

Nutrition and Health Info Sheet: Phytochemicals

For Health Professionals

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What are phytochemicals?

Phytochemicals are bioactive compounds found in vegetables, fruits, cereal grains, and plant-based beverages such as tea and wine. Phytochemical consumption is associated with a decrease in risk of several types of chronic diseases due to in part to their antioxidant and free radical scavenging effects.¹ Recent research has also highlighted their potential role in improved endothelial function and increased vascular blood flow.²

What are the various types of phytochemicals?

About 10,000 different phytochemicals have been identified, and many still remain unknown.¹ Based on their chemical structure, phytochemicals can be broken into the following groups³, as shown below in Figure 1.

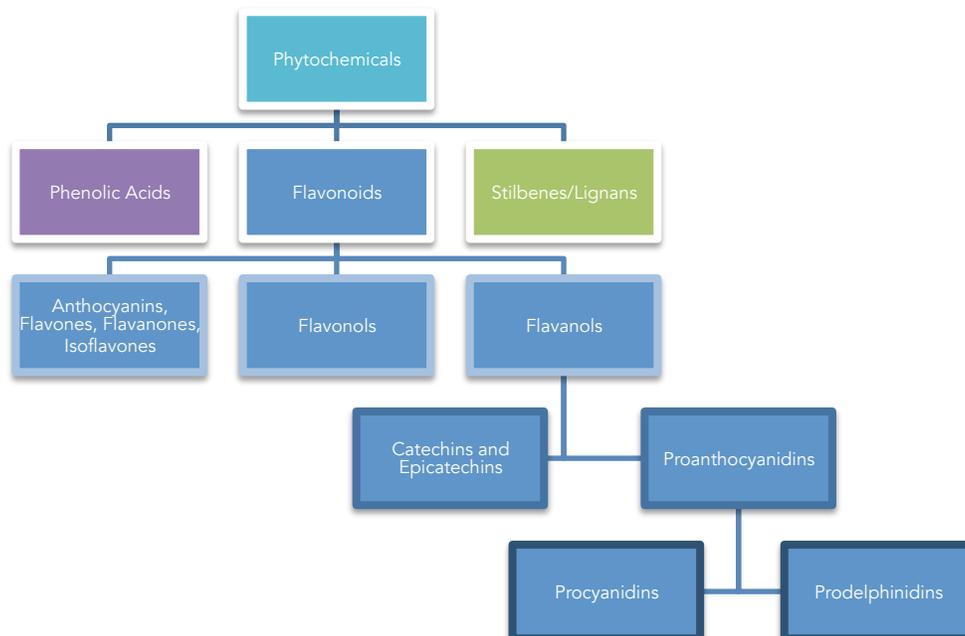


Figure 1: Types of Phytochemicals

What are flavonoids and why are they of particular interest?

Flavonoids make up the largest class of phytochemicals.² In general, flavonoids can play an important role in decreasing disease risk through various physiologic mechanisms. Some of these include antiviral, anti-inflammatory, cytotoxic, antimicrobial, and antioxidant effects.⁴ Mechanisms responsible for improvements in heart disease risk include improved endothelial function, decreased blood pressure, and improvements in lipid and insulin resistance.⁵ Flavonoids can be divided into the following subclasses flavonols, flavanones, flavones, flavan-3-ols, and flavanonols.⁶ Certain clinical studies have documented relationships between flavonoid consumption and decreased cancer risk. For example, research has shown a relationship between the reduction of colorectal cancer risk, which is the third most common type of cancer in the world, and the consumption of dietary flavonoids.⁶ Additionally, the Flaviola Health Study reported that cocoa flavanol intake can improve endothelial function in those with cardiovascular risk factors and disease. Through this study, intake of cocoa flavanol significantly predicted a lowering of 10-year risk for CHD, heart attack, CVD, and death from CVD or CHD in high risk subjects, as well as the potential to maintain health in low-risk subjects.⁵

What are some examples of flavonoids and their food sources?

