

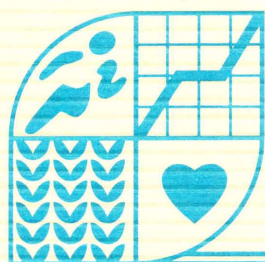
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Dietary Fiber Nutrition & Your Health  
Michigan State University Cooperative Extension Service  
Mark Messina, Foods and Nutrition  
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# Dietary Fiber

Michigan State University

Cooperative Extension Service

E-1855 (Revised) April 1990

**D**ietary fiber, once called roughage or bulk, is currently in the news as a benefit for many health problems. This bulletin discusses the importance of dietary fiber and the amount needed.

Current interest in dietary fiber stems from observations by British scientists that certain diseases occur less frequently in Africa than in European countries and the United States. The diet in Africa — high in grains, fruits and vegetables and low in meat and fat — has been thought to explain the difference. Much research on fiber has been done in recent years.

The one benefit of dietary fiber on which researchers agree is its ability to help maintain normal bowel regularity. Diseases currently being studied to determine whether they are affected by low fiber consumption include diabetes, diverticular disease, cancer of the colon, atherosclerosis associated with high blood cholesterol levels (hypercholesteremia), appendicitis, hiatal hernia, irritable bowel syndrome and hemorrhoids.

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

Fiber is plant material that cannot be broken apart by the stomach and small intestine of humans. Consequently, fiber adds to the waste material in bowel movements but gives humans few calories because most of fiber is not digested. Plants provide the only natural source of fiber. The majority of it is contained in the plant cell walls.

Dietary fibers can be grouped into two types: water-soluble and water-insoluble. Not all foods containing dietary fiber are good sources of both soluble and insoluble fiber (*see table*).

Soluble fibers are mainly pectins and gums. They dissolve during digestion to form a gummy, gel-like material. Good sources of soluble fiber are apples, barley, cabbage, carrots, cauliflower, citrus fruit, corn bran, cranberries, dry beans and peas, green beans, kale, oat bran, peas, pears, plums, potatoes, rice bran, squash and strawberries.

Insoluble fibers include cellulose, lignin and many hemicelluloses. Sources of insoluble fiber include wheat bran and most grains, whole grains such as whole wheat and whole grain cereals and breads, nuts, seeds and vegetables such as cabbage, green and wax beans, and broccoli.

Since the early 1900s, Americans have eaten fewer foods that are good sources of fiber. In contrast, the consumption of animal products, which contain no fiber, has increased. Americans currently consume an average of 10 to 15 grams of fiber per day. Many foods have both soluble and insoluble fiber. Though there is no specific recommendation for dietary fiber in the daily diet, a study by the Federation of American Societies for Experimental Biology (FASEB) says that healthy adults should consume 20 to 35 grams of dietary fiber per day from a variety of foods. This translates to about 5 servings of breads and cereals plus 6 servings of fruits and vegetables daily. Choosing a variety of foods for fiber

should provide a mixture of soluble and insoluble fiber.

If you are trying to lower blood cholesterol, Dr. James W. Anderson at the University of Kentucky recommends that your daily fiber sources should provide 5 grams of soluble fiber. Dietary fat intake should also be reduced to 20 to 30 percent of total calories. (*See MSU Extension bulletin E-1856, Nutrition and Your Health: Dietary Fat.*)

## What are the benefits of eating fiber?

Insoluble and soluble fibers help the body in different ways. Therefore, the diet should include sources of both.

Insoluble fiber is of greatest benefit in preventing constipation. It increases the bulk of bowel movements (feces). This helps to decrease the time that feces stay in the intestine.

Soluble fiber has been the subject of much research. Because it dissolves in water, soluble fiber slows the movement of food through the intestine. According to the National Research Council's report, *Diet and Health: Implications for Reducing Chronic Disease Risk*, soluble fibers have been found to reduce serum cholesterol and serum glucose (blood sugar) levels. However, it is difficult to determine if this effect is due to the soluble fiber alone or to other protective substances contained in these foods.

When foods from plants make up a major part of the diet, people appear to be at less risk of developing heart disease and cancer of the lung, esophagus, colon and stomach. The specific

dietary component responsible for this occurrence has not been identified — it could be higher fiber, lower dietary fat, less obesity or non-nutrient components of the food/diet that are not yet identified.

