

Non-nutrients: Fiber and Water

Summary

The importance of dietary fiber and water as a essential non-nutrients.

Main Core Tie

Food And Nutrition

Strand 3

Background for Teachers

Dietary fiber is not a nutrient, but it is necessary to regulate digestion and appears to prevent some epidemiological diseases.

DEFINITIONS:

WATER: a compound composed of two atoms of hydrogen and one atom of oxygen. Water is the most important of all the essential nutrients, since human life cannot be sustained without water.

FIBER: A loose term denoting the substances in plant food that are not digested by human digestive enzymes. It provides almost no calories.

CRUDE FIBER: The residue of plant food remaining after extraction with acid and alkali.

DIETARY FIBER: The residue of plant food resistant to hydrolysis by human digestive enzymes. (1 gm crude fiber = 2-4 gm dietary fiber.)

In addition to simple and complex carbohydrates, many plants that we eat for food contain cellulose, which is not broken down, digested and used by our body. It is tough and stringy and is essential for regulating the body. It is called dietary fiber. The cellulose strings in a stalk of celery is a good visible example.

Dietary fiber is a non-nutrient because it is not digested or absorbed by the body. It helps to move food through the body and aids digestion by (1) attracting water to the small and large intestines, and (2) the water increases bulk in foods and keeps the mass of fiber, food particles, digestive juices soft and moving though the system.

Fiber is thought to be a protective agent for certain diseases, including colon cancer, diverticulosis*, and coronary heart disease. Because so many of the foods eaten in the United States are processed and refined, much of the fiber-rich parts are removed. MyPyramid recognizes this and suggests that one half of choices from the Grains Group be whole grains. Whole grains, raw fruits and vegetables are the best sources of fiber as are legumes, nuts and seeds. Foods from animals, such as meat, milk, eggs, and cheese do not contain fiber.

* Diverticulosis - out-pockets of weakened areas of the intestinal wall (like blow-outs in a car tire) can cause diverticulitis where those pockets can become inflamed or may rupture. This is usually caused by high pressure in the intestine and prolonged transit time of waste materials. Fiber in the diet reduces both pressure and transit time.

People in the Unites States need to be conscious of adding fiber to their diets. Food composition tables list fiber as crude fiber (also called roughage) because home economists, dieticians, and other scientists can measure the fiber in a food. These professionals, however, define dietary fiber as any part of ingested food that is not digested or absorbed by the human digestive tract. There is no way to measure dietary fiber which could be 3-5 times the amount of crude fiber in a diet. Crude fiber measurements, however, can be used to rank the value of foods from lowest to highest in fiber content.

Some people are concerned about fiber bonding with minerals such as iron and removing them from the system. There is little danger of this if individuals eat a balanced diet that includes a variety of grains and breads.

There is no recommended Dietary Allowance for fiber. It is suggested that the average person needs about 20 to 35 grams of dietary fiber per day. Americans are currently consuming much less than the recommendation.

SOURCES: Fiber is found only in foods of plant origin. This includes fruits, vegetables, nuts, peas, and other legumes. One of the best sources of dietary fiber is found in grains. Wheat is the most commonly used grain in the American diet, but corn, oats, barley and rye are also used to produce the cereals and other grain products used. The following discusses wheat in particular, but all grains are constructed the same way.

The wheat kernel has three main parts:

The germ is the part that reproduces when planted, and contains concentrated food to maintain new life. It is rich in vitamins and minerals, fat, iron, and protein.

The bran, a protective coating around the kernel is similar to the covering on a nut, is rich in nutrients and fiber.

The endosperm is the soft inside part of the kernel and contains starch and proteins. When endosperm has been milled and ground into flour, the flour has the ability to form a stretchy protein called gluten. Gluten allows a lacy network of air bubbles to be baked in, making bread light and soft.

