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Michigan State University Cooperative Extension Service  
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# Dietary Fiber

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**T**he nutritional qualities of foods are usually described in terms of protein, carbohydrate, fat, and vitamin and mineral content. Dietary fiber, or "roughage," is mentioned less frequently, though certain high-fiber foods are desirable for maintaining normal bowel regularity.

Current interest in dietary fiber stems from observations by British scientists that certain diseases occur less frequently in developing countries in Africa than in Western countries. These scientists suggest that something in the environment differs between underdeveloped and industrialized cultures and must be responsible for the noted difference. Their research led them to conclude that the difference could be related to low dietary fiber consumption in Western countries and very high fiber intakes in developing countries.

Diseases that may be related to low fiber consumption or for which fiber consumption is beneficial include diabetes, diverticular disease, cancer of the colon, atherosclerosis associated with high blood cholesterol levels (hypercholesteremia), appendicitis, hiatal hernia, irritable bowel syndrome and hemorrhoids.

Different kinds of fiber vary considerably in composition. Therefore their physical and, more importantly, their physiological properties differ.

## What is fiber and where does it come from?

Fiber is undigestible plant material. Plants provide the only natural source of fiber, which is contained primarily within the plant cell wall. Whole grains, legumes, fruits and vegetables are all good sources of fiber.

Consumption of fiber-rich foods has decreased since the early 1900s. In contrast, the consumption of animal products, which contain no fiber, has increased. Today the average fiber intake in the U.S. diet is between 15 and 20 grams per day, an amount considered by many researchers to be too low for optimum health.

## Fiber is beneficial for diabetics.

The maintenance of normal blood glucose levels is of primary concern to diabetics. Recent attention has been placed on the role of fiber in this process. Soluble fibers, such as guar and pectin, absorb water and are able to form gels in the stomach. Gel formation slows the rate at which food is emptied from the stomach. In the small intestine, gel formation leads to slower digestion and absorption rates. These effects may account for the lower glucose and insulin levels observed in insulin-dependent diabetics when they consume fiber. A similar response is noted in non-insulin-dependent diabetics and non-diabetic individuals.

Research evidence suggests that soluble fiber enhances insulin sensitivity, thereby decreasing the patient's need for insulin. Insoluble fibers, such as cellulose and wheat bran, have a less significant effect on insulin, though they also are able to reduce blood glucose levels.

The form in which a food is eaten can also have a significant impact on glucose levels. For example, when a whole apple is consumed (with the fiber present), the glucose response is lower than when the same food is eaten in the form of applesauce or apple juice.

\*updated from Extension Bulletin E-901, "Dietary Fiber and Health," by Gilbert Leveille.



## New studies recommend high fiber for diverticular disease.

This disease involves an outpouching or ballooning of the intestinal wall. The pouches (diverticula) do not present a problem unless they become inflamed, resulting in the condition known as diverticulitis. Until recently, a low-residue diet—one virtually devoid of dietary fiber—was the standard diet for this disease. British scientists have now shown that diets high in dietary fiber are usually a more effective treatment.

Diverticular disease apparently develops as a consequence of a relatively small, hard, dry intestinal residue that slows movement through the intestine and increases pressure within the colon. Dietary fiber prevents increased pressure by absorbing large amounts of water, resulting in a softer stool that moves faster. Thus, there is less chance that outpouching or ballooning will occur.

## Dietary fiber can reduce cholesterol levels.

Cholesterol is a normal constituent of blood and is found in every animal cell, including those of

humans. It has several important functions, including a role in the manufacture of certain hormones. For reasons not fully understood, however, cholesterol and other fats can build up in blood vessels of certain individuals. This can contribute to the development of heart disease and stroke.



It is generally believed that the higher blood cholesterol levels of individuals in developed countries result from high dietary fat intake, particularly animal fats. As we increase animal products in our diet, we decrease intake of foods that are high in dietary fiber, such as cereals, fruits and vegetables.

Several animal and human studies have shown that dietary fiber components can reduce cholesterol levels in the blood. The addition of

pectin to the diet is an example. Pectin, which is not normally digested by humans, has the ability to “bind” bile acids and hasten their excretion from the body. Bile acids are normally absorbed and reutilized. When bile acids are excreted, cholesterol from the blood is used to synthesize new ones to replace those that were excreted, and blood cholesterol levels drop.

## Studies show high fiber diet can reduce incidence of cancer of the colon.

Colon cancer may also be related to low fiber intake. Research shows a low incidence of colon cancer in countries whose people consume dietary fiber in great quantities. The increased incidence of the disease in developed countries can be correlated with lower dietary fiber consumption and/or higher animal product consumption. For example, a very low incidence of colonic cancer has been observed among Japanese residing in Japan, whereas Japanese residing in Hawaii have a higher incidence. The Japanese in Hawaii consume a diet higher in animal products, whereas in Japan a traditional diet centers on grains and vegetables. In general, experiments with laboratory animals support these data from human studies showing that low fiber diets are more conducive to the development of cancer than high fiber diets.



Neither the exact biological mechanism of carcinogenesis nor the exact manner by which fiber reduces the risk of colon cancer is understood. Dietary fiber could decrease the concentration of a carcinogen in the colon, reduce the time that a carcinogen remains in the colon or reduce the production of a carcinogen in the colon. It is possible that any of these mechanisms, or a combination of them, could play a role in reducing cancer risk.

