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Fiber in the Diet

Ever wonder why "an apple a day keeps the doctor away?" It may be the fiber or roughage in the apple.

Researchers have reported that rural Africans, for example, who consume high fiber diets have a lower incidence of diverticular disease, cardiovascular disease, and colonic cancer than Americans or other populations with low fiber intakes. The incidence of these diseases has increased over the last century in the United States at the same time that fiber intake has been decreasing. Because of this, many scientists, physicians, food faddists, and consumers are advising increased fiber in the diet. Is this wise advice?

What is dietary fiber?

Dietary fiber is the component in food not broken down by native enzymes and secretions of the gastrointestinal tract but which may be metabolized by the bacteria in the lower gut. This fiber is more than the roughage grandma used to talk about. It includes hemicelluloses, pectins, gums, mucilages, cellulose, and lignin, the only non-carbohydrate component of dietary fiber.

Fiber in foods has usually been measured by the crude fiber method: treatment of the food with strong acid and alkali which may remove 50 to 90 percent of the lignin, 85 percent of the hemicellulose, up to 50 percent of the cellulose, and all of the pectin. Crude fiber may represent as little as one-seventh of the total dietary fiber in human foods, so the crude fiber method should not be used to measure dietary fiber in human foods.

Are there any proven benefits to high fiber diets?

High fiber diets cause increased stool size and may help prevent or cure constipation. Cereal fiber, especially bran, is most effective at increasing stool size while pectin has little effect. Lignin actually can be constipating.

Dietary fiber also has been effectively used for the treatment of diverticulosis. Diverticula are outpouchings that develop on weak areas in the bowel wall. Approximately one-third of the adult U.S. population have them although in many people the diverticula cause no symptoms. Patients with diverticulosis used to be placed on a low fiber diet, but research has since shown that a high fiber diet is the preferred treatment.

What other diseases may fiber protect against?

Fiber may protect against the development of colon cancer, for populations consuming high fiber diets have a low incidence of this disease. The slow transit time (between eating and elimination) associated with a low fiber intake would allow more time for carcinogens present in the colon to initiate cancer. Fiber could also bind bile acids and other agents that may have a role in producing cancer. But constipated people do not have a higher incidence of colon cancer than fast eliminators, so fiber's role in colon cancer remains unclear.

Dietary fiber may limit cholesterol absorption by binding bile acids. High fiber diets lower serum cholesterol and may prevent cardiovascular disease. Some fibers, such as pectin and rolled oats, are more effective than others, such as wheat, at lowering serum cholesterol.

Diabetics may benefit from a high fiber diet. Pectin and other water soluble fibers have reduced the insulin needs of some diabetics in clinical studies. Diabetics should consult a physician before adopting a high fiber diet.

High fiber diets may be useful for weight loss. When apples, apple puree, and apple juice were fed in equal caloric amounts, the apples were much more filling than the apple juice.

The exact role of fiber in disease is difficult to define because as the fiber content of the diet increases, the fat and protein in the diet decrease. Low fat or low protein diets may be more important in the prevention of colon cancer than high fiber.

Which foods are the best sources of dietary fiber?

Dietary fiber is found only in plant foods. Foods that naturally contain fiber include fruits, vegetables, nuts, and grains (table 1). Refining processes decrease the fiber in foods. For example, whole wheat bread contains more fiber than white bread and apples contain more fiber than apple juice.

Because of high water content, fruits and vegetables provide less dietary fiber than the drier grains and cereals. Then, too, composition of the fiber in fruits, vegetables, and grains is different. Fruits are generally high in pectins while vegetables contain a high percentage of cellulose. Grains, especially wheat bran, are high in hemicellulose.

What about fiber supplements?

Because of widespread consumer interest in dietary fiber, many companies are marketing fiber supplements. These range from bran tablets to purified cellulose. Many laxatives sold as stool softeners are essentially fiber supplements.

Not all fiber sources are equal. Purified cellulose has a very minimal effect as a stool softener while bran is very effective. But bran has little effect on serum cholesterol while gums or pectin will lower serum cholesterol. Because of the limited knowledge about the physiological effects of dietary fiber, it would be wise to avoid fiber supplements and instead increase the unrefined carbohydrates (fruits, vegetables, grains) in the diet.