Class	Example	Common Food Source
Flavonol	Quercetin	Citrus fruits, apples, onions
Flavanol	Catechin	Chocolate, tea, coffee
Isoflavone	Genistein	Lupin, fava beans, soybeans
Flavonone	Hesperetin	Citrus fruits: oranges, lemons, grapefruit
Anthocyanidin	Cyanidin	Berries

What is the evidence that phytochemicals protect against disease?

Critical reviews of studies available in the literature support the concept that diets high in fruits and vegetables reduce the risk of hypertension, CHD, stroke, and other diseases evidenced by dose-response relationships.⁷ Several research groups have confirmed the critical role that can be played by phytochemicals in reducing the risk for several diseases such as cancer and inflammatory conditions.⁸ For example, recent research has cited various effects of phytochemical consumption on cancer prevention⁹, reduction in stroke risk¹⁰, and Type 2 Diabetes prevention.¹¹ Proposed mechanisms of action for these findings include inhibition of lipid oxidation, lipid-lowering effects, hypoglycemic- and insulin-lowering effects, antioxidant activity, anti-inflammatory activity, and anti-proliferative or apoptotic cell death activity.¹¹

Why is it important to eat a variety of plant-based foods?

Plant-based foods like fruits, vegetables, and grains, contain several bioactive phytochemicals which may decrease the risk of chronic diseases. The health effects attributed to the consumption of phytochemicals are primarily due to the synergistic actions of bioactive dietary components which include micronutrients and phytochemicals. It is largely accepted that the additive effects of the combinations of various phytochemicals in whole plant-based foods are shown to have stronger protective actions than single, isolated phytochemical compounds.¹¹

What are the potential health benefits from select phytochemical compounds?

Food	Phytochemical	Possible Benefit
Soybeans and soy based products	Isoflavones (Genistein and Daidzein)	Decreased arterial stiffness. ¹²
Berries, red wine	Anthocyanins	Increase in Natural Killer (NK) cells, decrease in aortic systolic blood pressures, reduction in diastolic blood pressures and arterial stiffness. ¹³
Grapes, apples, cocoa, red wine	Proanthocyanidins and flavan-3-ols	Increased endothelial function, decreased LDL oxidation, and reduction in blood pressure. ¹⁴
Onion, garlic, leeks, olives, scallions	Sulfides and thiols	Decrease total LDL cholesterol. ¹⁵
Tomatoes and tomato products, carrots, sweet potatoes, and various fruits and vegetables	Carotenoids such as lycopene, and beta-carotenes	Inhibits vasopressor activity through suppression of Reactive Oxygen Species (ROS) to reduce CVD risk. ¹⁶
Cruciferous vegetables such as broccoli, cabbage, and kale	Isothiocyanates (sulforaphane)	Protection against some cancers, protection against neurodegeneration and CVD risk. ¹⁷
Apples, onions, citrus fruits	Quercetin	Reduction in blood pressure, decrease in LDL oxidation, and decrease in inflammation. ¹⁸

What is the recommended intake of phytochemicals?

Quantitative recommendations for the antioxidants Vitamin C, Vitamin E, and selenium are supported by the Panel on Dietary Antioxidants and Related Compounds, Subcommittees on Upper Reference Levels of Nutrients and Interpretation of Uses of DRIs, and the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes within the Institute of Medicine. Beta-carotene and other carotenoids are discussed, but quantitative recommendations for their intake are not given at this time. Requirements for beta-carotene or other carotenoid intake cannot be established due to lack of understanding of the exact mechanisms of these nutrients and their importance to health. However, recommendations for increased consumption of carotenoid-rich fruits and vegetables are supported.¹⁹

Should people take phytochemical supplements?

Because it is hypothesized that the beneficial health effects observed from phytochemicals are related to the synergistic mixture of phytochemicals and other nutrients found in whole foods and its components, consumption of variety of plant-based foods is encouraged. In clinical studies, when phytochemicals are isolated from the food source and taken alone as a supplement, individual compounds studied do not have consistent preventive health effects. Furthermore, the efficacy and long-term safety of many bioactive compounds as dietary supplements, especially at pharmacologic doses, requires further study.¹¹

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