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What Are Polyphenols and Why Do We Need Them?

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STORY AT-A-GLANCE

- Polyphenols are powerful organic compounds found in plants, which help protect plants from ultraviolet light, pathogens, oxidative damage and harsh climates
- Consuming foods rich in the more than 8,000 known polyphenols may help ward off chronic diseases, including cardiovascular and neurodegenerative diseases, cancer, Type 2 diabetes and obesity
- There are four major types of polyphenols — flavonoids, phenolic acids, stilbenes and lignans
- Polyphenols positively influence gut microbiota, and it's likely that gut-modulatory effects may partially explain the benefits of many polyphenol-rich foods
- If you eat a diet based on whole foods, you'll naturally consume plenty, as polyphenols are abundant in fruits, vegetables, tea, cocoa and more

Polyphenols are powerful organic compounds found in plants, which offer protection from ultraviolet light, pathogens,[1] oxidative damage and harsh climates. With more than 8,000 identified to date, consuming foods rich in polyphenols may help ward off both acute and chronic diseases, including cardiovascular and neurodegenerative diseases, cancer,[2] Type 2 diabetes and obesity.[3]

While polyphenols are best known for their anti-inflammatory and antioxidant effects, they affect multiple physiological processes related to enzyme activity, cell proliferation, signaling pathways and more.[4]

As such, these compounds may be integral to achieving optimal health. Fortunately, if you eat a diet based on whole foods, you'll naturally consume plenty, as polyphenols are abundant in fruits, vegetables, tea, cocoa and more.

Four Major Types of Polyphenols

All polyphenols have phenolic structural features, but there are a variety of sub-groups within this group of phytochemicals, each with its own distinct features.

1. **Flavonoids —** Among the 8,000-plus known polyphenols, more than 4,000 are flavonoids.[5] These compounds are responsible for the vibrant color in many flowers and fruits, and contribute to the bitterness, astringency, flavor, aroma and oxidative stability of many fruits, berries and vegetables. They can be broken down into six subclasses:[6]

Flavonols	Flavones	Flavanones
Flavanols	Anthocyanins	Isoflavones

Several well-known flavonoids include:

- **Quercetin**, a natural antiviral agent[7] found in foods such as onions, apples, plums and green tea, which also combats inflammation and works as a natural antihistamine.

  Quercetin shows promise for helping to protect vision as well, with researchers describing their potential effects on degenerative retinal diseases, and noting, "Some polyphenols, especially flavonoids (e.g., quercetin and tannic acid), could attenuate light-induced receptor damage and promote visual health benefits."[8]

- **Myricetin**, found in cranberry, Swiss chard, rutabagas, garlic, blueberries and other foods,[9] is being studied for a range of potential therapeutic actions, including anticancer, antidiabetic, antiobesity, anti-inflammatory and

hepatoprotective effects, along with protection against cardiovascular disease and osteoporosis.[10]

- **Catechins**, which are abundant in **green tea**, include epicatechin, epigallocatechin, epicatechin gallate and epigallocatechin gallate (EGCG). These compounds have anticancer effects that may help prevent lung, breast, esophageal, stomach, liver and prostate cancers,[11] along with anti-inflammatory and antioxidant properties.

  Researchers at the University of Leeds and Lancaster University found he EGCG in green tea can help prevent heart disease by dissolving arterial plaque.[12] Other research suggests this compound also has the ability to inhibit amyloid beta plaque formation in the brain, which is associated with Alzheimer's disease.[13]

2. **Phenolic acids —** Phenolic acids make up about one-third of the polyphenols in an average diet. Common examples include caffeic acid, gallic acid and ferulic acid. While you can find phenolic acids in all plants, researchers explained in Oxidative Medicine and Cellular Longevity that these compounds "are particularly abundant in acidic-tasting fruits."[14]

   Edible plant sprouts, such as alfalfa, sunflower and broccoli, also contain phenolic acids,[15] as does hibiscus. In hibiscus extract, caffeic acid may be responsible for some of its antiobesity effects, as it's known to decrease body weight, regulate lipid metabolism and promote the breakdown of fats in the liver.[16]

3. **Stilbenes —** In plants, most stilbenes are synthesized in response to infection or injury. There are more than 400 known stilbenes,[17] but the longevity compound resveratrol is one of the most popular.[18] Resveratrol is found in abundance in muscadine grapes,[19] with most of the antioxidants concentrated in the **grape skins** and seeds.[20]

   Other food sources include berries, such as raspberries, blueberries, cranberries and mulberries, pomegranate, apples, Indian jackfruit and raw cacao. Another

potent, yet lesser-known, source of resveratrol is itadori tea, made from Japanese knotweed.[21]

Stilbenes also have "extraordinary potential for the prevention and treatment of different diseases, including cancer, due to their antioxidant, cell death activation, and anti-inflammatory properties," noted researchers with the University of Valencia in Spain.[22]