## **D**ietary fiber can reduce cholesterol levels.

Cholesterol is a normal constituent of blood and is found in every animal cell, including those of humans. Cholesterol has several important functions, including a role in manufacturing certain hormones and in building cell walls in our bodies. Excess serum cholesterol and other fats can build up in blood vessels of certain individuals, contributing to the development of heart disease and stroke. (See MSU Extension bulletin E-2141, *Nutrition and Your Health: Cholesterol, for more information on serum and dietary cholesterol and fat.*)

The relation between fiber intake and heart disease is not clear. Several studies have found that men fed sources of soluble fiber daily (e.g., oat bran, dried beans, rice bran) have had significant reductions in serum cholesterol. In one study, a low-fat diet that included daily intake of a bowl of oat bran cereal and five oat bran muffins containing 15 grams (about 1/6 cup) each resulted in about a 15 percent decrease in serum cholesterol over a six-week period. Reducing soluble fiber intake after cholesterol levels decreased resulted in a return to the original serum cholesterol levels. Many of the oat bran products available commercially do not contain this level of oat bran in a serving.

## **T**he effect of high fiber diets on colon cancer.

There are many theories about the relationship between fiber and colon cancer. Dietary fiber intake may protect the intestine, but how fiber does this is not fully understood. Some research suggests that fiber dilutes cancer-causing agents by increasing the

size of bowel movements. Other theories are that fiber binds cancer-causing agents in the intestine and helps eliminate them from the body, or that fiber reduces the colon's contact with cancer-causing substances because it speeds up movement of waste through the intestine.

Studies comparing countries in which dietary fiber consumption is high with countries that have lower fiber intakes and/or higher animal product consumption indicate that less cancer occurs in the countries with high fiber consumption. For example, a very low occurrence of colon cancer has been observed among Japanese residing in Japan; but among Japanese residing in Hawaii, a higher incidence of colon cancer occurs. The Japanese in Hawaii eat a diet higher in animal products, than residents of Japan, where a traditional diet centers on grains and vegetables.

Current research evidence supports eating a diet that contains a variety of fruits, vegetables and whole grain products and lowering intake of fat in the diet to 30 percent of total calories. This is a wise practice, even though scientists do not know whether the fiber in these foods or some other factor protects against colon cancer.

## **B**enefits of fiber for diabetics.

The maintenance of normal blood glucose levels is of primary concern to diabetics. Advantages of dietary fiber have been studied in this process. Soluble fibers such as guar gum 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 of sugar (glucose). These effects may account for the lower blood glucose levels and reduced need for insulin in insulin-dependent diabetics when they con-

sume fiber. A similar response is noted in non-insulin-dependent diabetics and non-diabetic individuals.

Research evidence suggests that soluble fiber increases the body's sensitivity to insulin, thereby decreasing the person's need for insulin. Diabetics should include soluble fiber sources in their daily diets. Insoluble fibers, such as cellulose and wheat bran, have a less significant effect on insulin, though they also seem to reduce blood glucose levels.

Some researchers believe that weight reduction and reduced fat in the diet resulting from high fiber diets are responsible for the diabetic's achieving improved control over blood sugar. It has not been determined if improved blood glucose control is the result of increased fiber or increased complex carbohydrate in the diet, or the combined effect of both fiber and carbohydrate along with decreased fat intake.

## **S**tudies of fiber intake and 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, a condition known as diverticulitis.

Diverticular disease appears to develop because of pressure in the intestine caused by small, hard, dry feces that move slowly through the intestine. Dietary fiber prevents increased pressure by absorbing large amounts of water, resulting in a softer stool that moves faster.

Until recently, a diet with no dietary fiber was the standard diet for diverticulitis. Scientists have been evaluating the effect of a high fiber diet on diverticular disease. Currently, high fiber intake has not shown clear results in eliminating diverticular disease, but it does appear to reduce the pain for many individuals.

## Do we need more fiber?

In the past decade, evidence supporting the need for increased dietary fiber intake has become increasingly convincing. Although research findings demonstrate a strong connection between increased fiber intake and reduced disease occurrence, this does not mean that fiber in the diet either causes or prevents disease. Nevertheless, the beneficial effects of dietary fiber would justify efforts to increase the fiber content of the diet.

The report on diet and health by the National Research Council does not recommend using fiber supplements. Decreasing animal product intake and increasing consumption of fruits, vegetables, grains and legumes increases the amount of fiber we consume. Though animal products are good sources of many nutrients, they supply appreciable amounts of saturated fat and cholesterol and no fiber.

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 such as green and yellow vegetables, fruits, dried beans, dried peas and whole grain cereals and breads contain no cholesterol but do contain complex carbohydrates — including dietary fiber — and generally contain less fat than animal products, desserts and many bakery foods.

Increasing dietary fiber consumption too rapidly can have negative effects. 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 decrease over time and can be avoided if foods high in fiber are added to the diet slowly. It is also important to drink sufficient liquids — the usual recommendation is 8 cups of non-caffeine-containing liquid daily.

