

Family Resources



Virginia Cooperative Extension Service
Extension Division
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061

Publication 348-912
Reprint October 1981

Fiber in the Diet

Ann A. Hertzler
Food and Nutrition Specialist

What is Fiber?

Technically, fiber is the part of plant cells that supports the cell walls. Although many animals can digest much of the fiber in plants, humans cannot. The human digestive system does not contain secretions or enzymes to break down fiber, or roughage as it is sometimes called. Since most of the fiber cannot be digested, it is unavailable to the body.

Most fiber is classified as carbohydrate. Cellulose, hemicellulose, and pectin are examples of fiber that are carbohydrate. These carbohydrates have a bulking effect in the intestinal tract because they absorb water. Fiber absorbs water from the intestinal tract and makes a softer and larger volume stool which is easier for the intestine to handle. Constipation is often related to lack of dietary fiber.

Lignin is another component of dietary fiber. Although lignin does not absorb water, it does absorb bile acids. Thus, increased dietary fiber results in an increased fecal excretion of bile acids and may be related to lower cholesterol levels.

The larger size stool stimulates passage of material through the intestinal tract and thereby maintains intestinal regularity. A smaller stool is harder to pass through the digestive tract and is

therefore likely to cause constipation. Stool transit time, on a low fiber diet, averages about 80 hours. On a high fiber diet, stool transit time is only about 40 hours. Therefore, high fiber diets increase the frequency of bowel movements. However, some reports indicate transit times are extremely unpredictable and fiber does not change normal habits.

Fiber diets also cause a change in bacterial flora. Some scientists think differences in bacteria are related to the breakdown of dietary fat and bile salts instead of being related entirely to fiber content. A low fiber diet, which takes longer to pass through the digestive tract, allows more time for bacteria to degrade bile salts to potential carcinogenic substances. The addition of fiber may alter the action of bacteria on bile salts and, because of the faster transit time, shortens contact time with the intestinal tract.

Much more research is needed to learn the role of fiber in the digestive tract. What is fiber's role as a bulking agent absorbing water? What is the role of fiber in changing the bacterial flora? What is the importance of sterol changes on high fiber diets? How are each of these related to colon problems? What other dietary differences could be causing colon diseases instead of fiber?



LD
5655
A762
no. 348-912
VPI
Spec

Why Are Nutritionists Interested in Fiber?

Epidemiological research suggests that low fiber diets may be related to cancer of the colon. Epidemiology means comparing the incidence of disease among different populations. By studying different groups of people, their habits, and diseases, scientists can uncover problems and differences to give focus and directions to laboratory studies.

