*What is fiber?*

Multiple definitions of total fiber are recognized; however, the most recently accepted definition is that Total Fiber is the sum of Dietary Fiber and Functional Fiber. Dietary Fiber, also called roughage, bulk, and viscous fiber, include non-digestible carbohydrates and lignin most commonly found in plants. Functional Fiber is defined as isolated, manufactured, or synthetic oligosaccharides with three or more degrees of polymerization found in both plants and animal products that play an important role in several beneficial physiological functions, including effects on laxation, blood glucose, and cholesterol concentrations (1). Fiber has also been implicated in reducing the incidence of diverticulosis, cardiovascular disease, and some cancers (1, 2).

*What is the difference between soluble (viscous) and insoluble fiber?*

Historically, fiber has been classified as soluble, now referred to as viscous, (gums, mucilages, and pectins) and insoluble (cellulose, hemicellulose, and lignin). These classifications were intended to predict their physiological outcomes but their value is coming under increasing scrutiny as further studies suggest otherwise (4). The United Nations, in a joint FAO/WHO report, proposed that these terms be phased out, but nutritionists continue to rely on them heavily (5).

*What are good sources of fiber?*

Whole grain products, vegetables, and fruits are the principal sources of fiber in our diet. According to Food and Drug Administration (FDA) label content laws, the term “high” fiber is indicative of a food that has at least 20 percent of the AI for fiber, and a “good source” of fiber food must have between 10-15 percent of the AI for fiber (6). There is no fiber in meat, fish, eggs, milk, or cheese.

- **Grain products**- whole grain flour and foods made from whole grains contribute the greatest amount of fiber in the diet compared with other food sources. Rye is highest on the list, followed by wheat, barley, oats, brown rice, and corn meal. Bran (the outer layer of the grain kernel) contains most of the fiber in a grain (up to 90 percent, depending on how it is processed).

- **Vegetables**- legumes (dried beans, peas, and lentils) are the highest source of total fiber among vegetable sources. Potatoes, carrots, cabbage, and tomatoes have lower fiber content, but they often contribute more fiber to our daily diet because we eat them more frequently. Vegetables tend to have less fiber than cereals because they are higher in water content.

- **Fruit**- Raspberries, apples and oranges provide a good source of fiber.
What is meant by “whole grain”?  

The term whole grain refers to a grain that has not had any of its parts, including the germ, the bran, and the endosperm, removed (has not been refined). During the milling process in the production of white flour, for example, only the endosperm is used and the remaining layers are discarded. As a result, the other layers, which are rich sources of nutrients including fiber, are lost (6). Although many nutrients are added back to enriched refined grains, high fiber plant foods (such as whole wheat flour and breads and brown rice) are higher in a number of nutrients that are not added during the enrichment process.

Why do people need fiber?  

Eating foods with fiber is important for proper bowel function and can reduce symptoms of chronic constipation, diverticulosis, and hemorrhoids. Populations with low intakes of dietary fiber may have more heart disease, obesity, and some cancers. Fiber is associated with a reduced incidence of these chronic health problems, although the precise protective factor is yet unknown (2).

- **Fiber and Colon Health**- Fiber promotes healthy bowel function, due to microflora activity, water holding capacity, increasing fecal bulk, and reducing fecal transit time, thereby preventing constipation (2). Fiber is fermented by microflora that reside in the large intestine, which produce butyrate. Butyrate is the preferred source of energy for colon cells; furthermore, theories suggest that an absence of butyrate may contribute to colon cancer and ulcerative colitis (1).
- **Fiber and Heart Disease**- Foods rich in fiber have been associated with reducing cholesterol concentration, particularly LDL cholesterol, which is associated with increased risk for cardiovascular disease. The mechanism, though not fully understood, has been suggested to relate to the viscous property of some fiber (1).
- **Fiber and Obesity**- Fiber may also help to prevent obesity because of its ability to hold water, thereby creating more bulk to help the stomach feel full. Some fibers empty from the stomach more slowly, which prolongs satiety.
- **Fiber and Cancer**- There is an association between high-fiber intake and a reduced incidence of some cancers. This protective factor has not been linked to the fiber alone, however, and may be due to an interaction among other components in the food (2).
- **Fiber and Diabetes**- In people with diabetes, a diet high in viscous fiber, especially from whole grains, can help control blood glucose concentration by slowing down the rate of nutrient absorption (1, 6).

