, Vitolins MZ: One-year weight losses in the Look AHEAD study: factors associated with success. *Obesity* 17:713–722, 2009
- ¹⁷Berkowitz RI, Wadden TA, Gehrman CA, Bishop-Gilyard CT, Moore RH, Womble LG, Cronquist JL, Trumpikas NL, Levit Katz LE, Xanthopoulos MS: Meal replacements in the treatment of adolescent obesity: a randomized controlled trial. *Obesity* 19:1193–1199, 2011
- ¹⁸Cavalot F, Petrelli A, Traversa M, Bonomo K, Fiora E, Conti M, Anfossi G, Costa G, Trovati M: Postprandial blood glucose is a stronger predictor of cardiovascular events than fasting blood glucose in type 2 diabetes mellitus, particularly in women: lessons from the San Luigi Gonzaga diabetes study. *J Clin Endocrinol Metab* 91:813–819, 2006
- ¹⁹American Diabetes Association: Standards of medical care in diabetes—2013. *Diabetes Care* 36 (Suppl. 1):S11–S66, 2013
- ²⁰Fonda SJ, Jain A, Vigersky RA: A head to head comparison of the postprandial effects of 3 meal replacement beverages among people with type 2 diabetes. *Diabetes Educ* 36:793–800, 2010
- ²¹Yip I, Go VL, DeShields S, Saltsman P, Bellman M, Thames G, Murray S, Wang HJ, Elashoff R, Heber D: Liquid meal replacements and glycemic control in obese type 2 diabetes patients. *Obes Res* 9 (Suppl. 4):S341–S347, 2001
- ²²U.S. Department of Health and Human Services: Dietary Guidelines for Americans, 2010. Available from <http://www.cnpp.usda.gov/DGAs2010-PolicyDocument.htm>. Accessed 8 April 2013

Jacqueline Craig, MS, RD, LD, CDE, is an outpatient dietitian at the Cincinnati Veterans Affairs Medical Center in Ohio.