

## “Low-Carbohydrate” Food Facts and Fallacies

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Ten years ago, weight-conscious Americans jumped on the fat-free bandwagon. Supermarket shelves were replete with products touting “reduced-fat” and “fat-free” labels, which implied that these products were healthier and lower-calorie alternatives to standard “high-fat” fare. Yet, in the same 10-year time interval, Americans have continued to struggle with ever-expanding waistlines, gaining an average of 1 lb/year.<sup>1</sup> The prevalence of type 2 diabetes has risen simultaneously.<sup>2</sup>

Thirty-eight percent of our population is currently attempting to lose weight.<sup>3</sup> The latest trend in the highly lucrative, yet often fickle, diet industry is a resurgence of low-carbohydrate, high-protein, high-fat diets. Findings of a February 2004 survey by A.C. Nielsen, a leading market information company, revealed that 17.2% of households included someone on a low-carbohydrate diet. Slightly more, 19.2%, included someone who had tried a low-carb diet but had quit.<sup>4</sup> This current diet trend directly counters the decade-old focus on low-fat diets and implicates carbohydrates as the culprit in America’s obesity problem.

In response to the low-carb resurgence, food manufacturers have rapidly revised food products and package claims to seemingly reduce the carbohydrate content of their products and increase consumer demand for them. Restaurant menus have incorporated purportedly low-carb entrees to accommodate demand for low-carb meals away from home. Aggressive marketing schemes imply that these products are healthier alternatives to standard high-carb fare and that they promote weight loss. For individuals

with diabetes who are counting carbohydrates or attempting to lose weight, the current marketplace can be a source of a great deal of misinformation, cause considerable confusion, and possibly affect glycemic control.

### Confusing Labeling Terminology

Many food manufacturers have created their own terminology for carbohydrate content that they claim has minimal effect on blood glucose. They suggest that consumers subtract carbohydrate contributed from sugar alcohols, fiber, and glycerin from the total carbohydrate value on the Nutrition Facts panel of packaged foods to determine the “net carbs,” “impact carbs,” “effective carbs,” or “net effective carbs” of these foods. While these terms sound slightly different, they are used by manufacturers to mean essentially the same thing.

However, this calculation can substantially underestimate the actual carbohydrate value in many products and may result in insulin errors for people using carbohydrate counting to determine their insulin dosages. In addition, individuals with type 2 diabetes following a low-carb regimen for weight loss may erroneously interpret these “disappearing carbs” to mean “disappearing calories,” as well.

Currently, there are no Food and Drug Administration (FDA) regulations for the use of carbohydrate claims on food package labels, as there are for claims about fat, such as “low-fat,” “reduced-fat,” and “fat-free.” Several organizations, including the Grocery Manufacturers of America, have petitioned the FDA to establish regulations for carbohydrate content claims. The FDA is working

on guidelines for defining “low,” “reduced,” or “free” carbohydrates and for the use of the term “net” in relation to carbohydrate content of food, based on recent recommendations by its Obesity Working Group.

The U.S. Department of Agriculture (USDA) Food Safety and Inspection Service has implemented an interim policy that provides guidelines for the use of such labels on products within its jurisdiction, such as meat and poultry. The USDA permits manufacturers to use the terms “net carbs,” “impact carbs,” and “net effective carbs,” provided such claims are truthful, not misleading, and supported by calculations shown on the label.<sup>5</sup>

The net effect of this labeling lingo is confusion and a host of inquiries to which health care professionals must respond.

### How Do Manufacturers Lower the Carbohydrate Content of Foods?

A few creative chefs have replaced some naturally occurring carbohydrate with healthy lower-carbohydrate alternatives, such as making low-carbohydrate mashed “potatoes” with pureed cauliflower. But for the most part, food manufacturers are lowering the grams of carbohydrate in processed foods by altering the portion size or replacing naturally occurring carbohydrate with ingredients that are higher in protein, fat, or other types of carbohydrate. Examples include:

- substituting soy flour, soy protein, or wheat protein for refined flour
- adding fiber from wheat bran, oat bran, corn bran, inulin, or polydextrose as a bulking agent
- adding high-fat ingredients, such as nuts and oils

- replacing sugar with sugar alcohols, such as maltitol, lactitol, or sorbitol, or nonnutritive sweeteners, such as sucralose or acesulfame potassium

**Are the Terms “Net Carbs,” “Impact Carbs,” and “Net Effective Carbs” Truthful?**

Fiber and sugar alcohols (including glycerin) currently must be included in the total carbohydrate value shown in foods’ Nutrition Facts panel. To appeal to the low-carb market, food manufacturers are subtracting these values from the total carbohydrate grams to yield a lower-carbohydrate value termed “net carbs,” “impact carbs,” “effective carbs,” or “net effective carbs” (Figure 1). The intent of these claims is to convince consumers that the products are beneficial to a low-carb diet because with their minimal effect on blood glucose, increases in insulin levels and consequent weight gain will not occur.