How much fiber is recommended?  

According to a recent study, women eat between 12.1 to 13.8 g/day of fiber and men eat between 16.5 and 17.9 g/day of fiber. The current Adequate Intake (AI) for fiber as recommended by the Institute of Medicine and the Food and Nutrition Board indicate 25 and 38g/day for women and men, respectively, based on health benefits from fiber that protect against coronary heart disease (1).

What are some ways to increase fiber intake?  

To increase fiber intake, the Dietary Guidelines for Americans suggest the following for adults and children over 2 years of age every day:

**Three or more servings of various vegetables (a serving is 1 cup of raw, leafy greens or 1/2 cup of other kinds)**
- Have dark green, leafy and deep yellow vegetables often.
- Eat dry beans and peas often.
- Eat starchy vegetables such as potatoes and corn.
Two or more servings of various fruits (a serving is 1 medium apple, orange, or banana)
- Have citrus fruits, melons, or berries regularly.
- Choose fruits as desserts.

Six or more servings of grain products such as breads, cereals, pasta, and rice (a serving is 1 slice of bread, 1/2 bagel or English muffin, 1 ounce of dry ready-to-eat cereal, or 1/2 cup of cooked rice or pasta)
- Eat products from a variety of grains, such as wheat, rice, oats, and corn meal.
- Have several servings of whole grain breads and cereals daily. Look for the words “whole grain” on the label.

Other ways to increase fiber intake include the following suggestions:
- Use fresh or dried fruits for desserts and snacks.
- Use beans, lentils, and peas. Add cooked beans and peas to soups, stews, casseroles, and salads. Nuts and seeds, although high in fiber, are also high in fat, so use them sparingly.
- Choose whole grain breads and cereals, and check the ingredient label to make sure the food is really “whole grain.”
- Choose high fiber grains such as buckwheat, brown rice, and bulgur. Choose them in place of white rice or a white flour product as a side dish, in pilaf and in soups and stews.
- Leave the skin on potatoes, fruits, and vegetables. This outer layer is high in fiber.

Can too much fiber be harmful?
Eating too much fiber (more than 50-60 grams of fiber a day) may decrease the amount of vitamins and minerals your body absorbs. To add more fiber to the diet, an individual can increase the amount eaten gradually; this gives the stomach and intestines time to get used to the change. In addition, fiber supplements could easily lead to excess, which may cause intestinal discomfort; thus, adding fiber to the diet with the addition of fiber rich foods is a safer route. Eating too much fiber too quickly may cause gas, diarrhea, and bloating. Studies suggest that proper hydration is essential in order for fiber to be beneficial; consequently, drinking at least 8 glasses of water and other liquids a day is recommended (1).

Adding fiber to the diets of young children needs to be done carefully. Extra fiber may make them feel full too quickly and make it hard for them to eat enough food to grow properly. Too much fiber may interfere with the body's ability to obtain enough vitamins and minerals; this can be a problem with adults but is more serious in children.

It may be easy to overdo the intake of fiber in people such as the elderly since they often have limited intake of food. Elderly people and people who have had gastrointestinal surgery (on some part of the stomach, intestines, colon, or rectum) may feel the effects of added fiber more than others and should check with their physician before adding fiber to their diet.

Should people take fiber supplements?
Excessive use of fiber supplements is associated with greater risk for intestinal problems. Some of the benefits from a high fiber diet may be from the food that provides the fiber, not from fiber alone (6). For this reason, it is best to obtain fiber from foods rather than from supplements. Following the guidelines above is one way to ensure sufficient amounts of fiber are being consumed without going overboard.
Listed below are some common foods and their dietary fiber content (7).