4. **Lignans —** Lignans, found in seeds such as flax and sesame and fruits like **jackfruit**, are metabolized by bacteria in your gut, converting into compounds such as enterodiol and enterolactone, which have weak estrogenic activity. They may help prevent cardiovascular disease and Type 2 diabetes and may help reduce the risk of hormone-associated cancers such as breast, uterine, ovarian and prostate.[23]

Health Benefits of Polyphenols

Polyphenols act as functional foods with antioxidant properties, helping to eliminate reactive oxygen species that contribute to disease. They also offer anti-inflammatory, antihypertensive and anti-diabetic actions, making them ideal for warding off some of the most common diseases worldwide. Writing in the Journal of Food Biochemistry, researchers with the University of Manitoba in Canada and colleagues explained:[24]

> *"The non-communicable diseases (NCDs) burden has been increasing worldwide due to the sedentary lifestyle and several other factors such as smoking, junk food, etc. Scientific literature evidence supports the use of plant-based food polyphenols as therapeutic agents that could help to alleviate NCD's burden. Thus, consuming polyphenolic compounds from natural sources could be an effective solution to mitigate NCDs concerns."*

In fact, consuming polyphenol-rich foods may have a number of health benefits, including:[25,26,27]

Reducing blood pressure	Improving lipid metabolism

Lowering blood glucose	Reducing body weight
Preventing and improving metabolic syndrome	Protecting heart health
Skin protective effects	Antibacterial properties
Reducing cancer risk. Researchers believe the antioxidant effects of polyphenols help protect DNA from free radical damage,[28] which can trigger cancer development. Polyphenols also reverse epigenetic markers in the DNA believed to reduce tumor growth	Boost your immune function
Protection against osteoporosis, due to a positive effect on bone metabolism[29]	Reduced risk of neurodegenerative diseases

Polyphenols Are Good for Your Gut

In the video above, you can hear professor Yves Desjardins, with the Institute of Nutrition and Functional Food at the Université Laval, Québec, explain the impressive effects of polyphenols on the gut microbiota, and the resulting beneficial influence on metabolic diseases.[30]

"We surmise that (poly)phenols' broad antimicrobial action free ecological niches occupied by competing bacteria, thereby allowing the bloom of beneficial gut bacteria … The beneficial direct impact of (poly)phenols on the gut microbiota relies on two principal modes of action: a direct bacterial stimulatory effect and a direct antimicrobial effect," Desjardins and colleagues wrote in Frontiers in Nutrition.[31]

They've proposed the term duplibiotics to describe polyphenols' two modes of action in the gut that benefit humans. Polyphenols also appear to have a prebiotic effect, improving the beneficial bacteria living in your gut. Much of the research has been done on green tea, which plays an important role in balancing your gut flora by increasing good bacteria and reducing the number of potentially harmful bacteria.[32]

However, it's likely that gut-modulatory effects may partially explain the benefits of many polyphenol-rich foods. For instance, researchers wrote in The Journal of Nutritional Biochemistry, "The weight-lowering property of fruits, green tea and vinegar wine in obese people may be partly related to their polyphenol content, which changes the gut microbiota."[33] They added:[34]

> *"It is clear that dietary polyphenols and their metabolites contribute to the maintenance of gut health by the modulation of the gut microbial balance through the stimulation of the growth of beneficial bacteria and the inhibition of pathogen bacteria, exerting prebiotic-like effects."*

What Are the Best Food Sources of Polyphenols?

If you'd like to add more polyphenol-rich superfoods to your diet, the European Journal of Clinical Nutrition published a list of the 100 richest dietary sources of polyphenols based on milligrams (mg) per 100 grams.

"The richest sources were various spices and dried herbs, cocoa products, some darkly colored berries, some seeds (flaxseed) and nuts (chestnut, hazelnut) and some vegetables, including olive and globe artichoke heads," the team found.[35] Additional foods topping that list include:[36]

Cloves	Peppermint	Star anise
Cocoa powder	Mexican oregano	Celery seed
Dark chocolate	Flaxseed meal	Black elderberry

Chestnut seeds	Dried sage	Rosemary
Spearmint	Thyme	Blueberries
Blackcurrant	Capers	Black olives
Hazel nuts	Pecans	

You can further optimize the health benefits of these foods by eating them with a little bit of healthy fat, as polyphenols are fat soluble.[37] How the plant is grown can also influence its healing potential. As noted in The American Journal of Clinical Nutrition, agricultural practices and industrial processes can reduce the health effects of polyphenols in food.

"It is important to realize that the polyphenols that are the most common in the human diet are not necessarily the most active within the body, either because they have a lower intrinsic activity or because they are poorly absorbed from the intestine, highly metabolized, or rapidly eliminated," the researchers explained.[38]

However, organically grown foods contain statistically higher levels of polyphenols compared to conventionally grown varieties. Also, freeze-drying preserves higher phenol content than air-drying does.[39] So, to optimize the polyphenols in your diet, focus on eating a wide variety of fresh, homegrown, organic or biodynamically grown fruits, vegetables, herbs and spices, along with cocoa and tea.

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