But is this labeling misleading? Do these alternative carbohydrate values have a minimal impact on glycemia?

**Sugar alcohols/polyols**

Sugar alcohols, or polyols, are hydrogenated carbohydrates that are used in foods primarily as sweeteners and bulking agents. Table 1 provides a list of commonly used sugar alcohols or

polyols and their caloric values. Sugar alcohols provide 0.2–3.0 kcal/g, rather than the usual 4 kcal/g from completely absorbed carbohydrate, because they are incompletely absorbed in the small intestine. FDA regulations require that food manufacturers count polyols as 2 kcal/g or use the specific kcal/g value determined by the FDA for a single-sugar alcohol.<sup>6</sup> Because of their incomplete absorption, consumption of polyols can cause flatulence or a laxative effect in varying degrees in some individuals.

Despite claims by many food manufacturers, sugar alcohols *do* affect the postprandial blood glucose response in individuals both with and without diabetes.<sup>7</sup> In some studies, specific sugar alcohols elicited a lower glycemic response than glucose, fructose, and/or sucrose.<sup>7,8</sup> In addition, a recent study showed maltitol syrup to have a significantly greater glycemic effect than other sugar alcohols.<sup>9</sup>

The glycemic effect of sugar alcohols may vary because of the type and amount of sugar alcohol consumed or because of individual responses. The American Diabetes Association nutrition recommendations state: “There is no evidence that the amounts likely to be consumed in a meal or day will result in significant reduction in total daily energy intake or improvement in

**Table 1. Calories in Common Polyols**

Name of polyol	kcal/g
Sorbitol	2.6
Mannitol	1.6
Maltitol	3.0
Lactitol	2.0
Xylitol	2.4
Erythritol	0.2
Isomalt	2.0
Hydrogenated starch hydrolysates	2.1
Glycerin	4.3

Adapted from Ref. 5.

long-term glycemia.”<sup>10</sup> The following general guidelines<sup>11–14</sup> are frequently used for counseling individuals with diabetes in carbohydrate counting (Figure 2):

- Subtract half of the grams of total sugar alcohols (polyols) listed from the total carbohydrate value.
- Many sugar-free products that contain sugar alcohols, such as sugar-free hard candy and gum, would fall into the “free foods” category, with < 5 g of carbohydrate or < 20 kcal/serving, making it unnecessary to count the carbohydrate from the sugar alcohol.

Individuals with diabetes who adjust their insulin based on carbohydrate intake would be most likely to benefit from this information. However, many educators are finding the need to address the topic with other patients who have type 2 diabetes simply because of their interest in the carbohydrate information on food packages.

**Glycerin(e)/glycerol**

Glycerin (sometimes spelled glycerine), or glycerol, is a sweet, syrupy liquid that is about 75% as sweet as sucrose. It is chemically categorized as a polyol with 4.32 kcal/g. The FDA classifies glycerin as a Generally Recognized as Safe food additive. As a food additive, glycerin is used in a variety of products, including nutrition or energy bars, because of its ability to retain moisture, and reduced-fat frozen desserts, to prevent formation of ice crystals. Many nutrition bars have > 9 g of glycerin in a single-serving bar.