<table>
<thead>
<tr>
<th>Food</th>
<th>Serving</th>
<th>Dietary Fiber (g)</th>
<th>Calories</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fruits</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apple (with skin)</td>
<td>1 medium</td>
<td>3.0</td>
<td>81</td>
</tr>
<tr>
<td>Cantaloupe</td>
<td>1/4</td>
<td>1.1</td>
<td>47</td>
</tr>
<tr>
<td>Fig, dried</td>
<td>2</td>
<td>3.5</td>
<td>95</td>
</tr>
<tr>
<td>Orange</td>
<td>1 medium</td>
<td>3.1</td>
<td>62</td>
</tr>
<tr>
<td><strong>Vegetables, cooked</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broccoli</td>
<td>1/2 cup</td>
<td>2.0</td>
<td>23</td>
</tr>
<tr>
<td>Brussels sprouts</td>
<td>1/2 cup</td>
<td>3.4</td>
<td>30</td>
</tr>
<tr>
<td>Potato, baked (with skin)</td>
<td>1 medium</td>
<td>3.6</td>
<td>220</td>
</tr>
<tr>
<td><strong>Vegetables, raw</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrots</td>
<td>1 medium</td>
<td>2.3</td>
<td>31</td>
</tr>
<tr>
<td>Spinach</td>
<td>1 cup</td>
<td>1.5</td>
<td>12</td>
</tr>
<tr>
<td>Tomato</td>
<td>1 medium</td>
<td>1.6</td>
<td>24</td>
</tr>
<tr>
<td><strong>Legumes, cooked</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lentils, cooked</td>
<td>1/2 cup</td>
<td>3.7</td>
<td>97</td>
</tr>
<tr>
<td>Baked beans (vegetarian or with pork), cooked</td>
<td>1/2 cup</td>
<td>9.8</td>
<td>118</td>
</tr>
<tr>
<td><strong>Breads, grains, and pasta</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bagel</td>
<td>1</td>
<td>1.2</td>
<td>163</td>
</tr>
<tr>
<td>Rice, brown, cooked</td>
<td>1/2 cup</td>
<td>1.7</td>
<td>109</td>
</tr>
<tr>
<td>Spaghetti, cooked</td>
<td>1/2 cup</td>
<td>1.1</td>
<td>99</td>
</tr>
<tr>
<td>Whole wheat bread</td>
<td>1 slice</td>
<td>1.9</td>
<td>61</td>
</tr>
<tr>
<td><strong>Breakfast Cereals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-Bran</td>
<td>1/3 cup</td>
<td>8.5</td>
<td>71</td>
</tr>
<tr>
<td>Cheerio’s</td>
<td>1 cup</td>
<td>2.7</td>
<td>111</td>
</tr>
<tr>
<td>Raisin Bran</td>
<td>3/4 cup</td>
<td>4.8</td>
<td>115</td>
</tr>
<tr>
<td>Oatmeal (regular, quick or instant), cooked</td>
<td>3/4 cup</td>
<td>1.6</td>
<td>108</td>
</tr>
</tbody>
</table>

References:

4 Slavin JL, Martini MC, Jacobs Jr. DR, and Marquart L. Plausible mechanisms for the protectiveness of whole grains. Am J Clin Nutri; 70(3 SUPPL); 1999; 459S-463S.
5 Chen HL, Haack VS, Janecky CW, Vollendorf NW, and Marlett JA. Mechanisms by which wheat bran and oat bran increase stool weight in humans. Am J Clin Nutri; 68(3); 1998; 711-719.
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Publication 8139

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pr-11/05

This publication has been anonymously peer reviewed for technical accuracy by University of California scientists and other qualified professionals. The review process was managed by the ANR Associate Editor for Food and Nutrition.