Starch and Fiber for Health

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Your grandmother was right when she encouraged you to eat your vegetables or corn bread and bean soup. More and more people are taking that advice and reaping the benefits from eating fruits and vegetables, dried beans and peas, and the infinite variety of whole-grain breads and cereals available – all good sources of starch and fiber.

This leaflet will examine the current research and thinking about the complex carbohydrates of starch and fiber, how they relate to health and how much to eat. The new dietary recommendations suggest more servings of foods high in starch and fiber.

Starch is a plant's way of storing the sun's energy and is our body's preferred fuel. Each plant produces its own characteristic starch, but all starches break down to the sugar glucose when digested. Glucose is further metabolized, becoming a ready source of energy. Each gram of starch or sugar will furnish 4 calories of energy.

Dietary fiber, on the other hand, is largely calorie-free. Dietary fiber (also called roughage or bulk) is parts of whole grains, vegetables, fruits and nuts that resist digestion in the human gastrointestinal tract. *Crude fiber* figures on food labels only indicate part of the fiber content. Dietary fiber, more appropriately termed "total dietary fiber," is a more inclusive and accurate term for fiber content.

Water-soluble fibers, including some hemicelluloses, pectins, gums, mucilages, etc., are excellent water holders. Water-insoluble fibers also trap water and are mainly the celluloses, the rest of the hemicelluloses, and the noncarbohydrate lignins. Soluble and insoluble fibers function differently in our bodies. No one kind of fiber is best; they are all useful.

Relation to Disease

Coronary Heart Disease (CHD) and Stroke: *High-starch foods*, by replacing undesirable fats, should form the backbone of a heart-healthy diet. If they are relatively unprocessed, they also provide useful amounts of vitamins and minerals promoting cardiovascular health.

For *fiber*, researchers generally agree that certain water-soluble fibers in foods can lower blood cholesterol levels but just how this is done is unclear. Some evidence suggests that soluble fibers (pectins, gums, hemicelluloses, mucilages and even some substances in algae and seaweed) can be converted by bacteria into volatile fatty acids that, in turn, may interfere with intestinal absorption and in-body synthesis of cholesterol. Although fiber is considered calorie-free, these bacteria-produced fatty acids may have some caloric value. In the typical U.S. diet, calories contributed by dietary fiber are insignificant – a total of less than 100 calories daily.

Water-soluble fiber has been big media and advertising news, with numerous studies documenting the cholesterol-lowering benefits of soluble fiber from oat bran, barley, psyllium seed and dried beans. Highly competitive companies have exploited the soluble-fiber research and added fiber to many products, particularly cereals and breads. Often the amount added is so small as to be insignificant, while the price of the product is far higher than plain oats, oat bran, barley or cooked dry beans.

A 1990 study in Boston suggested that *oat bran* was no better than a low-fat diet in lowering blood cholesterol levels. This report confused and angered consumers who felt they had been betrayed, and oat sales dropped sharply. It is worth remembering that one research report does not negate all the previous evidence demonstrating the cholesterol-lowering ability of oat bran and other soluble fibers in persons with high cholesterol levels.

In this case, the credibility of researchers, the food industry and government itself suffered because the public didn't know whom to believe.

Recent research suggests that the soluble fiber left in white flour after the bran is removed is useful in lowering blood cholesterol levels. This supports the need to eat a variety of foods from the different food groups, and confirms that soluble fiber is available in many foods.

Other research suggests that *pectin* – abundant in fresh apples, citrus fruits, grapes and berries and used in making jelly – likewise has this cholesterol-lowering ability. *Apple fiber* made from apple pulp is a product containing pectin and other soluble and insoluble fibers. It could possibly reduce blood cholesterol, but has not been well tested for this effect.

Stroke can result from hypertension and atherosclerosis. While other factors – obesity, sodium and alcohol intake – are important in elevating blood pressure and thus increasing stroke risk, researchers also have noted that vegetarians usually have lower blood pressures. As yet the evidence supporting this benefit is quite limited.

Diabetes: High-starch and high-fiber diets for treating diabetes are relatively new. They are particularly helpful for non-insulin-dependent diabetes mellitus (NIDDM) because they can control blood sugar levels to the point that some people can reduce or even eliminate the need for drugs or insulin.

To obtain this benefit, the diet prescription must be followed carefully. Fifty-five to 60 percent of the calories must come from carbohydrates, with about two-thirds from starches and the rest from natural sugars in fruits and milk, with practically no added sugar. Fiber intake should be increased dramatically from the U.S. average of 7 grams per 1,000 calories daily to 20 to 25 grams per 1,000 calories. Soluble fiber is especially recommended because it slows the absorption of glucose from the intestine, thus aiding blood sugar control. Careful control of blood sugar levels, whatever the method, is believed to help prevent or at least postpone the common complications of diabetes, namely heart and vascular disease, blindness, nerve damage, and kidney disease.

