

Nutrition and Health Info Sheet: Fiber

For Health Professionals

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What is fiber?

Dietary fiber, also called *roughage*, *bulk*, and *viscous fiber*, includes non-digestible carbohydrates and lignin most commonly found in plants. Functional fiber, as defined by the Health and Medicine Division of the National Academies of Sciences, Engineering, and Medicine (formerly the Institute of Medicine), includes non-digestible carbohydrates that have beneficial physiological effects in humans. The term total fiber includes both dietary fiber and functional fiber. Fiber plays an important role in several physiological functions and has beneficial effects on laxation, blood glucose, and cholesterol concentrations. Physical characteristics of different fibers such as viscosity, solubility, and fermentability can directly affect the body on a physiological level. Fiber has also been implicated in reducing the incidence of diverticulosis, cardiovascular disease, and some cancers. Further research on specific fibers and their structures is needed to determine if consumption of certain fibers can be beneficial to long-term health.¹⁻⁶



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What is the difference between soluble (viscous) and insoluble fiber?

Historically, fiber has been classified as soluble or viscous (gums, mucilages, and pectins), and insoluble (cellulose, hemicellulose, and lignin). Definitions are difficult to establish due to disagreements on whether to classify fibers by their analytical characteristics or nutritional benefits.⁶ Soluble fiber dissolves in water and forms a viscous gel. This form of fiber has been associated with lowering blood glucose and cholesterol levels.⁷ Conversely, insoluble fiber does not dissolve in water, but rather draws water in, adding bulk to stool mass which is why insoluble fiber has been associated with reducing constipation.⁷

What are good sources of fiber?

Whole grain products, many cereals, legumes, vegetables, and fruits are the principal and natural sources of fiber in the U.S. diet. In the past years, some food items and fortified beverages have been fortified with fiber to increase the daily dietary fiber consumption in the Western diet.⁶ According to the U.S. Food and Drug Administration label content laws, the term high fiber indicates a food that has at least 20 percent of the Adequate Intake (AI) for fiber, and a food considered good source of fiber must have between 10 and 15 percent of the AI for fiber.⁸ Soluble fiber sources include lentils, beans, oatmeal, and apples. Insoluble fiber sources are wheat products, brown rice, carrots, and legumes, however many food sources contain a combination of both types of fiber.⁹ There is no fiber in meat, fish, eggs, milk, or cheese.

Grain products

Whole grain flour and foods made from whole grains contribute the greatest amount of fiber in the diet compared with other food sources. Rye is highest on the list, followed by wheat, barley, oats, brown rice, and corn meal. Bran (the outer layer of the grain kernel) contains most of the fiber in a grain (up to 90 percent, depending on how it is processed).⁸

Vegetables

Legumes (dried beans, peas, and lentils) are the highest source of total fiber among vegetable sources.⁶ Navy beans have the highest dietary fiber content followed by split peas, lentils, and white beans.¹⁰ Potatoes, carrots, cabbage, and tomatoes have lower fiber content, but they often contribute more fiber to the daily diet because they are eaten more frequently. Vegetables tend to have less fiber than cereal grains because they are higher in water content.⁶

Fruit

Raspberries, pears, apples, and oranges provide a good source of fiber.⁶

What is meant by whole grain?



The term whole grain refers to a grain that has not been refined by having any of its parts removed, including the germ, the bran, and the endosperm.¹¹ During the milling process in the production of white flour, for example, only the endosperm is used and the remaining layers are discarded. As a result, the other layers—rich sources of nutrients, including fiber—are lost.⁶ Although many nutrients are added back to enrich refined grains, high-fiber plant foods (such as whole wheat flour and breads along with brown rice) are higher in a number of

nutrients that are not added during the enrichment process.

Why do people need fiber?