The upper recommended limit of fiber intake is 50 grams. Dietary fiber has the ability to bind other nutrients in the intestine and decrease their absorption. This may be significant for people whose diets contain marginal quantities of the minerals iron and zinc.

## Increasing fiber intake from food.

- Choose whole grain rolls, breads and cereals.
- Choose five or six fruit and vegetable servings daily and eat the edible skins whenever possible; eat whole fruits rather than drink juices.
- Use whole wheat flour for up to half of the white flour in recipes.
- Choose fiber-rich soups, such as bean, split pea or vegetable.
- Make salads from vegetables other than lettuce. Try spinach, chinese cabbage, cabbage, broccoli flowers, cauliflower or carrots.
- Add beans such as kidney or garbanzo beans to salads.
- Choose fresh fruits for snacks and desserts.
- When you go to parties, take raw vegetable platters and eat fruits and raw vegetables.
- Choose air-popped popcorn with no fat added, whole wheat crackers or unsalted corn tortillas for snacks.
- Try steaming vegetables until just tender but still crisp. For flavor, experiment with herbs. Good herb/vegetable combinations are sesame or poppy seeds with cabbage; dill with green beans or carrots; and oregano with carrots, broccoli or green beans.

## References

Anderson, J. W. 1986. Dr. Anderson's Life-Saving Diet. Tucson, Ariz.: The Body Press, a division of HP Books.

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National Academy Press. 1989. Diet and Health: Implications for Reducing Chronic Disease Risk. Executive Summary. Washington, D.C.

Gorman, M.A., and Bowman, C. 1988. Position of the American Dietetic Association: Health Implications of Dietary Fiber — technical support paper. Journal of the American Dietetics Association. 88(2):217-221.

**For more information** about nutrition and your health, consult the following MSU Extension bulletins, available from your county Cooperative Extension Service. Unless otherwise noted, single copies of each are free to Michigan residents.

E-1854, **Nutrition & Your Health: Vitamin A.**

E-1856, **Nutrition & Your Health: Dietary Fat**, 35 cents.

E-1857, **Nutrition & Your Health: Sodium.**

E-1954, **Nutrition & Your Health: Calcium.**

E-1955, **Nutrition & Your Health: Managing Your Food Choices**, 40 cents.

E-2141, **Nutrition & Your Health: Cholesterol.**

E-2196, **Nutrition & Cancer: Food Choices to Reduce Cancer Risk** \$1.25.

## Values for Dietary Fiber in Selected Foods

	Serving size	Dietary fiber (grams)	Soluble fiber (grams)
<b>Breads &amp; cereals</b>			
All-Bran <sup>1</sup>	1/3 cup (1 oz)	8.6	1.43
Cornflakes, plain <sup>1</sup>	1 1/4 cup (1 oz)	0.6	0.16
Corn tortilla <sup>2</sup>	1 tortilla	1.6	N.A.
Fig bars, square <sup>2</sup>	4 cookies	2.6	N.A.
Graham crackers <sup>1</sup>	2 squares	0.7	0.33
Grapenuts <sup>1</sup>	1/4 cup (1 oz)	2.8	0.83
Mixed grain bread <sup>2</sup>	1 slice	1.8	N.A.
Oat bran, dry <sup>1</sup>	1/3 cup (1 oz)	4.0	2.01
Oat flakes, fortified <sup>2</sup>	1 1/4 cup (1 oz)	0.8	N.A.
Oatmeal (rolled oats), dry <sup>1</sup>	1/3 cup (1 oz)	2.6	1.33
Popcorn, air-popped, no oil added <sup>2</sup>	1 cup	1.2	N.A.
Rice, brown, cooked <sup>2</sup>	1 cup	3.3	N.A.
Rice, white, cooked <sup>3</sup>	1 cup	2.1	N.A.
Rice Krispies <sup>1</sup>	1 cup (1 oz)	0.3	0.09
Rye bread <sup>3</sup>	1 slice	1.6	N.A.
Rye crackers <sup>2</sup>	2 crackers	2.2	N.A.
Shredded wheat <sup>3</sup>	1 biscuit	2.2	N.A.
Special K cereal <sup>1</sup>	1 cup (1 oz)	0.9	0.16
White bread <sup>1</sup>	1 slice	0.6	0.28
Whole wheat bread <sup>1</sup>	1 slice	1.5	0.34
Whole wheat crackers <sup>2</sup>	2 crackers	0.8	N.A.
<b>Fruits</b>			
Apple <sup>1</sup>	1 small	2.8	0.97
Apricots, dried <sup>2</sup>	3	2.2	N.A.
Bananas <sup>1</sup>	1 small	2.2	0.64
Cantaloupe <sup>3</sup>	1/4 melon	1.6	N.A.
Cherries <sup>3</sup>	1/2 cup	0.1	N.A.
Cranberry sauce, sweetened <sup>3</sup>	1/4 cup	0.8	N.A.
Figs, dried <sup>2</sup>	5 figs	8.7	N.A.
Gooseberries <sup>3</sup>	1/2 cup	2.0	N.A.
Grapes <sup>3</sup>	22 medium	2.6	N.A.
Orange <sup>1</sup>	1 small	1.9	1.13
Peach, raw <sup>1</sup>	1 medium	2.0	0.78
Pear, raw <sup>3</sup>	1 medium	4.7	N.A.
Plum, canned, purple <sup>1</sup>	1/2 cup	2.7	1.19
Prunes, dried <sup>2</sup>	5 large	2.3	N.A.
Raisins <sup>2</sup>	1/2 cup	3.8	N.A.
Strawberries <sup>3</sup>	1/2 cup	1.6	N.A.
Tangerine <sup>3</sup>	1 medium	1.7	N.A.