In this diet, fat intake is limited to 30 percent or less of total calories. Saturated fats are restricted to 10 percent or less of calories (about a third of the total fat intake). Protein provides the remaining calories. Alcohol in very limited amounts may be allowed (1 or 2 non-sweetened drinks daily). High-starch diets without increased fiber do not control diabetes as well because blood triglycerides may rise, a complication for many women with atherosclerosis. For most diabetics, high-starch and high-fiber diets, often referred to as High Carbohydrate and Fiber (HCF) diets, do not cause this problem.

Colon Cancer: Colon cancer is the second leading cause of cancer deaths in the United States. In Asian and African countries, people eating traditional diets have almost no cancer, but the incidence rises as they adopt Western food and other life-style habits.

Fiber is believed to protect the colon several ways, including entrapping and diluting potential cancer-causing materials, hurrying the fecal contents along, and by altering the types and numbers of colon bacteria. Even the different types of fiber can influence cancer risk. As with fiber and heart disease, more research is needed, and there are numerous other food and nonfood factors involved in colon cancer.

Breast Cancer: Fiber's role in preventing breast cancer is less certain than that for colon cancer; however, a number of studies support the theory that high-fiber, low-fat diets lower breast cancer rates. Future research will likely focus on which fibers and how much they lower levels of the female hormone, estrogen, the mechanism suspected of being involved in breast cancer.

Other Gastrointestinal Disorders: The simplest and best solution for most constipation is to increase dietary fiber, the insoluble kind from bran (outermost layers of seeds) and whole-wheat and rye products as well as most fruits and vegetables. Refined breads and cereals and fruit juices are low in constipation-curbing fiber. Soluble fiber does not help much either. The advantage of insoluble fiber (lignins and celluloses) is its water-holding capacity and resistance to bacterial enzyme breakdown in the colon. The result is a large volume of soft, easily-passed feces.

Diverticulosis (outpouches or pockets formed in the colon wall) can become infected and painful. Previously treated by a low-residue diet, clinicians now believe the condition can be largely overcome by increasing fiber intake, particularly insoluble fiber. Increasing the volume of feces reduces the buildup of pressures along the colon wall , believed to be the underlying reason for the condition.

Gallstones and hiatal hernias may benefit from adequate dietary fiber. Fiber stimulates bile salt secretion, diluting the bile solution with its cholesterol, thus reducing the likelihood of gallbladder stone formation. Hiatal hernias (a portion of the stomach protruding into the lung cavity) and varicose veins may also be related to abdominal pressures exerted during passage of hardened feces.

Investigators report that other intestinal disorders – *irritable bowel*, *Crohn's disease* (in its latent stage), and even *peptic ulcers* – may benefit from higher-fiber diets during their long-term treatment. Of course, follow your physician's advice as to what is best for your condition, especially in its acute phases.

Obesity: High-starch foods are not fattening unless eaten in large quantities. Not only are carbohydrates lower in calories than fat – 4 vs. 9 calories per gram of fat – but they use more energy in the process of being converted to fat and stored in a fat cell. For every 100 excess calories, only 3 calories are required to store dietary fat, compared to 23 calories used to convert and store dietary carbohydrate as fat. The bottom line is that it's difficult to become fat from eating starch. The best weight-loss regimens keep fat intake low (20 to 30 percent of calories) and encourage plenty of exercise.

Researchers have proposed low-calorie, high-fiber diets to aid weight loss. In one study comparing a group that ate white bread with a group that ate high-fiber bread, both groups lost weight on 12 slices of bread daily, but the high-fiber eaters lost 40 percent more weight than the white-bread eaters. Of course, the rest of the diet was carefully chosen to provide the necessary balance and variety of essential nutrients. Bread alone would be nutritionally inadequate.

Among the reasons why fiber may promote weight loss is that it increases satiety, a feeling of fullness, through prolonged digestion. Slower digestion improves blood sugar and insulin levels and delays hunger. Fiber may also interfere with the absorption of calorie-laden nutrients such as sugar and fat.

Every reducing diet should provide at least 100 grams of carbohydrate daily, preferably in the form of fruits, vegetables, and cereal grains. The fast weight loss achieved by high-protein, high-fat diets is not only deceiving but also dangerous. Besides stressing the kidneys and upsetting the acid-base balance in blood, such diets guarantee that weight regain will occur rapidly as the body replenishes its glycogen (animal starch) stores depleted by such diets.

