



Dietary Fiber: What is it?

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Much is published on the benefits of “fiber” in the diet. Nevertheless, there is some confusion over what constitutes dietary fiber. Moreover, some of its proclaimed benefits are controversial. Therefore, it is a challenge to determine if, how much, and what kind of fiber one should take. This article addresses the nature of dietary fiber; its sources; its commonly accepted benefits, especially for the intestinal tract; and how to achieve sufficient daily fiber intake.

What is Dietary Fiber?

Dietary fiber is defined as indigestible carbohydrate, and may or may not be fibrous. Note that carbohydrate contains no nitrogen, only carbon, hydrogen, and oxygen. It derives from a process by which green plants use energy in sunlight to convert water and carbon dioxide into carbohydrates and oxygen (photosynthesis). Carbohydrate is distinct from the other two energy-producing nutrients: protein and fat. *Digestible carbohydrate* consists of simple carbohydrates (sugars), and complex carbohydrates (starch). The small intestine supplies digestive enzymes in its lining cells or secretions to break down (digest) these digestible carbohydrate molecules into smaller units that can be absorbed. Thus, little if any ingested sugar or starch survives its passage through the small intestine to reach the colon. *Indigestible carbohydrate* or dietary fiber cannot be digested by the available human small intestinal enzymes, and therefore it is able to reach the colon relatively intact.

As mentioned above, dietary fiber is not always fibrous. In fact, food scientists classify it into *soluble* (in water) and *insoluble* fiber – each with specific properties and possible health benefits. Soluble fiber dissolves in water; it forms a gel when water is added to it. Insoluble fiber absorbs liquid and therefore in the intestine it adds bulk to stool. Soluble fiber and insoluble fiber are both indigestible. Both types of fiber are important in the diet and have digestive system benefits. As discussed later in this article, many claim that soluble fiber has benefits beyond the *gut* (intestines). However, the actions and benefits of these two types of fiber seem to overlap.

The Sources of Dietary Fiber

Soluble fiber consists of gels, mucilages, pectins, and gums. It is found in oats, peas, beans, apples, oranges, pears, peaches, grapes, prunes, vegetables, and psyllium (ispaghula in the U.K). Prunes are rich in soluble fiber. Psyllium is found in some cereal products, in dietary supplements, and in commercial bulk fiber laxatives (e.g., Metamucil, Konsyl, generic). Note that some commercial psyllium preparations are combined with a laxative, which is unnecessary for most people.

Insoluble fiber resides in fruits, vegetables, dried beans, wheat bran, seeds, popcorn, brown rice, and whole grain breads, cereals, and pasta. Wheat bran is a convenient source of dietary fiber. It derives from the outer coating of the grain that is largely removed when the grain is milled into white flour. That is why less refined whole grain bread provides more fiber than refined white bread. The constituents of insoluble fiber include cellulose, hemicellulose, and lignin.

The Benefits of Dietary Fiber

Soluble and insoluble fibers are often lumped together as “fiber,” especially on the labels of foods, laxative preparations, or nutrition products. It appears that soluble fiber, by inactivating bile acids can reduce blood cholesterol. Insoluble fiber, on the other hand, is more effective as a bulking agent with a direct effect on gut function.

Some believe a high fiber diet reduces the risk of heart disease and stroke, presumably through its cholesterol-lowering effect. However, readers should be aware of the difficulties in scientifically proving the long-term effectiveness of any diet in prolonging life or preventing disease. Fiber benefits glucose metabolism and may help prevent or treat Type 2 or adult diabetes. Because of its bulking effect, fiber is “filling” and may reduce overall food intake, thereby reducing weight gain and helping to prevent obesity. References listed below discuss the evidence for these benefits beyond the gut.

We are most concerned in this article with the more immediate benefits to the intestines of regularly consuming dietary fiber. Ingested fiber, unaffected by intestinal enzymes, reaches the colon intact where it encounters the multitude of

bacteria resident there. Unlike humans, certain species of bacteria are able to digest fiber, which produces hydrogen, other gases, and short chain fatty acids. The net effect is to attract water into the colon from the blood stream through osmosis, and greatly increase intestinal bacteria that in turn locally produce gas. These effects enlarge and soften the stool. Larger stools mechanically stimulate colon expulsion reflexes, and softer ones pass more easily. The short chain fatty acids themselves are laxative, that is they help to promote bowel movements. Some believe that fiber helps prevent colon cancer. However, cancer prevention through increased fiber intake has received inconsistent scientific support, and colon-screening strategies (e.g., screening colonoscopy) promise to be more reliable in preventing colorectal cancer.

Studies in the 1930s and since have demonstrated that cereals and fiber supplements actually do increase stool bulk, reduce gut transit time, and benefit some patients with constipation. Constipation is uncommon among the African populations and vegetarians who consume more dietary fiber than the average European or North American. It should be the first choice of treatment for constipation and often makes laxatives unnecessary. Wheat bran has long been popular in the treatment of the irritable bowel syndrome (IBS), but its early apparent success in IBS patients was not confirmed in subsequent randomized controlled trials. Diarrhea, abdominal pain, and bloating seem to worsen on bran. Patients whose stools are hard and lumpy are the most likely to improve on bran and other fiber products.