## Do we need more fiber?

The evidence supporting the need for increased dietary fiber intake has become increasingly convincing within the past decade. Although research findings demonstrate a strong correlation between increased fiber intake and reduced disease incidence, the relationship is not necessarily causal. Nevertheless, the beneficial effects of dietary fiber would justify efforts to increase the fiber content of the diet.

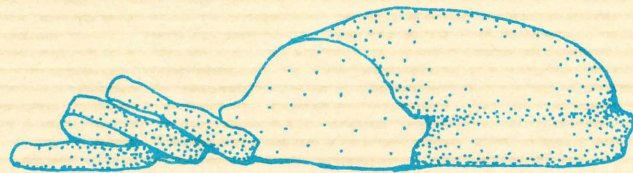
An increase in dietary fiber is best achieved by changing food choices rather than choosing a fiber supplement. Decreasing animal product intake and increasing consumption of grains and legumes enhances the fiber content of our diet. Though animal products are good sources of many nutrients, they supply appreciable amounts of

saturated fat and cholesterol. A reduction of dietary fat and cholesterol has been promoted as a means of reducing the risk of cardiovascular disease. Similarly, a reduction in total dietary fat may reduce cancer risk. Plant products contain no cholesterol, contain complex carbohydrates—including dietary fiber—and generally have less fat.

Possible negative effects could result from large increases in dietary fiber consumption. Dietary fiber has the ability to bind other nutrients in the intestine, thereby preventing their absorption. This may be

evidence indicates a daily intake of 30 grams or more of dietary fiber would possibly reduce the risk of certain diseases linked to low fiber intake.

It is possible to get this amount of fiber by including a variety of plant foods in your daily diet. As a general rule, unrefined foods contain more fiber than refined foods because of fiber removal during processing. For example, breads and breakfast cereals made from whole wheat contain more fiber than products made from



significant for people whose diets contain marginal quantities of iron and zinc. Sudden increases in fiber consumption have caused considerable intestinal discomfort for some individuals. Symptoms include abdominal pain, flatulence (gas), cramps and diarrhea. These symptoms often dissipate over time and can be held to a minimum if fiber is added to the diet slowly.

The decision to increase fiber intake is a personal one, as are all dietary decisions. Health organizations such as the National Research Council (NRC) and the American Institute for Cancer Research, however, support such a dietary change. Both the "Dietary Goals for the United States" (NRC) and the "Dietary Guidelines for Americans" recommend increasing our consumption of complex carbohydrates and fiber. Present

wheat that has had the bran removed. Raw apples or other fruits contain some fiber, primarily in the skins, that is not present in processed products. Raw and cooked vegetables are excellent sources of fiber.

Fiber is also available in supplement form. Such products, however, will not supply the added benefit of vitamins, minerals and other nutrients that fiber-rich foods have to offer. When fibrous foods are included in the diet, supplements are an unnecessary expense.



# Fiber Value of Foods

## Breads and Cereals

	Serving Size	Fiber (g)
All-Bran	1/2 cup	9.2
Cornflakes	1 cup	2.8
Grape Nuts	1 cup	5.8
Rice Krispies	1 cup	1.4
Shredded Wheat	1 biscuit	3.0
Special K	1 cup	1.7
Graham Crackers	2 squares	1.5
Rice, brown, <i>cooked</i>	1 cup	2.7
Rice, white, <i>cooked</i>	1 cup	.9
Rye Bread	1 slice	2.0
White Bread	1 slice	.6
Whole Wheat Bread	1 slice	2.4

## Fruits

Apple	1 medium	3.2
Apricots	3	2.4
Bananas	1 medium	2.7
Cantaloupe	1/4 melon	1.2
Cherries	1/2 cup	1.2
Grapes	22 medium	.8
Orange	1 small	2.1
Peach, <i>raw</i>	1 medium	1.3
Pear, <i>raw</i>	1 medium	2.8
Strawberries	1/2 cup	2.6
Tangerine	1 medium	2.1

## Nuts

Almonds	2 tablespoons	3.6
Walnuts	2 tablespoons	1.1
Peanuts	2 tablespoons	3.1

## Vegetables

Asparagus, <i>cooked</i>	2/3 cup	1.3
Beans, <i>green</i>	1/2 cup	2.5
Beets, <i>cooked</i>	1/2 cup	.9
Broccoli, <i>cooked</i>	2/3 cup	3.2
Brussels sprouts, <i>cooked</i>	2/3 cup	2.1
Cabbage, <i>raw</i>	1/2 cup	1.4
Carrots, <i>cooked</i>	2/3 cup	2.1
Carrots, <i>raw</i>	1 large	3.7
Cauliflower, <i>cooked</i>	1/2 cup	1.2
Cauliflower, <i>raw</i>	1 cup	1.8
Celery, <i>raw, diced</i>	1 cup	3.0
Corn, <i>canned, kernels</i>	1/2 cup	4.7
Lettuce	1 cup	.8
Peas, <i>cooked</i>	1/2 cup	3.8
Potato, white, <i>cooked</i>	2/3 cup	3.1
Spinach, <i>raw</i>	1 cup	3.0
Tomato, <i>raw</i>	1 small	1.0



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