Recommended Amounts

Nutrition advice, as it evolves, reflects the most recent scientific findings and conclusions. For starch and fiber, this has meant going from being ignored to the 1990 dietary guideline that specifically addresses foods containing starch and fiber: "Choose a diet with plenty of vegetables, fruits and grain products."

Consensus statements, such as the 1988 Surgeon General's Report, the 1989 National Research Council Committee's report on Diet and Health, and the National Cholesterol Education Program Expert Panel Report, all recommend the same thing – eat foods with more starch and fiber.

While opinions vary as to what is "adequate" and there is no Recommended Dietary Allowance (RDA) for starch or fiber, most experts favor carbohydrate intakes of at least 50 percent of calories with an emphasis on starch rather than refined or added sugars. Currently, most Americans consume more than 45 percent of their calories as carbohydrate with nearly one-quarter of that from added sugars. New government recommendations suggest:

Breads and cereals: six to 11 servings; several servings of whole-grain products daily.

Vegetables: three to five servings from entire group. Use dark green, leafy vegetables and dry beans and peas several times a week.

Fruits: two to four servings.

The exact number of servings depends on your calorie needs. This volume of food surprises most people, but it is not too much. Just keep the fats and sugars low.

While a few experts suggest increasing fiber intakes to only 15 or 20 grams daily, the National Cancer Institute recommends 25 to 35 grams, and the Expert Panel of the Federation of American Societies for Experimental Biology agreed on a range of 20 to 35 grams of fiber daily. Depending on your choices, the suggested servings of foods above can provide adequate fiber.

Unless your physician advises otherwise, begin eating more foods from whole grains, dried peas and beans (legumes), and fruits and vegetables. Look for recipes and buy products that are low in fat and added sugars.

High-Starch, High-Fiber Menu

30-35 grams of total dietary fiber and 9-10 grams of soluble fiber, approximately 2,000 calories

Breakfast
Grapefruit half
Ready-to-eat oat cereal
Oat bran muffin with jelly
Skim milk, 1 cup
Coffee or weak tea

Morning Snack
Bran muffin (no spread)
Coffee or weak tea (no cream or "creamer")

Lunch or Supper
Vegetable soup
Tuna sandwich on whole-wheat bread
Fresh pear or apple
Skim milk, 1 cup

Afternoon Snack or Bedtime Snack
Whole-wheat crackers (10 small)
Peanut butter, 2 tablespoons
Beverage, low or no calories

Main Meal
Oven-baked chicken (breast half or thigh, no skin)
Baked potato with low-fat yogurt and parsley
Carrots and peas, with margarine
Leafy green salad with reduced calorie dressing
Whole-grain roll or bread, no spread
Wholesome apple crisp with ice milk
Water

Fiber Supplements: Fiber supplements are usually unnecessary. They are expensive and furnish limited amounts of fiber, even though the percentage of fiber in the supplement is high.

Psyllium seed husks and sugar beet fiber have been added to some ready-to-eat breakfast cereals. The Food and Drug Administration has asked the cereal companies to establish safety data for the amounts added because a few people are allergic to psyllium powder.

Psyllium powder is a principal ingredient in two FDA-approved, nonprescription laxatives, Metamucil and Fiberall. Fiber supplements should always be accompanied by adequate fluids. Also, limit children to one serving daily of any high-psyllium cereal.

Excess Fiber: Like most aspects of nutrition, too much starch and fiber can cause problems. Very-high-starch diets could reduce protein and fat to dangerous levels. This most often happens with the poor, especially children in developing countries.

High-fiber diets can decrease mineral absorption. Studies have shown calcium, magnesium, phosphorus, copper, iron and zinc to be among the minerals reduced. Refined cellulose, such as alpha-cellulose added to some low-calorie breads, can interfere with calcium and iron absorption. For those whose mineral levels are already borderline, high fiber intakes can lead to mineral deficiencies. Very high levels of fiber also have been linked to kidney stones and bowel obstructions, but inadequate water may be a factor as well.

Whatever your intake of fiber, remember to drink at least six to eight cups of liquids daily to maintain adequate supplies of body water and prevent dehydration.

Sudden increases in fiber intakes may result in gastrointestinal symptoms of diarrhea, bloating, cramping and gas. To prevent this, increase your fiber intake gradually. It takes time for your intestinal tract and the bacteria in it to adjust.

The optimal level of fiber is between diarrhea and constipation with soft, easily passed stools even more often than once a day. If you eat the recommended amounts of starch and fiber in foods, you should not need fiber supplements. For overcoming constipation, fiber supplements are usually preferred to laxative drugs. Check with your health care provider as to what is best for you.

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