Eating foods with fiber is important for proper bowel function and can reduce symptoms of chronic constipation, diverticulosis, and hemorrhoids. Populations with low intakes of dietary fiber may have more heart disease, obesity, and some cancers. Furthermore, this puts this population at risk for developing Type II Diabetes and decreased insulin sensitivity. Increased dietary fiber can increase satiety, encourage healthy gut microbiota to benefit digestion, as well as lead to decreased energy intake.⁶ Fiber is associated with a reduced incidence of these chronic health problems through a variety of mechanisms, however, more research is needed to understand the underlying mechanisms.²

Fiber and colon health

Fiber promotes healthy bowel function, due to microflora activity, water holding capacity, increasing fecal bulk, and reducing fecal transit time, thereby preventing constipation.²

Fiber is fermented by microflora that reside in the large intestine, which produce butyrate and this may underlie the reduction in colon cancer risk.¹² Prebiotics, including food ingredients that promote beneficial changes to gut microflora, are all forms of fiber that promote microflora colonization through fermentation; it should be noted that not all fiber is considering prebiotic.¹³ This prebiotic mechanism not only promotes healthy microflora growth, but also prevents the growth of pathogenic bacteria as well.^{1,13}



Fiber and heart disease

Foods rich in fiber have been associated with reducing cholesterol concentration, particularly LDL cholesterol, which is associated with increased risk for cardiovascular disease. The mechanism, though not fully understood, may be related to the viscous property of some fiber, as it is thought to interfere with absorption of dietary fat and cholesterol. Furthermore, interference of the enterohepatic recirculation of cholesterol and bile acids can help reduce blood cholesterol concentrations.^{1,5} More studies on which type of fiber, soluble or insoluble fiber, will be conducted in the near future.⁶

Fiber and obesity

Fiber may also assist in preventing obesity because of its ability to hold water, thereby creating more bulk to help the stomach feel full. Some fibers empty from the stomach more slowly, which prolongs satiety and can help with weight loss or weight maintenance. The slow gastric emptying has also been correlated with a reduction of the concentration of postprandial blood glucose and improved insulin sensitivity.^{1,10} Further research needs to be conducted to evaluate the exact benefits of soluble versus insoluble fiber.

Fiber and cancer

An association between high-fiber intake and a reduced incidence of some cancers has been observed. One group described an inverse relationship between dietary fiber intake and gastric cancer.¹⁴ Several groups have detailed a relationship between increased fiber intake and decreased risk of colon cancer. A study in female adolescents concluded that higher fiber intakes reduced breast cancer risk. The authors state the importance of adequate fiber during adolescence and young adulthood to reduce the risk of breast cancer.⁹ It is important to note that the mechanisms of action are not well-characterized and these protective effects may be due to an interaction among other components in the food.^{2,5}

Fiber and diabetes

In people with diabetes, a diet high in soluble fiber, especially from whole grains, can help control blood glucose concentration by slowing down the rate of glucose absorption (1,6). Consumption of dietary fiber can also prevent weight gain and increase intake of additional nutrients, all of which may reduce the risk of diabetes.¹³

How much fiber is recommended?

Fiber is considered a shortfall nutrient by the Dietary Guidelines Advisory Committee.¹⁵ Currently, fiber is under-consumed; therefore, it is a major concern for all age groups. The recommendation (AI) is to consume 14 g of fiber per every 1,000 kcal consumed.¹⁶ The AI is based upon recommendations to reduce the risk for cardiovascular disease.¹⁷

What are some ways to increase fiber intake?

To increase fiber intake, the following suggestions apply on a daily basis for adults and children over 2 years of age:

- Consume a sufficient amount of fruits and vegetables while staying within energy needs. Two cups of fruit and 2 1/2 cups of vegetables per day are recommended for a reference 2,000-calorie intake, with higher or lower amounts depending on the calorie level.
- Choose a variety of fruits and vegetables each day. In particular, select from all five vegetable subgroups (dark green, orange, legumes, starchy vegetables, and other vegetables) several times a week.
- Consume 3 or more ounce-equivalents of whole-grain products per day, with the rest of the recommended grains coming from enriched or whole-grain products. In general, at least half the grains should come from whole grains.¹⁵



Other ways to increase fiber intake include the following suggestions:

- Use fresh or dried fruits for desserts and snacks.
- Use beans, lentils, and peas. Add cooked beans and peas to soups, stews, casseroles, and salads. Nuts and seeds, although high in fiber, are also high in fat, so use them sparingly.
- Choose whole grain breads and cereals, and check the ingredient label to make sure the food is really whole grain.
- Choose high fiber grains such as buckwheat, brown rice, and bulgur. Choose them in place of white rice or a white flour product as a side dish, in pilaf, and in soups and stews.
- Leave the skin on fruits, and vegetables. This outer layer is high in fiber.¹⁵

Can too much fiber be harmful?