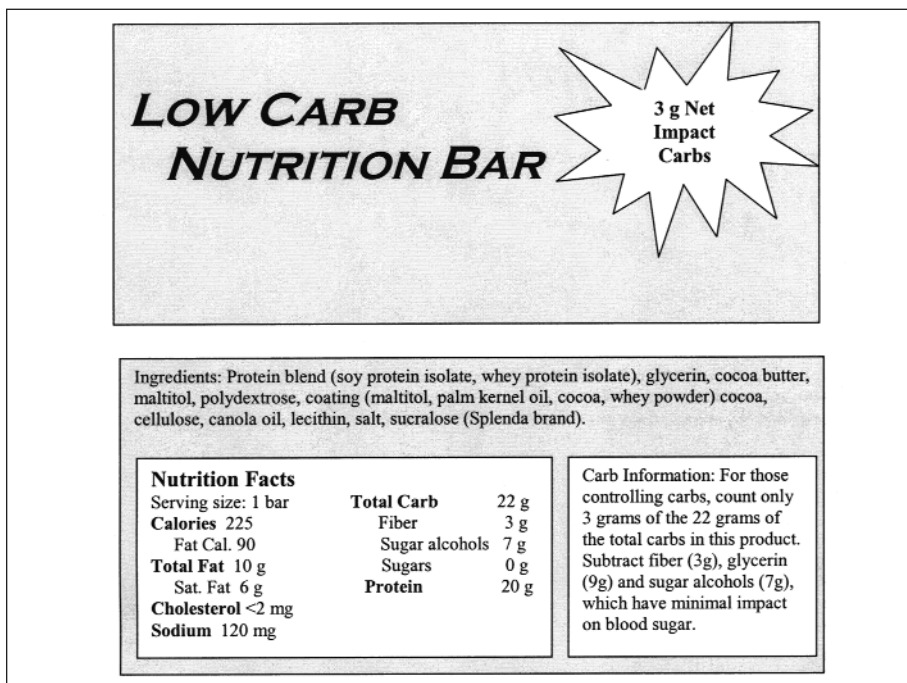


Figure 1. Low-carb food package label.

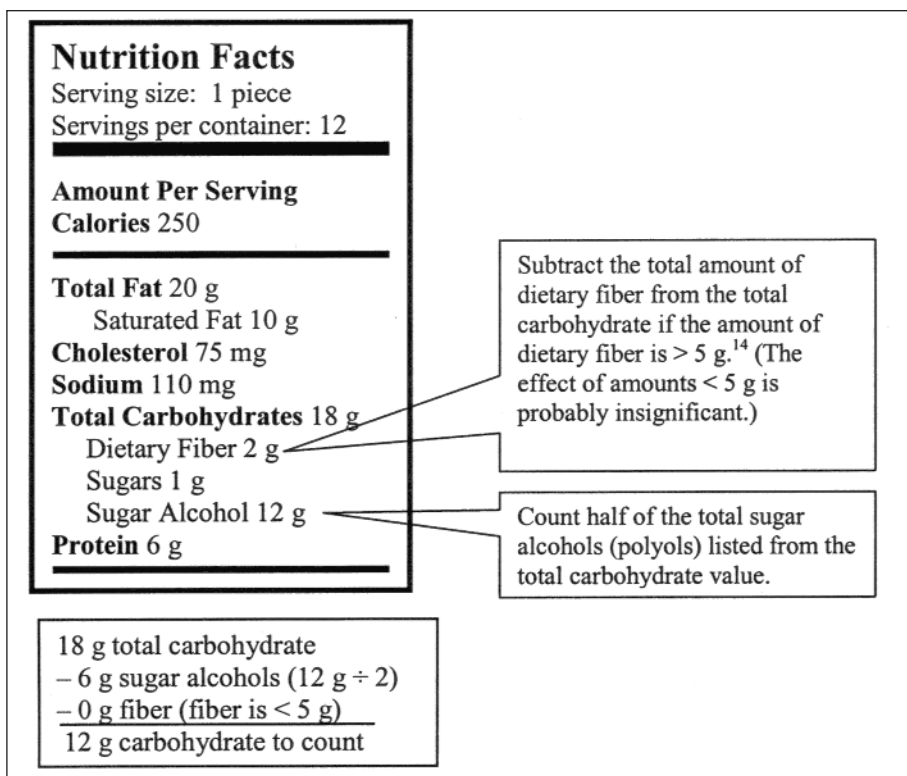


Figure 2. Guidelines for including dietary fiber and sugar alcohols (polyols) in carbohydrate counting.<sup>13,14</sup>

According to the FDA, synthetic glycerin is produced by the hydrogenolysis of carbohydrates<sup>15</sup> and must be included in the grams of total carbohydrate listed in the Nutrition Facts panel. If the label has a statement regarding sugars, the FDA requires the glycerin content per serving to be declared as sugar alcohol.<sup>16</sup> Some food manufacturers disagree with the classification of glycerin as a carbohydrate and have been omitting it from their calculations.

The metabolic fate of glycerin has yet to be determined, but it is believed to be converted into glucose primarily via gluconeogenesis.<sup>17</sup> The effect of glycerin on blood glucose levels in individuals with diabetes is unknown.

**Dietary fiber**

The term dietary fiber includes a wide variety of food components, each having different physiological effects. Dietary fiber is not digested and absorbed in the small intestine like glucose. Fiber is fermented in the large intestine to produce fatty acids, which are then absorbed and used as energy. Foods rich in hemicelluloses and pectins (generally known as soluble fiber), such as fruits and vegetables,

are more completely fermentable than foods rich in celluloses (insoluble fiber), such as cereals.<sup>18</sup> Although the energy derived from fermented fiber varies among individuals, the estimated energy yield from fiber is between 1.5 and 2.5 kcal/g.<sup>18</sup>

Although fiber does contribute to calories, its effect on blood glucose is likely minimal. For individuals with diabetes who desire this level of detail, practitioners may suggest subtracting the total grams of dietary fiber from

the grams of total carbohydrate on the Nutrition Facts panel. The effect is probably insignificant if the amount of dietary fiber is < 5 g.<sup>13,14</sup>

**Do Products Billed as “Low-Carb” Support a Healthy Weight Loss Regimen?**

Food products, whether manufactured or naturally occurring, must be evaluated within the context of the dietary goals they are intended to support. Therefore, it is essential to evaluate products advertised as “low-carb” with regard to the contribution they make to weight loss or maintenance and overall health.