Nutrition-conscious people are concerned about the loss of nutrients from the wheat kernel during the milling process. Many years ago, grains were milled by grinding them between two stones to expose the soft interior. The chaff or husk was then blown away. Important nutrients were left in the grains. As improvements were made in milling machinery, a whiter, smooth-textured flour resulted, and people came to look on it as being preferable to the crunchy, dark-brown, old fashioned flour. But where whole wheat flour uses the entire wheat kernel, white flour only uses the endosperm. Unaware of the nutrition implications, people were delighted by the baked products made from white flour. Bread eaters suffered a tragic loss of needed nutrients when they began to eat only white bread. A survey that took place in the United States in 1936 revealed that many people were suffering from deficiencies of the nutrients iron, thiamin, riboflavin, and niacin, which they had formerly gotten from whole wheat bread. The Enrichment Act of 1942 standardized the return of these lost nutrients to commercial flour. Thus, in enriched bread, iron, thiamin, and niacin have been restored to the levels found in whole wheat. To a great extent, the enrichment of white flour eliminated the deficiency problems that had been observed in the eaters of refined white bread. However, this restoration did not restore the fiber. Whole grain contains fiber.

THE IMPORTANCE OF WATER: It is necessary for an individual to drink 8 glasses of water daily and more if participating in sports or exercising. Water is the most critical nutrient for sustaining life. Two-thirds of the human body is water. As a comparison, our bodies are 60% water by weight; raw meat is about 75% water and fruits and vegetables up to 95% water. It may take us weeks to starve, but only a very few days to dehydrate. About 3/4 of our water is contained within individual cells. Of the rest, most is fluid surrounding the cells, with a small amount in the blood plasma. Outside the cells, water is a means of transporting nutrients and wastes, a physical cushion, a lubricant. When exhaled or perspired, water removes excess heat energy from the body. Within the cell, it is the solvent in which all chemical interactions occur. Water is not represented on MyPyramid because the U.S.D.A. assumes people in the United States will drink adequate amounts of water.

Water and minerals need proper balance. When the sodium ions in the blood are increased, water in the cells is drawn from the cells into the blood plasma. If an excess of sodium, usually from large amounts of table salt, is habitually ingested and remains in the body, so much water is drawn into the blood plasma that high blood pressure can develop and put a dangerous strain on the heart and vascular system.

Water is needed in the body for many reasons:

Water is used to move nutrients through the digestive tract.

Water is needed to remove and waste products.

Water acts as a diluter. Without sufficient water, fiber does no good. Fiber absorbs water thus allowing waste products to move freely through the digestive tract, and thus preventing toxic waste from accumulating.

Water is a heat regulator. It helps the body temperature to stay the same.

Water is a solvent necessary in the production of and maintaining body cells.

Water helps coat and lubricate body joints.

Instructional Procedures

LEARNING ACTIVITIES AND TEACHING STRATEGIES

OPTION #1

As an introduction, display examples and non-examples of food products that represent fiber. For example:

Examples of fiber foods	Examples of Non-fiber foods
bran muffin	blueberry muffin
walnuts	white bread
apple	spaghetti sauce
refried beans	Captain Crunch
All-Bran cereal	lunch meat

Have students guess the topic to be discussed. Ask them some pre-assessment questions such as:

What is fiber? a cellulose, non-nutrient necessary to aid digestion and is thought to help prevent some colon diseases

What nutrient works hand-in-hand with fiber? water

After showing them 5 or 6 fiber containing foods, ask students to rank them according to the amount of fiber. answer will depend on foods selected

OPTION #2

FIBER DEMONSTRATION

Materials needed:

1 cup dried beans

water

- [ROUGHAGE OR FIBER WORKSHEET](#)

- [A PARTIAL LIST OF FOOD SOURCES FOR FIBER CONTENT](#)

The day before the class demonstration put 1/2 cup dried beans in a glass jar. Place an elastic band around the jar indicating the bean line. Add 1 1/2 cups of water. Allow the beans to soak overnight.

