Does an apple a day really keep the doctor away? A nutritionist explains the science behind 'functional' foods

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We've all heard that an apple a day keeps the doctor away, but how true is that?

Apples are not high in vitamin A, nor are they beneficial for vision like carrots. They are not a great source of vitamin C and therefore don't fight off colds as oranges do.

However, apples contain various bioactive substances—natural chemicals that occur in small amounts in foods and that have biological effects in the body. These chemicals are not classified as nutrients like vitamins. Because apples contain many health-promoting bioactive substances, the fruit is considered a "functional" food.

For years, I have taught university classes on nutrients such as vitamins, minerals, carbs, proteins and fats. But recently I developed a course specifically on functional foods. The class explores the various bioactive substances in food and how some may even function like a medicine.

Functional foods defined

Functional foods are not the same as superfoods. "Superfood" is a buzzword marketers use to promote foods like kale, spinach and blueberries. Labeling them as "super" appeals to the public and increases sales. But superfood is generally meant to imply a food that has superior nutritional value and that is high in nutrients that are beneficial for health. For example, salmon and tuna are considered superfoods because the omega-3 fats they contain have been linked to heart health.

Superfood advertisements claim that eating the food will improve some aspect of health. The problem is that most of those claims are not based on scientific research, like the criteria for functional foods are.

In addition to the nutrients that our bodies need for growth and development, functional foods contain a variety of bioactive substances, each with a unique function in the body. The bioactive substances can be found naturally in foods or added during processing.

The list of bioactive components in foods grows daily as research expands. Though the components themselves are not new, the evidence-based research confirming their health benefits is.

The carotenoids are the most easily recognizable examples of bioactive substances. They are a group of 850 different pigments that give yellow, orange and red fruits and vegetables their color. Carotenoids primarily function as antioxidants, which means they promote health by helping to prevent damage to the body's cells. Various individual carotenoids may function in different ways.

Beta-carotene is the most well-known carotenoid because of the high amounts found in carrots. Beta-carotene converts to vitamin A in the body after we consume it. Vitamin A is needed for normal vision.

Lutein and zeaxanthin are the yellow carotenoids found in corn and peppers. The two help support vision, especially among older adults.

Research suggests that the carotenoids from foods and the other categories of bioactive substances may help prevent certain cancers and improve heart health. It's important to note that carotenoid-rich fruits and vegetables are associated with reduced risks of cardiovascular disease and some cancers but that carotenoids in supplements offer fewer benefits.

History of the functional food movement

Though the adage about apples and health originated in the 1800s, nutrition is a relatively young science—and the idea of functional foods and bioactive components is even younger.

From the early 1900s to the 1970s, nutrition research focused on vitamin deficiencies. The public was encouraged to eat more vitamin-fortified, processed foods to prevent nutrient deficiency diseases like scurvy, which is caused by a severe vitamin C deficit, or rickets, caused by prolonged vitamin D deficiency.

This emphasis on eating in order to correct nutrient deficiencies had the tendency to cause people to focus on certain nutrients, which can contribute to overeating. This, combined with an increased availability of highly processed foods, resulted in weight gain, which led to increased rates of diabetes, high blood pressure and heart disease.

In 1980, the U.S. government published the first dietary guidelines that encouraged people to avoid fat, sugar and salt. Public health messaging encouraged people to replace fatty foods with starchy foods such as breads and pasta.

The logic of this recommendation was that if people consume less fat, they should increase their calories from carbohydrates to ensure adequate calories. That nutritional advice contributed to the skyrocketing obesity and diabetes rates that continue today.

Japan's focus on foods for health

Historically, the Japanese were one of the healthiest populations on Earth. However, as the 21st century approached, many Japanese people had adopted the American diet and developed health problems similar to

those in the U.S.

As a result, the Japanese government became concerned about its citizens' expanding waistlines and declining health. To correct this problem, Japan became the first country to introduce the concept of functional foods in the 1980s.

Today, Japan uses the phrase "Food for Specialized Health Uses" for products that can be scientifically shown to promote health.

It has paid off. Japan has more than 1,000 foods and beverages approved as food for specialized health uses, such as hypoallergenic rice. Rice allergies, though uncommon, are a major problem for Japanese people who have them because rice is a staple food.

About half of Japan's health claims relate to improving digestion using bioactive prebiotic dietary fibers.

The bioactive components in apples

An apple's natural dietary fibers are one of the bioactive components that lead to its being classified as a functional food. The fiber pectin is found mainly in an apple's pulp.

Pectin functions to reduce the amount of sugar and fat that is absorbed into the body. This helps reduce the risk of diabetes and heart disease.

Apple peels are also packed with fiber that acts as a laxative.

In addition, apples contain high amounts of natural chemicals known as polyphenols that have vital roles in promoting health and reducing chronic disease. More than 8,000 polyphenols have been identified in various plant foods. Because they are mainly in the peel, whole apples

are better sources of polyphenols than juice or applesauce.

Anthocyanins are a subclass of the polyphenols that give the apple peel much of its red color. Diets high in anthocyanins help improve heart health and are being studied for use in treating Alzheimer's disease.

Another of the primary polyphenols in apples is phloridzin. Researchers have studied the role of phloridzin in helping to control blood glucose for more than 100 years. Recent studies confirm that it plays an important role in regulating blood glucose levels by decreasing the amount of glucose absorbed from the small intestine and increasing excretion from the kidneys.

Revisiting the original question

So if apples are functional foods that promote health, do they really help keep the doctor away?

Researchers have tried to figure this out. One U.S. team analyzed the apple-eating patterns and number of doctor visits among more than 8,000 adults. Of those, about 9% ate one apple daily. Once adjusted for demographic and health-related factors, the researchers found that the daily apple eaters used marginally fewer prescription medications than the non-apple eaters. But the number of doctor's visits was about the same between the two groups.

If one apple a day is not enough to make us healthy, what about eating two or three?

A group of European researchers found that eating two apples a day improved heart health in 40 adults. And Brazilian investigators found that eating three apples daily improved weight loss and blood glucose levels in 40 overweight women.

While eating an apple a day won't necessarily cut down substantially on prescription medications or doctors visits, it could be one step in the direction of making the transition to eating more healthful, fiber-filled, whole foods.

Apples require no cooking or refrigeration at least for a week or so, and one red delicious apple costs about 50 U.S. cents.

So next time you are in the grocery store, grab some apples and—if you feel like it—try eating at least one a day.

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