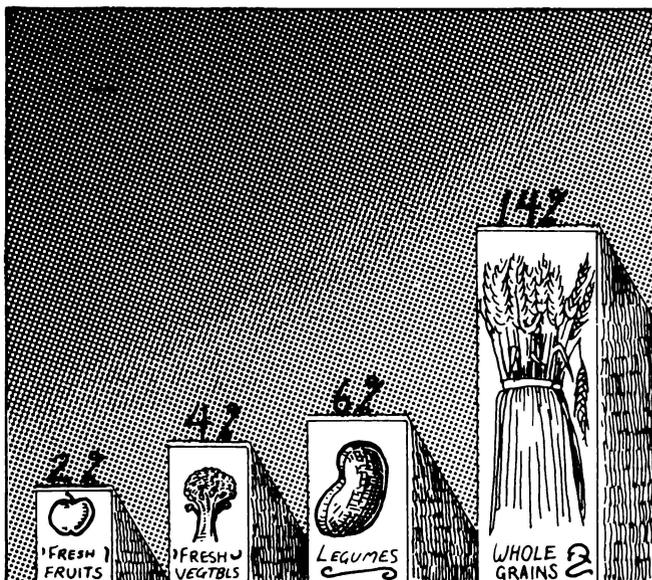
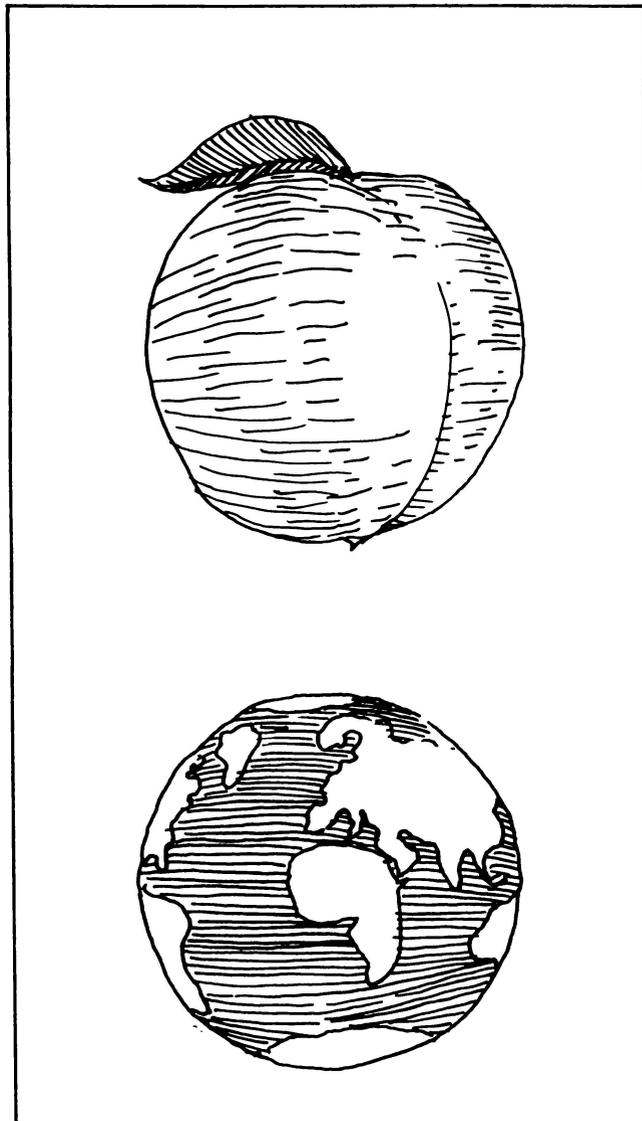
In the case of dietary fiber, Dr. D. P. Burkitt, a member of the British Medical Research Council, and his colleagues in England and South Africa were interested in learning what caused cancer of the colon. They observed Africans have less colon cancer than American negroes; Japanese have less colon cancer than Japanese immigrants to Hawaii; and Africans have far less colon cancer than people in the more affluent countries of Great Britain and the United States. In the United States, colon cancer is second only to lung cancer in men and breast cancer in women.

Burkitt also noticed the increased rise of non-infectious diseases of the large bowel — appendicitis, diverticular disease, ulcerative colitis, and hemorrhoids in countries where people tend to consume low fiber diets. By exploring the cause of colon cancer, answers might also explain other intestinal problems. What is it about more civilized countries that causes a higher incidence of bowel problems? Dietary differences seemed to be the obvious area to study, since diet influences fecal content and the lining of the intestinal tract. Also, dietary habits vary considerably between low and high risk cancer areas. Fiber may be the answer: but, the presence or lack of other types of foods may be causing colon problems.

Diet and Fiber

Most food labels list crude fiber content. In laboratory studies, crude fiber is determined in foods by using strong acids and alkalies which break down some of the fiber much more thoroughly than does a person's digestive tract. The amount of crude fiber is about one-fourth to one-half of the actual fiber content of the diet and represents mostly cellulose. Measures of dietary fiber are now appearing. They are about three times the amount of crude fiber estimates and are considered more accurate in estimating cellulose, hemicellulose, and lignin.

Dietary fiber essentially comes from cell wall materials. Major food sources are cereals, vegetables, fruits and nuts. Refined wheat flour as used in breads has about 3 to 4% dietary fiber. Whole grain contains 11 to 14%. Dietary fiber of fresh fruits and vegetables is diluted by water. Fresh vegetables average 3 to 4% dietary fiber; legumes such as peas and beans, about 6%; and fresh fruits, 1 to 2%.