### Nuts

	Serving size	Dietary fiber (grams)	Soluble fiber (grams)
Almonds, slivered <sup>2</sup>	2 T.	1.9	N.A.
Peanuts <sup>2</sup>	2 T.	1.6	N.A.
Sunflower seeds, oil roasted <sup>2</sup>	3 T.	1.9	N.A.
Walnuts <sup>3</sup>	2 T.	1.5	N.A.

### Vegetables

	Serving size	Dietary fiber (grams)	Soluble fiber (grams)
Asparagus, canned <sup>1</sup>	1/2 cup	2.8	0.51
Beans, baked with sweet sauce <sup>2</sup>	1/2 cup	9.8	N.A.
Beans, green, canned <sup>1</sup>	1/2 cup	2.0	0.49
Beets, canned <sup>1</sup>	1/2 cup	2.2	0.68
Black-eyed peas, canned <sup>1</sup>	1/2 cup	3.2	0.35
Broccoli, frozen <sup>1</sup>	1/2 cup	2.2	0.98
Brussels sprouts, frozen <sup>1</sup>	1/2 cup	3.5	1.42
Cabbage, raw <sup>1</sup>	1/2 cup	0.7	0.27
Carrots, cooked <sup>3</sup>	2/3 cup	3.8	N.A.
Carrots, raw <sup>1</sup>	1/2 cup	1.8	0.84
Cauliflower, frozen <sup>1</sup>	1/2 cup	1.7	0.57
Cauliflower, raw <sup>3</sup>	1/2 cup	1.3	N.A.
Celery, raw, diced <sup>3</sup>	1 cup	1.2	N.A.
Chickpeas, canned <sup>2</sup>	1/4 cup	2.4	N.A.
Corn, canned, kernels <sup>3</sup>	1/2 cup	1.1	N.A.
Kale, frozen <sup>1</sup>	1/2 cup	2.5	0.74
Kidney beans, canned <sup>1</sup>	1/2 cup	5.8	1.45
Lettuce, iceberg <sup>1</sup>	1 cup	0.5	0.12
Lima beans, cooked <sup>1</sup>	1/2 cup	3.0	0.79
Navy beans, dried, cooked <sup>1</sup>	1/2 cup	6.8	2.29
Peas, cooked <sup>3</sup>	1/2 cup	3.0	N.A.
Pinto beans, canned <sup>1</sup>	1/2 cup	4.3	1.01
Potato, white, cooked <sup>3</sup>	2/3 cup	3.7	N.A.
Spinach, frozen <sup>1</sup>	1/2 cup	1.7	0.39
Squash, frozen <sup>1</sup>	1/2 cup	0.7	0.25
Sweet potato, canned	1/2 cup	1.2	0.46
Tomato, raw <sup>1</sup>	1 medium	1.0	0.17
White beans, canned <sup>1</sup>	1/2 cup	5.0	1.50

N.A. = value not available

#### Sources:

<sup>1</sup> Lawrence, S.R., and Anderson, J.W. Table in Kantor, M.A. 1989. Nutrition, cholesterol and heart disease. Part IV: The role of dietary fiber. Nutrition Forum 6(4):28.

<sup>2</sup> USDA, Provisional Table on Dietary Fiber, 1988. Nutrient Data Research Branch, Human Nutrition Information Service, Publication No. HNIS/PT-106.

<sup>3</sup> USDA Data Base, Nutritionist III, 1987, Silverton, Oregon, N-Squared Computing.

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