Place the other 1/2 cup dried beans in a similar container without water.

The next day compare the two bean samples. The beans that have been soaked in the water will be bigger and softer because of absorbed water. Explain that fiber, often called roughage, acts as a sponge in the digestive tract, keeping food and digestive materials soft and able to move through the intestines and colon.

NOTE TO TEACHER: Re-emphasize the need for people to drink 8-10 glasses of water per day for fiber to work properly. The ROUGHAGE OR FIBER WORKSHEET can be used as a pre-assessment or an evaluation.

OPTION #3

Demonstrate the nature of fibrous material by displaying in glass jars: a 1/2 cup sample of bran, a 1/2 cup sample of white flour, and a 1/2 cup sample of whole wheat flour. Place a rubber band around jar indicating the original level of the bran and the two types of flour. For each sample, measure 1 cup water. Add water to each sample, 1/4 cup at a time, to demonstrate absorption ability. Continue to add water until maximum absorption is reached by each sample. As the jars sit on the counter students can see how the bran and whole wheat flour absorb and swell while the white flour remains

about the same. Discuss the following.

Describe the absorption of each one. bran should absorb 1 1/2 times its volume of water, whole wheat should absorb an equal amount, and white flour should not absorb 1/2 its volume of water. How would bread, made from each of these products, influence the body differently? since most baked products are made from flour, not bran, it is important to select whole grain products over white.

How does dietary fiber make you feel less hungry? the fiber swells with the absorption of water thus making a person feel full.

VARIATIONS:

Bring a dried out sponge to class. Have a student try to push it down a 1" tube. (It is difficult because the sponge is hard and dry). Add water to the sponge and have the student try it again. (Sponge will easily slip through). This is a good simulation of fiber in the digestive system. Have the students observe that, as the sponge absorbs the water, it softens. This is a good demonstration to do at the same time as the bran/flour demonstration outlined above. Students can then easily see the effects of water on fiber.

Do an overhead of the lower abdominal cavity. (Pictures can be obtained from any anatomy text book.) Students can see why, due to its shape and position in the body, that the colon is the part of the body most affected by lack of fiber, and why lack of fiber makes a person susceptible to colon cancer.

Display a large basket of foods high in fiber. Pull food from basket and place in front of each one of the number of grams of dietary fiber in each food. Since 20 grams of fiber is recommended daily, have students plan a day's menu, including snacks, that would have foods containing fiber totalling 20 grams.

OPTION #4

Using the transparency [KERNEL OF WHEAT](#) or a chalkboard drawing, discuss the "parts" of the kernel. Discuss the nutritional value of wheat.

VARIATION: Use popped popcorn to show the parts of a kernel of corn. Let students see and eat the parts as they explain them to each other. A hot-air popper will allow students watch the endosperm grow once the bran is broken.

OPTION #5

Demonstrate a quick bread recipe emphasizing the incorporation of dietary fiber into food by adding or substituting oat bran, wheat germ, or fibrous fruits and vegetables. Use [DATE AND BANANA BUTTERMILK MUFFINS](#) or a recipe of choice such as an oatmeal cookie recipe substituting whole wheat flour for white and adding nuts and/or raisins.

Have students explain the purpose of each ingredient and identify the Pyramid group involved.

Worksheet [INCORPORATION OF DIETARY FIBER INTO RECIPES](#).

OPTION #6

Have students prepare a [COBBLER](#) which adds extra fiber. Each unit prepares the same recipe but adds a different fiber additive - oat bran, all bran, wheat germ, whole wheat flour.

NOTE TO TEACHER: The cobbler recipe may need to be cut in half. Have students use their math skills to reduce the recipe.

Using [ANALYSIS OF DIETARY FIBER ADDITIVES TO A COBBLER](#) students will taste compare finished products and discuss their results.

OPTION #7

Evaluate the student's knowledge about fiber by having them take a [FIBER TEST](#).

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