Table 2 compares a purportedly low-carb meal to a more traditional meal advocated by many professional organizations that promote health. Neither menu was devised with the intent to restrict calories, because caloric restriction is not a point of focus for many popular low-carb diets. Controlled-carb processed products were added to the low-carb meal as allowable deviations. When comparing the two meals, the following legitimate reasons for concern about the low-carb claim become apparent:

- The low-carb meal contains less food volume and potentially less satiety value than the traditional meal.
- The low-carb meal provides ~ 520 more calories and ~ 51 more grams of fat than the traditional meal.
- Total carbohydrate contained in the low-carb meal is 52 g compared with 83 g in the traditional meal—a difference of 31 g.

**Table 2. Comparison of a Low-Carb Dinner to a Traditional Dinner**

Low-Carb Dinner	Traditional Dinner
8 oz. beef filet with bacon and gorgonzola	4 oz. grilled salmon with mustard dill sauce
Butter	Lentil and brown rice pilaf (3/4 cup)
Controlled-carb pasta side dish (1 cup)	Steamed broccoli (1/2 cup)
Caesar salad	1 Tbsp. reduced-fat margarine
Controlled-carb chocolate cake with icing (2.25-oz. serving)	Salad of mixed greens (1 cup)
	1 Tbsp. balsamic vinaigrette
	1 whole-wheat roll
	Fresh strawberries (1/2 cup) with 2/3 cup sugar-free, no-fat yogurt
<b>kcal: 1,360</b>	<b>kcal: 840</b>
<b>Fat (g): 82</b>	<b>Fat (g): 31</b>
<b>Carbohydrate (g): 52</b>	<b>Carbohydrate (g): 83</b>
<b>“Net carbs” (g): 17</b>	

- Of the 52 g of total carbohydrate in the low-carb meal, 17 g are claimed to be “net carbs.” The other 35 g (27 of which are from the controlled-carb products) seem to be negated.

Individuals with diabetes should be advised that use of low-carb products does not necessarily lead to weight loss or improvements in metabolic measures.

### Implications of the Low-Carb Diet Trend

History tells us that popular diets, like fashion trends, tend to cycle. The currently fashionable low-carbohydrate diet trend has experienced periods of more and less popularity during the past 40 years. Unfortunately, this diet trend promotes misconceptions about carbohydrates and can cause people to restrict health-promoting nutrients while guiding them to consume liberal amount of nutrients, especially saturated fat and cholesterol, that can negatively affect health.

Perhaps the greatest risk of this diet trend is the impact it may have on eating behaviors of those individuals who have been unable to establish sensible relationships with food. Manipulations in food manufacturing and terminology that seemingly allow undesirable nutrients and, by association, their calories to magically disappear are psychologically appealing to dieters who are rationalizing how to eat more without having it count.

Individuals with diabetes should be offered sound guidance about how to interpret truths and mistruths of any diet trend. This is crucial within the context of the low-carb trend because claims about the glycemic effects of carbohydrate foods and their contribution to insulin resistance/hyperinsulinemia and weight gain tend to be a central philosophical feature. Confusing labeling lingo that has been contrived and printed on packages of manufactured foods can create unique challenges for individuals with diabetes who must accurately count grams of carbohydrate to achieve glycemic control, particularly individuals on intensive insulin therapy.

In truth, the rise in prevalence of overweight and obesity can largely be attributed to energy imbalance resulting from an increase in energy intake and decrease in energy expenditure—not to the excessive intake of any single nutrient.<sup>19</sup> Diets that support severely restricting or omitting any single nutrient without offering psychosocial support and monitoring of metabolic parameters should be considered suspect. Severely restricting or omitting carbohydrates can have potential negative long-term health consequences, especially if healthful carbohydrate sources, such as fruits, vegetables, whole grains, and dairy foods, are severely restricted.

Thus, not only *amounts*, but also *sources* of carbohydrate should be a focus of any discussion about meal planning.<sup>7</sup> Highly processed grains, cereals, and sugars should be replaced with minimally processed whole grains, fruits, vegetables, and dairy foods for optimal nutritional benefits. Sweets and sugars should be used with moderation, especially for those who need to lose weight. When these sensible, but not headline news-making, guidelines are applied, use of highly processed and manufactured foods that manipulate carbohydrates becomes unnecessary.

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