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Antioxidative-Micronutrients and Chronic Non-Communicable Diseases

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Editorial

Human being survives only in presence of oxygen. During the utilization of this life supporting element, oxygen we generate by-products as 'reactive oxygen species' (ROS), commonly known as free radicals. These free radicals are produced as the part of the body's normal stress response. But when these reactive species formed in larger amount and with chronic exposure, it can damage healthy cells, especially by attacking the membrane fats resulting degenerative cellular function. Like rusting of iron takes place due to long exposure of oxygen, our body cells also get degenerated due to long exposure to these free radicals, resulting chronic non communicable diseases. Excessive production of reactive oxygen species is reflected by increased peroxidation of lipid and DNA, leading to oxidative stress.

Free radicals are also produced from exposure to cigarette smoke, excess exposure to the sun, drinking alcohol, from exposure to large amounts of heavy metals and during any inflammatory response [1] and become the cause for many lifestyle related non-communicable diseases. The reactive oxygen species (ROS) has now been identified to play a fundamental role in the pathogenesis of cellular function including endothelial dysfunction and atherosclerosis [2] or glucose auto- oxidation, monocyte dysfunction and nonenzymatic glycation etc [3].

Therefore oxidative stress is currently suggested as the mechanism underlying all non-communicable diseases as chronic diseases with slower progression causing 38 million deaths per year globally, with rising prevalence across the world particularly in developing countries [4].

In a normal situation, the reactive oxygen species production is controlled by the action of antioxidants. Antioxidants are the substance which neutralizes the free radical and or reduce their production. This antioxidant defence mechanism can be divided into two groups. 1st group represents the antioxidative enzymes, present inside the cells such as superoxide dismutase; catalase and glutathione peroxidase which prevents formation of free radicals.

Superoxide dismutase catalyses dismutation of superoxide to H_2O_2 (Hydrogen peroxide) and catalase metabolizes it to water [5]. The second group of antioxidants is provided through foods. Certain vitamins and minerals and some specific phytochemicals have a major antioxidative effect in the body. The lists of anti-oxidative vitamins, supplied through diet include vitamins C, E and beta carotene which are well-known dietary antioxidants. Vitamin E is lipophilic and inhibits lipid peroxidation, scavenging lipid peroxyl radicals to yield lipid hydroperoxides and the tocopheroxyl radical [6]. Vitamin C, a water-soluble vitamin, functions cooperatively with vitamin E by regenerating tocopherol from the tocopheroxyl radical. Selenium is the only mineral that has established antioxidative function, scavenge the free radical by preventing propagation of free radicals in the cell membranes in human body [7].

A combination of a variety of different antioxidants may be needed to keep the cells protected from oxidative stress. Once the chronic anti-oxidative stress sets in, it weakens the anti-oxidative enzyme system of the body and further increase the complication due to oxidative stress. Studies have reported that obesity may induce oxidative stress which is associated with irregular production of adiponectins, leading to development of metabolic syndrome [8]. The biomarkers of oxidative stress are found to be higher in obese individual [9].

West has reported that in diabetic patients, hyperglycemia weakens the antioxidant enzyme defence which further increases damage to cell proteins and increase the progression of complications of diabetes [10]. Dietary antioxidants have been hypothesized to have a protective effect against the development of diabetes by inhibiting peroxidation chain reactions [11].

Ulrich, 2005 reported that physical inactivity is a risk factor for vascular disease by promoting NADPH oxidase activity, resulting in increased vascular superoxide release and ultimately vascular dysfunction and atherosclerotic lesion formation [12]. Possible protective roles of various foods, including spices, herbs and tea, fruit, vegetables and antioxidants in extra virgin olive oil has been reported to be functional against cancer.

Faulty meal patterns such as energy dense meals, high fat foods, fast foods style breakfast, which are low in antioxidative nutrients, increase the oxidative stress [13]. In depth research on antioxidants is still in its infancy. Laboratory studies show that some antioxidants can become pro-oxidants at high doses which could potentially damage DNA. Evidence from laboratory studies indicates that particular antioxidants may have specific roles in disease prevention. However, most clinical trials using antioxidant vitamin supplementation have not shown expected outcome.

There is concern about possible interactions between high doses of some antioxidant supplements and chemotherapy drugs that work by using free radicals to kill cancerous cells. Routine supplementation of Vitamin E, C and Carotene is not recommended for patients with Diabetes or for prevention of cardiovascular diseases due to lack of evidence of efficacy and concerns related to long term safety [14,15].

Health promoting nutrition Strategy involves the daily intake of Five to ten vegetables and fruits, fruit juices, red wine and tea that are rich sources of micronutrients with antioxidant properties, including the antioxidant vitamins C, E and b-carotene. Tomatoes contain lycopene, a stable, active antioxidant. Many vegetables contain polyphenolic compounds. Green tea is a rich source of

epigallocatechin gallate, and theaflavin and the associated thearubigins, in black tea. Red wine contains resveratrol.

Epidemiological studies show that a diet rich in antioxidants is associated with longevity and good health [16]. We agree that fruit and vegetables are a wiser dietary choice to strengthen the body's fight against oxidative stress (Figure 1).

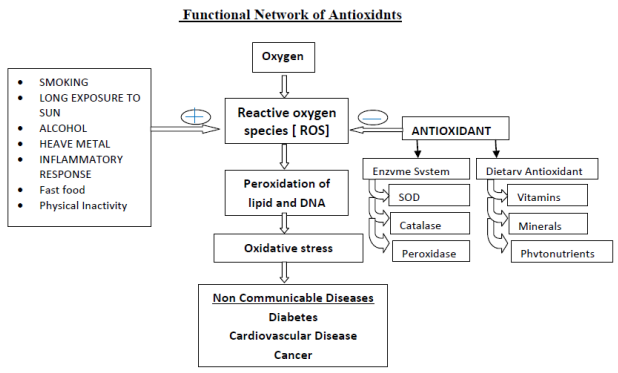

Figure 1: Functional Network of Anti-oxidants

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