



Perfect Timing Perfectly cooked vegetables should be colorful and flavorful.
What happens to vegetables that have been overcooked?

If you understand each type of cooking technique, you can combine them in ways that create great-tasting food. You will learn more about how to use combination cooking techniques in Section 15.3.

Reading Check **Distinguish** What are the key differences between the dry, moist, and combination cooking techniques?

Changes in Cooked Food

A food's nutritive value, texture, color, aroma, flavor, and appearance do not stay the same after cooking. The cooking technique you choose can affect all of these factors. It is important to know how food will change after it is cooked.

Nutritive Value

The length of time food is cooked and the cooking technique you use determine how much nutrition a food will retain. Raw foods

lose more nutritive value the longer they cook. In fact, certain cooking techniques can actually speed up nutrient loss. For example, boiling green beans extracts nutrients in two ways. Nutrients are destroyed simply because the green beans are exposed to heat. Nutrients also are lost during boiling because they are diluted in the liquid.

You might think that if you steam the green beans, you will maintain all of the nutrients. Although steaming is one of the best ways to minimize nutrient loss, exposure to heat will still extract some nutrients from the green beans. However, because the vegetables are cooked by the steam, and not in water, they will not lose nearly as many nutrients as if they had been boiled.

Texture

If you have ever overcooked vegetables, you have seen how cooking can change the texture of food. During cooking, moisture is lost, food tissue breaks down, and proteins coagulate. All of these factors change the texture of cooked food.

When heat is applied, the proteins in food **coagulate**. This means that they change from a liquid or semiliquid state to a drier, solid state. The longer that you **subject**, or expose, the proteins to heat the firmer and more solid they will become. For example, compare the difference in texture between a soft-cooked egg and a hard-cooked egg. If you simmer an egg for three to five minutes, you will produce a soft-cooked egg with a partly solid white and a semiliquid yolk. To produce a hard-cooked egg with both a solid white and yolk, the egg must be simmered for 8 to 10 minutes. The length of time cooked will affect the texture of the egg white and yolk.

Coagulation also occurs in meat proteins as heat is applied during cooking. Meat proteins lose some moisture as the protein becomes more solid during cooking. Long, slow cooking techniques and moderate heat will make some meats tender, flavorful, and juicy. However, using too much heat can toughen the protein in those same meats. This happens because too much moisture is lost.

Color

The cooking process also affects the color of food. For example, certain ingredients that are commonly used to cook vegetables, such as lemon juice, vinegar and baking soda, can change the color of vegetables. There are cooking techniques, such as blanching, that can help keep the color of vegetables. (You will learn about blanching in Section 15.3)

Fruits and vegetables get their unique colors from naturally occurring pigments. A **pigment** is the matter in cells and tissue that gives them their color. Common pigments in foods include chlorophyll (green vegetables), flavonoids (red, purple, and blue vegetables), and carotenoids (yellow, orange, and red vegetables). Many foods have more than one type of pigment. Remember that the longer that fruits and vegetables are cooked, the more their color will change.

Likewise, as meat cooks for extended periods of time, moisture is extracted. The meat will lose its deep-red color as it cooks. These color changes happen at different temperatures.



Texture Changes When high-protein foods are cooked, their texture changes. *How can you tell which egg has been cooked longer?*

Color Fade

Do you know what gives green vegetables their color? Green vegetables, such as broccoli and spinach, contain two types of the pigment chlorophyll. One type of chlorophyll is a bright bluish-green color. The other type is a yellowish-green color. Green vegetables have about four times more of the blue-green type than the yellow-green type.

To maintain the color of a green vegetable, do not overcook it. Heat from cooking damages the vegetable's cells. This allows the acids that were in the once-living cells of the vegetable to be released. Once exposed to this acid, the chlorophyll changes to a brownish-yellow color.

Procedure

To complete the following experiment, you will need four broccoli stalks, a pot with a lid, and a second pot without a lid. Bring 3 cups of water to a boil in each uncovered pot. Separate the florets, or flowers, of the broccoli. Place half of the broccoli in one pot and cover it with the lid. Place the rest of the broccoli in the other pot without a lid. Cook both pots of broccoli for 7 minutes. After 7 minutes, drain each pot and place the broccoli into two separate bowls.

Analysis

Determine which style of cooking provided a greener vegetable. Examine each bowl. Describe the color and the texture of the broccoli in each bowl. Which dish has the greener broccoli? Explain in a short summary why you think one method of cooking had a greater impact on the color change than the other.

NSES B Develop an understanding of chemical reactions.

As the internal temperature of meat reaches between 140°F and 160°F (60°C and 71°C), the redness decreases significantly. The same thing happens when the meat reaches an internal temperature between 168°F and 176°F (76°C and 80°C). That is why the inside of a rare steak is red, a medium rare steak is pink, and a well done steak is brownish gray. Remember, however, that using a thermometer to measure internal temperature is the only safe way to determine if meat is done.

Aroma

The aroma created from cooking food can be as appealing as the flavor and presentation of the final dish. Cooking techniques that use fat as an ingredient or as a way to transfer heat create an appealing aroma. **Caramelization** (¹ker-ə-məl-ə-zā-shən), or the process of cooking sugar to high temperatures, is what creates these pleasing aromas. As the sugar in the food turns brown, a rich aroma is produced. Caramelization can also affect the color and flavor of food.

Flavor

The cooking process also affects the flavor of food. If you have ever eaten overcooked meat or vegetables, you know that overcooking can ruin the flavor. However, if you use the correct cooking technique, you can actually **enhance**, or increase the quality of, the flavor of food. For example, if you grill meats over charcoal or woods such as hickory and mesquite, it will give them an appealing, smoky flavor. Foods that are cooked with dry-heat methods taste rich because of the caramelization that occurs. Moist cooking techniques help bring out a food's natural flavor.

The flavor of foods can also be changed during cooking by using seasonings and flavorings at different times during the cooking process. Cooking methods that use liquids rather than fats to cook can bring out

flavors in a food. Slow roasting foods will bring out rich flavors. Deep-frying foods creates a unique flavor that is enhanced by the crispness of the food.

It is important to enhance the flavor of food because it increases the appeal of the food to the customer. Appealing food is one of the main factors that will bring back customers to a restaurant. If you do not choose the right cooking method for a food, all other methods to enhance flavor will be wasted.