Fiber Tips

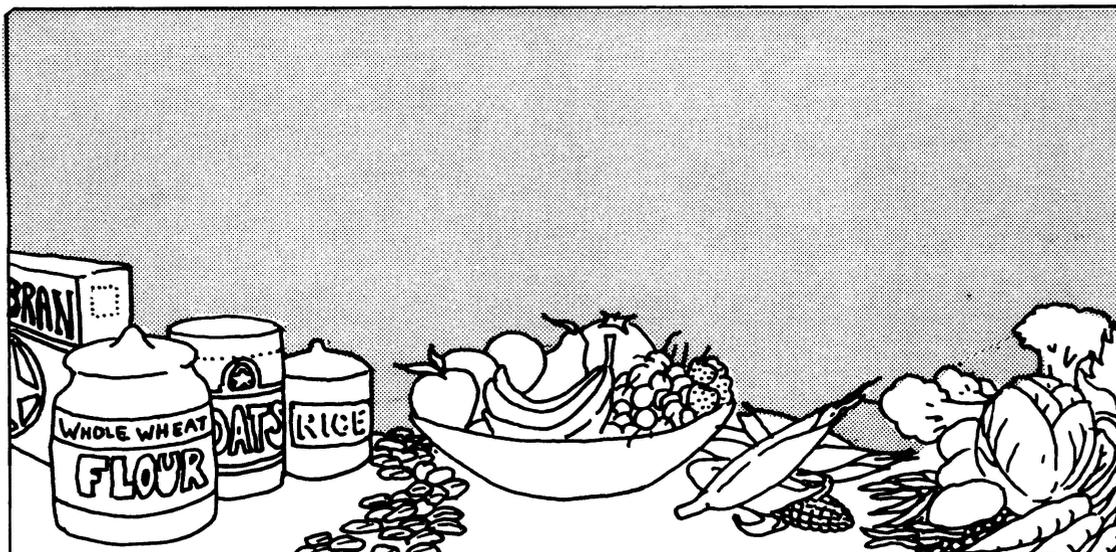
Baking Breads

1. Substitute half whole grain. The gluten of white bread provides a framework with good volume. Whole grain can be substituted for all the flour, but the resulting texture will be firmer and more compact.
2. Add crunchy cereal toppings as salad crispers, casserole toppings, and dessert toppings.
3. Use raw fruits and vegetables in salads, as desserts, and as snacks.



Food	Dietary Fiber g/100 gm	Food	Dietary Fiber g/100 gm
Grains		Vegetables	
white flour	3.5	broccoli tops	3.6
wholewheat flour	13.5	brussel sprouts	4.2
bran, sieved	30.6	cabbage	3.1
bran, coarse	48.0	carrots	3.2
oatmeal	7.7	cauliflower, boiled	1.8
rice, long grain	2.7	potatoes	3.4

Food	Dietary Fiber g/100 gm	Food	Dietary Fiber g/100 gm
Fruits		Legumes	
apple	1.4	baked beans	7.3
banana	1.8	peas, frozen	7.8
cherry	1.2	Nuts	
orange	1.9	Brazils	7.7
peach	2.3	Peanuts	9.3
pear	2.4		
strawberry	2.1		
sweet corn	4.7		
tomato	1.4		