How to take Sufficient Fiber

Although dietary fiber is not an essential nutrient, experts recommend diets containing 20 to 35 grams daily. The average North American diet contains only about 10 to 15 grams daily. Achieving the recommended amount is difficult, as it requires the ingestion of unrefined carbohydrates. One must review the available information, and be convinced and motivated by the assumed health benefits before embarking on a high fiber diet. One may increase fiber intake by replacing white bread and pasta with whole grain products; selecting whole grain cereals; and eating whole fruits rather than their juices. References listed below contain some further high-fiber suggestions. In order to minimize bloating, one should introduce such a diet slowly (over three weeks).

A high-fiber diet is often helpful to people who have constipation and hemorrhoids. It may help prevent attacks of diverticulitis in those who have colonic diverticula (See IFFGD

Fact Sheet No. 169, *Diverticula, Diverticulosis, Diverticulitis: What's the Difference?*). Those who do not change their eating habits, or who cannot take in enough fiber-rich foods to treat their constipation, may find it easier to consume bran regularly. Wheat bran is cheap and available in health food stores. It is unappealing to take, but it can be washed down with water or fruit juice, or be mixed with suitable foods like breakfast cereals, yogurt, and thick soups. One may start at one tablespoonful a day and increase if necessary to achieve softer and more easily passed stools, or until bloating, diarrhea, or abdominal discomfort occur. The amount consumed should be determined by the improvement in stool form and less need to strain, rather than by increased frequency of defecation. If wheat bran is not satisfactory, there are several pharmaceutical bulking agents, such as psyllium (e.g., Metamucil, Konsyl), Methylcellulose (e.g., Citrucel), or polycarbophil (e.g., Fibercon, Equilactin). Many people find these easier to manage than a diet. (See IFFGD Fact Sheet No. 168, *Medications. Current Pharmacologic Treatments of Irritable Bowel Syndrome*).

Tips on Adding Fiber to Your Diet

Making small, gradual changes can add up to a big difference in the nutritional value of your diet. Experiment with fresh foods and don't be afraid to try new foods and recipes. Here are a few practical tips for adding fiber to your diet.

Vegetables

- Cook in microwave to save time and nutrients
- Cook only until tender-crisp to retain taste and nutrients

Beans

- Presoaking reduces the gas-producing potential of beans if you discard the soaking water and cook using fresh water

Fruit

- Snack on fruit anytime, anywhere
- Leave peelings on fruit whenever possible
- Use fresh and dried fruit in muffins, pancakes, quick breads, and on top of frozen yogurt

Grains

- Choose whole-grain varieties of breads, muffins, bagels, and English muffins
- Mix barely cooked vegetables with pasta for a quick pasta salad

Source: IFFGD web page at:

<http://www.aboutibs.org/site/about-ibs/management/controlling-gas> (Accessed August 30, 2010.)

Some Food Sources of Fiber

Food Source	Approximate Content of:		
	Insoluble Fiber (g)	Soluble Fiber (g)	Total Fiber (g)
CEREALS – DRY (1 oz)			
Bran	7	1.5	9
Oatbran	2	2	4
Oatmeal	1.5	1	2.5
Wheat Germ	3.5	.4	4
NUTS (1/2 cup)			
Almonds, roasted	7	1	8
FRUIT (1 medium fruit)			
Apple, with peel	2	1	3
Banana	1.5	.5	2
Blackberries (½ cup)	3	.5	3.5
Citrus Fruit (orange, grapefruit)	1.5	2	3.5
Pear, with peel	3	1	4
Prunes, canned (½ cup)	3	4	7
BEANS (½ cup)			
Black-eyed Peas	7	1	8
Kidney Beans	4	1	5
Lima Beans	3.5	1	4.5
Navy Beans	3.3	2.5	6
Northern Beans	3.5	1	5
Pinto Beans	4	2	6
BREADS (1 slice)			
Bran Bread	2	.5	2.5
Multigrain Bread	1.5	.5	2
Whole Wheat Bread	1.5	.5	2
VEGETABLES (½ cup)			
Broccoli	1	1	2.5
Brussels Sprouts	2	1.5	3.5
Carrots	1.5	1	2.5
Green Peas	3	.5	3.5

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Summary

Dietary fiber is indigestible carbohydrate and can be soluble or insoluble. Soluble fiber is associated with possible metabolic and cardiovascular benefits, while insoluble fiber's effects are said to be primarily intestinal. However, there appears to be much overlap, and it is customary for food labels to report total fiber content. It is difficult to achieve a daily level of dietary fiber that is sufficient to improve constipation, ease hemorrhoids, or help prevent diverticulitis. Thus, many people prefer dietary fiber supplements such as bran or commercial bulking preparations. Success should be measured by the achievement of softer, bulkier, and more easily passed stools.

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