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Flavonoids as Wonder Drugs for Fighting Oxidative Stress

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Editorial

Flavonoids are the most common group of polyphenolic compounds in the human diet which are found ubiquitously in plants with more than 6,000 types. Along with carotenoids, they are responsible for the vivid colors in fruits and vegetables. Due to their enormous health benefits, scientists are testing their efficacy in specific health ailments. Oxidative stress (OxiS) is a state in biological systems in which oxidation exceeds the antioxidant systems of the body leading to a loss of the balance between them [1]. OxiS also leads to events such as lipid peroxidation and oxidative DNA damage. Development of OxiS status as a result of free oxygen radical generation has been implicated in the pathogenesis of many diseases including Parkinson's disease, Alzheimer's disease, atherosclerosis, heart failure, myocardial infarction and even cancer [1,2]. Many daily habits are closely associated with OxiS which includes smoking, drinking and an irregular diet. One of the reactive oxygen species (ROS), the superoxide radical ($\cdot\text{O}_2^-$), is known to be generated in brain and is involved in the reduction of certain iron complexes including cytochrome C. In the same way, nitric oxide ($\text{NO}\cdot$) and peroxy ($\text{RO}_2\cdot$) radicals are highly unstable moieties. These are formed in the human body, disrupt proteins and promote DNA damage [2,3]. ROS are also engaged in disruption of the integrity of polyunsaturated fatty acids. Hypochlorous acid (HOCl), peroxynitrite (ONOO^-), hydrogen peroxide (H_2O_2) and ozone (O_3) are the non-radical forms of ROS that can easily enter free radical reactions.

OxiS leads to many pathophysiological conditions in the body including neurodegenerative diseases, gene mutations, atherosclerosis and cancers [4,5]. Thus, various antioxidant defense mechanisms have developed in the process of evolution to cope up with the increasing OxiS levels. Different compounds have been identified which play a vital role in minimizing the levels of OxiS. Flavonoid is the group of chemicals which possess different reported broad spectrum therapeutic and pharmacological properties including free radical scavenging and antioxidant capacity. The common groups of flavonoids are Flavones, Flavonones, Anthocyanidins, Isoflavones and Flavanols. Naringin (Nr) is a flavonoid which is widely distributed in plant foods. Its metabolite Naringenin is ubiquitously distributed in plant foods and traditional Chinese medicines. Nr has similar structure to hesperidin and is mainly extracted from grapefruit and some other related citrus species. Both Nr and its metabolite naringenin have been reported to show broad spectrum of therapeutic and pharmacological properties including anti-inflammatory, free radical-scavenging, lipid-lowering and antioxidant, anti-fibrosis and anti-obesity effects. Figure 1 shows the disorders in which the use of flavonoids can be beneficial.

Nr exhibited anti-inflammatory and antioxidative effects as revealed by the down-regulated pro-inflammatory cytokines, tumor necrosis factor alpha (TNF-alpha), interleukin-1beta (IL-1beta) and interleukin-6 (IL-6) [6]. Nr was also shown to reduce hyperglycemia-induced cardiac fibrosis by relieving OxiS. Nr was reported to relieve the kidney injury, improve renal function, inhibit collagen formation and renal interstitial fibrosis [7]. A study also reported the effect of Nr on regulation of diabetes associated cognitive decline and its underlying mechanisms [8]. Role of OxiS has been well documented in aging and related disorders such as Alzheimer's disease [9]. Bioflavonoids have been used in many researches as neuroprotectants in the treatment of neurological disorders. Nr has been reported to modulate OxiS and inflammation in 3-nitropropionic acid-induced neurodegeneration [10]. Flavonoid consumption has also been reported to significantly associate with longevity. Flavonoids should be a part of diet through plant-based foods, but one should be aware of the fact that cooking and long-term storage can change the overall flavonoid content of the food. Onions stored at room temperature for three weeks can lose one-third of their flavonoid content. The process of cooking also adds in losing up of the flavonoid content in different foods. A general perception is to look for vibrant colours of the fruit or vegetable. If your food is losing vivid colours, its losing flavonoids.

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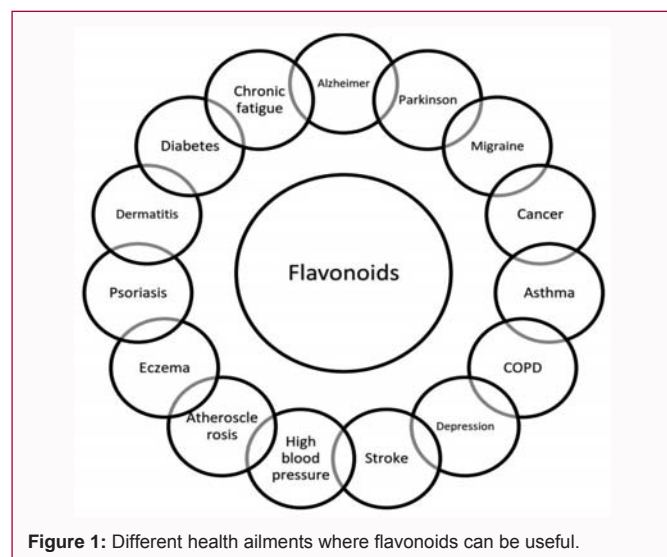
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Conclusion

Oxidative stress is a biological state which is associated with pathogenesis of many diseases. Free radicals can damage the integrity of biological molecules including DNA, proteins and lipids resulting in various health implications. A number of phytochemicals have been checked for their protective role against oxidative stress. Flavonoids are the natural potential antioxidants and their supplements can be used in various health disorders including diabetes, neurodegeneration, brain injury, cognitive dysfunction, cardiac hypertrophy and diabetic kidney.

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