American Dietary Habits

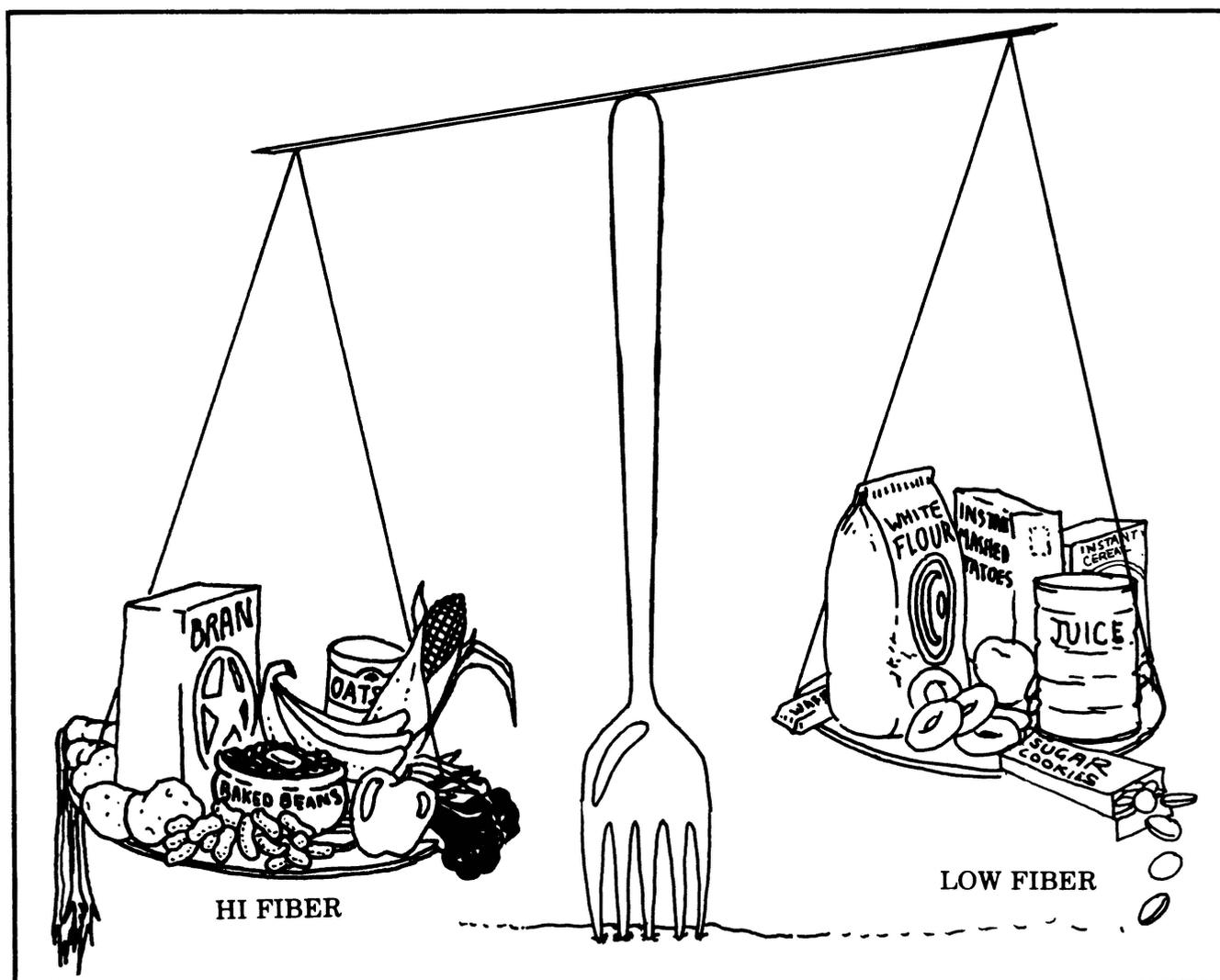
Americans are eating less dietary fiber because food habits in the United States have changed and because foods are becoming more highly refined. One source estimates that, in the United States in this century, fiber derived from fruits and vegetables has decreased by about 20 percent and fiber from cereals by about 50 percent.

Fruits and vegetables are being used in more processed forms of which many are mixtures. More raw fruits and vegetables in meals and snacks would increase dietary fiber. Raw carrots, celery, and apples contain tougher fiber which is more absorbent before cooking than after.

Not only are Americans using more refined cereals and grains than they did a century ago, but many "instant" cereals are available. In addition the use of sugar, a highly refined carbohydrate, also has increased dramatically.

Whole-grained, stone-ground flour and cornmeal are examples of partially ground cereals which contain more bran than highly refined cereals.

American diets differ in more than just dietary fiber. They are also higher in fat, protein, and food energy (calories). The consumption of meat, fish, poultry, eggs, and dried beans throughout the day helps to account for Americans' high protein intake. Many Americans eat two to three times the amount of protein they need each day. The high fat content is explained by the use of many pastries (e.g., cookies, cakes, pies, and doughnuts); fried foods; sauces and gravies; and spreads for breadstuffs. Thus, the American diet is, too often, oversupplied with calories, fat, and refined carbohydrate as well as being low in dietary fiber (e.g., fruits, vegetables, and whole grains).



Virginia Cooperative Extension Service programs, activities, and employment opportunities are available to all people regardless of race, color, religion, sex, age, national origin, handicap, or political affiliation.

An Equal Opportunity/Affirmative Action Employer

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, and September 30, 1977, in cooperation with the U.S. Department of Agriculture. W. R. Van Dresser, Dean, Extension Division, Cooperative Extension Service, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061; M. C. Harding, Sr., Administrator, 1890 Extension Program, Virginia State University, Petersburg, Virginia 23803.