Eating too much fiber (more than 50 to 60 grams of fiber per day) may decrease the amount of vitamins and minerals the body absorbs. To add more fiber to the diet, an individual can increase the amount eaten gradually; this gives the stomach and intestines time to get used to the change. Fiber supplements can easily lead to excess, which may cause intestinal discomfort; thus, a safer route to adding fiber to the diet is by eating more fiber-rich foods. Eating too much fiber too quickly, however, may cause gas, diarrhea, and bloating. Studies suggest that proper hydration is essential in order for fiber to be beneficial; consequently, drinking at least 8 glasses of water and other liquids per day is recommended.¹

Adding fiber to the diets of young children needs to be done carefully. Extra fiber may cause them to feel full too quickly and make it hard for them to eat enough food to grow properly. Too much fiber may interfere with the body's ability to obtain enough vitamins and minerals; this can be a problem with adults but is more serious in children.

It may be easy to consume more than the AI of fiber, especially in the case of seniors, since they often have limited intake of food, and people who have had gastrointestinal surgery (on some part of the stomach, intestines, colon, or rectum). These individuals may feel some negative effects of added fiber more than others and should check with their physician before adding fiber to their diet.^{1,6}

Should people take fiber supplements?

Excessive use of fiber supplements is associated with greater risk for intestinal problems, especially in individuals who suffer from Irritable Bowel Syndrome, constipation, and diarrhea.¹⁹ Some of the benefits from a high-fiber diet may be from the food that provides the fiber, not from the fiber alone.⁶ For this reason, it is best to obtain fiber from foods rather than from supplements. It is important to speak with a professional regarding adequate intake of fiber and how much an individual needs, especially those with compromised systems and adverse health problems. Over-consumption of fiber through supplements can pose many health risks for some individuals and should be taken with caution.

What is the fiber content of some common foods?²⁰

Table 1: Vegetarian Food Guide for Adults following a 2,000 calorie diet

Food Item	Serving Size	Dietary Fiber (g)	Calories
Breads, grains, and pasta			
Bagel (Plain, Large)	1	3.0	360
Rice, brown, cooked	½ cup	1.6	124
Pasta, cooked	½ cup	1.4	119
Spaghetti w/ Marinara Sauce	½ cup	2.4	116
Whole wheat bread	1 slice	1.9	81
Breakfast cereals			
All-Bran	1/3 cup	6.0	53
Cheerios	1 cup	2.6	105
Oatmeal (regular, quick, or instant), cooked	¾ cup	3.0	125
Raisin Bran	¾ cup	6.1	143
Fiber One Chewy Bars	½ cup	14	60
Fruits			
Acai (Brazilian Berry Pulp; Fortified)	100 g	1.2	62
Apple (with skin)	1 medium	4.4	95
Raspberries	1 cup	8.0	64
Elderberries	1 cup	10.2	106
Cantaloupe (Medium)	¼	1.2	47
Fig, dried	2	1.6	42
Orange	1 medium	7.2	100
Legumes, cooked			
Baked beans (plain or with pork), canned	½ cup	5.2	119
Lentils, cooked	½ cup	7.8	115
Vegetables, cooked			
Broccoli	½ cup	2.6	27
Brussels sprouts	½ cup	2.0	28
Potato, baked (with skin)	1 medium	4.6	115
Vegetables, raw			
Carrots	1 medium	1.7	25
Spinach	1 cup	0.7	7
Tomato	1 medium	1.5	22
Artichoke	1 medium	6.9	60

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