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Commentary

Role of Catechins in Cardiovascular Disorders and Cancer

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DESCRIPTION

Catechins are flavan-3-ols, often known as flavanols, which are natural polyphenolic chemicals and members of the flavonoid family. Many different fruits, vegetables and plant based beverages contain them in high proportions. Catechin gets its name from the Cutch tree (*Acacia catechu L.f.*). Fresh tea leaves, rock-rose leaves, broad beans, red wine, black grapes, strawberries and apricots all contain significant amounts of catechin. Epicatechin is abundant in apples, blackberries, broad beans, cherries, black grapes, pears, raspberries and chocolate. Green tea is the principal dietary source of catechins.

The European Pharmacopoeia recently included a green tea monograph. Green tea is standardized for caffeine level. Red wine contains the catechins catechin, epicatechin and gallate epicatechin, which interact with tannins to produce the wine's flavor. Products made from cocoa, like chocolate are likewise rich in catechin and epicatechin.

Catechins have an antioxidant effect by directly scavenging ROS (chelating metal ions) and indirectly stimulating antioxidant enzymes, inhibiting pro-oxidant enzymes and generating antioxidant enzymes and phase II detoxifying enzymes. Catechin and its diastereoisomers have phenolic hydroxyl groups in their chemical compositions, which have the ability to stabilize free radicals. This characteristic is what gives catechins their direct antioxidant properties, which also allow them to scavenge free radicals. Catechins phenolic hydroxyl groups can engage in a termination reaction with reactive oxygen and reactive nitrogen species to stop the production of new radicals. Catechins reduce free radicals by donating one electron to the phenolic OH group and the aromatic group is kept stable by the resonance of the resulting aroxyl radicals.

Catechins help in cardiovascular disorders

Cardiovascular disorders such as hypertension, endothelial dysfunction, atherosclerosis, ischemic heart diseases, cardiomyopathy, cardiac hypertrophy and congestive heart failure are all thought to be accelerated by oxidative stress. When there is an ischemic stroke or myocardial infarction, myocardial damage caused by ischemia/reperfusion injury produced by ROS is a critical factor. Multifactorial factors, including irregularities in lipid metabolism and disruptions in vascular cells, contribute to the development of cardiovascular disorders.

Green tea catechins reduced blood pressure as well as the risk of coronary heart disease and stroke. Catechins reduced vascular inflammation, smooth muscle cell proliferation, blood platelet aggregation, lipoprotein oxidation, changed lipid profiles and vascular reactivity, all of which are symptoms of vascular dysfunction. The balance between vasoconstricting molecules like endothelin-1, prostaglandins, and angiotensin II and vasodilating substances like nitric oxide, prostacyclin and different endothelium-derived hyperpolarizing factors is greatly influenced by catechins. In vascular smooth muscle cells, catechins reduced lipid peroxidation and prevented oxidative damage.

The bioactive substances in green tea could prevent the onset of coronary heart disease by lowering blood sugar levels and body weight. Insulin-like and insulin-enhancing actions were both present in green tea flavonoids. The Sodium Dependent Glucose Transporter (SGLT1 inhibition) of intestinal glucose uptake by epigallocatechin galate suggests that it is becoming more effective in regulating blood sugar.

Catechins help in cancer

The growth of cancer cells was slowed down by the catechins found in tea leaves. Additionally, catechins may have anti-carcinogenic properties in a variety of experimental models and organ types, including the lung, liver, pancreas, oesophagus, stomach, small intestine, colon, bladder, skin, the oral cavity, prostate and mammary gland. By preventing the activation of proangiogenic factors, catechins have been shown to reduce tumour angiogenesis, tumour development, cancer cell invasion and carcinogenesis. Green tea catechins decreased tumour blood vessel development in oestrogen receptor-negative breast cancer xenograft models and prevented metastasis of metastasis-specific mouse mammary carcinoma 4T1 cells.

The anti-cancer properties of green tea polyphenols are probably due to their antioxidant properties and direct protein binding, which affect a variety of cellular signaling pathways. An important

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stage in the therapy or prevention of cancer is the regulation of the apoptotic process. It is well known that apoptosis serves as a protective mechanism and contributes significantly to the death of precancerous and malignant cells. *In vitro* and in animal models, catechins, particularly epigallocatechin galate caused apoptosis and cell-cycle arrest, inhibited NF-B and decreased cyclooxygenase-2 (*COX*) overexpression. By modulating the expression of anti-apoptotic genes, catechins also controlled apoptosis. The amount of catechins used in the concentration had an impact on how they induced apoptosis. Antiapoptotic *bcl-xL* and *bcl-2* were immediately expressed at low concentrations (1 μM), while *Bax* expression was decreased. At high catechin concentrations (50 μM), a proapoptotic pattern of gene expression was seen, up regulating caspases-3 and 10, Fas and the Fas ligand, the NF-B p105 subunit and p53.