Is it possible to eat too much fiber?

Yes. The fiber content of the diet should be increased gradually so that the gastrointestinal tract can adjust. Large fiber intakes will initially cause gas and possibly diarrhea. High fiber diets may cause volvulus, an enlargement and twisting of the lower colon seen in Africans on high fiber intakes.

Fiber can affect mineral metabolism. Some studies have reported decreased absorption of calcium and zinc when subjects eat bran or purified cellulose. Pectin does not seem to change mineral absorption. It is unlikely that persons eating a variety of high fiber, natural foodstuffs need to be concerned about decreased mineral absorption. Eating large quantities of bran and purified cellulose should be discouraged.

How much dietary fiber do we eat and need?

Most surveys find that Americans consume an average of about 20 grams of dietary fiber daily. Because of the limited data on the physiological effects of fiber it is impossible to recommend the quantity or type of dietary fiber that should be consumed. Most experts agree that we could easily double the dietary fiber in the diet to 40 grams daily. Such a change in fiber intake should bring about the desirable effects of fiber on bowel function, yet avoid the negative effects on mineral absorption. A diet containing 40 grams of dietary fiber can be easily planned with foods normally present in our food supply. There is no need to buy fiber supplements.

Table 1. Dietary fiber in various plant foods*

	Total dietary fiber	Noncellulosic polysaccharides	Cellulose	Lignin
Dietary fiber in some breads				
		percent		
White	2.7	2.0	0.7	Trace
Whole wheat	5.1	3.6	1.3	0.2
Dietary fiber in some breakfast cereals				
All-Bran	26.7	17.8	6.0	2.9
Corn Flakes	11.0	7.3	2.4	1.3
Grape-nuts	7.0	5.1	1.3	0.6
Rice Krispies	4.5	3.5	0.8	0.2
Puffed Wheat	15.4	10.4	2.6	2.5
Dietary fiber in some vegetables				
Leafy vegetables				
Broccoli tops (boiled)	4.1	2.9	1.1	Trace
Brussels sprouts (boiled)	2.9	2.0	0.8	0.1
Cabbage (boiled)	2.8	1.8	0.7	0.4
Cauliflower (boiled)	1.8	0.7	1.1	Trace
Lettuce (raw)	1.5	0.5	1.1	Trace
Onions (raw)	2.1	1.6	0.5	Trace
Legumes				
Beans, baked (canned)	7.3	5.7	1.4	0.2
Peas, frozen (raw)	7.8	5.5	2.1	0.2
Root vegetables				
Carrots, young (boiled)	3.7	2.2	1.5	Trace
Potato				
White (raw)	3.5	2.5	1.0	Trace
Other				
Peppers (cooked)	0.9	0.6	0.3	Trace
Tomato (fresh)	1.4	0.6	0.5	0.3
Tomato (canned, drained)	0.9	0.5	0.4	Trace
Sweetcorn (cooked)	4.7	4.3	0.3	0.1
Dietary fiber in some fruits and nuts				
Fruits				
Apples (flesh only)	1.4	0.9	0.5	Trace
Apples (peel only)	3.7	2.2	1.0	0.5
Bananas	1.8	1.1	0.4	0.3
Cherries (flesh and skin)	1.2	0.9	0.3	0.1
Grapefruit (canned, fruit and syrup)	0.4	0.3	Trace	0.1
Peaches (flesh and skin)	2.3	1.5	0.2	0.6
Pears (flesh only)	2.4	1.3	0.7	0.4
Pears (peel only)	8.6	3.7	2.2	2.7
Plums (flesh and skin)	1.5	1.0	0.3	0.3
Strawberries (raw)	2.1	1.0	0.3	0.8
Nuts				
Brazils	7.7	3.6	2.2	2.0
Peanuts	9.3	6.4	1.7	1.2

*Credit: Journal of Human Nutrition, Vol. 30, 1976, p. 303.

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