Lesson 4: Processing Influences Nutritional Value

This lesson will examine four variables that can cause food to lose part of its nutrients during processing. The enhancement of food nutrients will likewise be examined.

Temperature Affects Nutrient Availability

Consumers who are nutrition conscious realize that purchasing nutritious food is only the first step in a healthy diet. The manner in which this food is stored and prepared determines the nutrients that will be available when the food is eaten. Temperature is one such variable. The organic nutrients: carbohydrates, fats, proteins, and vitamins, contain enzymes that are constantly being produced and then degraded. When, for example, a peach is harvested its natural enzymatic activity begins to degrade tissue. At room temperature, a significant vitamin loss could occur. Therefore, chilling is necessary to slow the enzymatic processes. Another control for fruit and vegetable enzyme activity is blanching. Blanching or boiling briefly stops enzymatic activity.

High temperatures can likewise be detrimental to proteins. Proteins tend to toughen when exposed to high temperatures. But they are usually more easily digested after heating. High temperatures and long cooking times tend to destroy vitamins.

Light Affects Nutrient Availability

Fluorescent light and the ultraviolet rays of the sun can destroy riboflavin in foods. It is for this reason that milk is no longer retailed in transparent glass containers, but rather it is sold in opaque plastic or cardboard. Vitamins, in general, are susceptible to light breakdown.

Water Content Affects Nutrient Availability

Foods that have a high water content need to be prepared in a different manner in order to preserve their nutrients. Vegetables that are cooked in water can lose nearly one-half of their water-soluble vitamins to the water. It is for this reason that steaming vegetables is often suggested. If food is to be prepared in water, think of ways to use the "pot juice," like in soup or to cook rice.

Oxidation Affects Nutrient Availability

Oxidation is the chemical reaction that takes place in the presence of oxygen. When it is controlled in the body cells, oxidation results in the breakdown of nutrients and the release of energy. However, when foods are overcooked, burned, or charred, nutrients are oxidized to carbon and oxygen gas and are not available for digestion. Protein molecules release nitrogen as N_2 or Nitrous oxide. Similarly, fruits that have been exposed to air and are dried out have lost some of their nutrients. For example, vitamin

C is lost from oranges. Transition BHA and BHT are commercial antioxidants. Vitamins C and E are natural antioxidants.

Table 4.1 - Nutrients in 2 oz Serving of Dry Spaghetti Pasta - % Daily Values*

Type of Spaghetti Pasta	Iron	Calcium	Thiamin	Riboflavin	Niacin	Vitamin B	Folacin	Fiber	Fat
Whole Wheat	10%	2%	20%	6%	15%	6%	8%	25%	1%
Enriched	15%	2%	40%	15%	25%	4%	2%	10%	1%
Unenriched	4%	2%	4%	2%	6%	4%	2%	6%	1%

*Based on 1994 USDA Percent Daily Values

Processes Used to Enhance Nutritional Value

The twentieth century has seen a nutritional revolution. Modern processes were invented to convert wheat into white bread rather than the standard whole wheat bread. This process, and similar ones, produce foods that are more pleasing to the taste buds; however, some nutrients may be reduced or even eliminated. The Enrichment Act of 1942 standardized the return of necessary nutrients to commercial flour. Enriched bread was supplemented with iron, niacin, thiamin, and riboflavin. Scores of food products today are enriched. Table 4.1 compares whole wheat spaghetti pasta, spaghetti pasta-enriched, and spaghetti pasta-unenriched.

Another means of nutrition enhancement is called fortification. This is very similar to enriched foods except that fortified foods have added nutrients that may or may not have originally been there. Examples of fortified foods include milk fortified with vitamins A & D, salt with iodine, and soft drinks with added vitamin C or calcium.

Nutritional supplements are slightly different from fortified foods. Supplements contain nutrients, usually vitamins and minerals, in amounts greater than 50 percent of the RDA. The most common form of supplements are vitamin pills, but many sport drinks are now on the market that could be considered to be supplements.

Sometimes foods have been fortified or supplemented with vitamins and minerals because the addition of these vitamins and minerals may be needed to help the body utilize vitamins and minerals naturally occurring in the foods. For example, vitamin D increases the absorption rate of calcium and phosphorous.

Many processing techniques are useful in maintaining nutrients. These range from quick cooling fresh fruits and vegetables to proper cooking temperatures and cooking length. Some types of produce are waxed or packaged to prevent dehydration.

Summary

Temperature is an important environmental variable that determines the nutrient availability of food. Organic molecules break down faster at high temperatures than at low temperatures. Fluorescent lights and ultraviolet rays break down riboflavin. High water content foods are likely to loose many of their nutrients when boiled or cooked in a liquid. Oxidation decreases levels of many vitamins. Careful control of storage and processing conditions is necessary to assure the maximum nutritional value of food products.

Enrichment and fortification may be used to enhance the nutritional status of food. Occasionally foods are formulated to contain relatively high levels of individual nutrients. These foods are called supplements.

Credits

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