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A HEALTHIER ANTIOXIDANTS-RICH FOOD WITH VITAMIN C AND E

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ABSTRACT
There is no doubt that the incredible advances in medicine will be perceived as one of the spectacular achievements of the twentieth century right along with some other innovations. Hazards such as radiation, pollution, smoke, nutrient poor diet handle many common diseases. This article demonstrates knowledge of the antioxidant to practice real preventive medicine by understanding the role that free radicals play in the onset and progression of known disease and how antioxidants can control them.

Keywords: antioxidant; antioxidant activity; free radicals, vitamin C, vitamin E

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INTRODUCTION

From the smallest single-celled to the multiple-celled organism on earth, every living thing is defined by its genes. The deoxy-ribonucleic acid (DNA) contained in our genes acts like an instruction manual for our cells composed of smaller units called atoms. Each atoms has a center or nucleus that surrounded by electrons. These electrons move from one oxygen molecule to the next by biological oxidation, the process of making energy. However, some electrons may escape. The free electron that escape is called free radicals. These free radicals and other free radicals from radiations can attack and oxidize DNA, the genetic material that controls cell growth and development, which can cause diseases, such as cardiovascular diseases and other age related diseases prevalent in developing countries (Blaszczak et al., 2019; Ogunlade, Oni, & Osasona, 2019).

An antioxidant takes part in antioxidant defense mechanisms, preventing destruction effects of free radicals on DNA, protein and lipids. Vitamins found in vegetables, fruit and supplements are potent antioxidant of biological systems in humans. Therefore, antioxidants derived from food are especially important in protecting organisms against diseases. The polyphenol that found in vegetable and fruit are phenolic compound that are uniquely qualified to scavenge free radicals or reactive oxygen species (ROS) before they can damage their target tissues, or even DNA. ROS are group of oxidants are a group of oxidants formed during oxygen metabolism that appears to be involved in the pathogenesis of many human diseases. Oxidative stress develops when the generation of ROS

overwhelms the scavenging level of antioxidant. Hence, certain amounts of antioxidants constantly keep an adequate level of antioxidants to balance the ROS.

VITAMIN C, E ARE ANTIOXIDANTS

Antioxidants are free radicals' scavenger consisting of group of compounds such as phenolic compounds that can reduce free radicals so that they could not attack other cells and target tissue. The antioxidant properties of phenolic compound are due to their redox properties, which allow them to neutralize free radicals, act as hydrogen donors and quench singlet oxygen (Filip, 2017). An example of antioxidants is vitamin, namely: Vitamin C (ascorbic acid) and E (tocopherols and tocotrienols), which can be found in plants. When antioxidant meets free radicals, it captures free radicals, and the free radicals then join its molecular structure. Furthermore, the antioxidant becomes a weak free radical and is not likely to do further chain reaction of lipid peroxidation (Vieira, Zhang, & Decker, 2017).

Antioxidants also boost the immune system. The antioxidant neutralizes the free radicals preventing the formation of the non-self-protein, that may induce cross-link immune reaction. Meanwhile, the antioxidant can also prevent cancer by preventing the free radical to modify the DNA Bases sequences. For example, high intakes of antioxidant-rich food such as Vitamin C and E are associated with lower risk of cancer diseases (Ahsan, Ahad, Iqbal, & Siddiqui, 2014; Bai et al., 2015).

VITAMIN C

Vitamin C or ascorbic acid (Fig. 1) is one of the most important vitamins and/or antioxidant that exist in fruits (e.g. oranges (Micucci, Alonso, Turner, Davicino, & Anesini, 2011), limes, lemons, grape berries (MENG et al., 2019), guava leaves (Luo, Peng, Wei, Tian, & Wu, 2019), strawberries (Martínez-González et al., 2020), kiwi (Foda, Ibrahim, Gouida, & Elsherbiny, 2019; Gümüşay & Yalçın, 2019), starfruit (Fan et al., 2019; Pothasuk et al., 2020; Shourove, Zzaman, Chowdhury, & Hoque, 2020), melon (Bouaziz, Djidel, Bentaher, & Khennouf, 2020; Islam & Sultana, 2020)), and vegetables (e.g. spinach)(Mudau, Soundy, Araya, & Mudau, 2019). Vitamin C may protect cell membranes against lipid-peroxidation through two mechanisms: (1) directly by intercepting free radicals formed in the aqueous cytosol and (2) indirectly through participation in the regeneration of Vitamin E (Dumbravă, Moldovan, Raba, Popa, & Drugă, 2016).

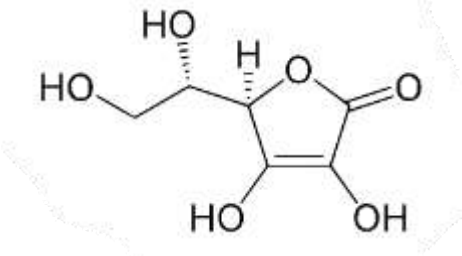

Fig. (1). Chemical Structure of Vitamin C

VITAMIN E

Antioxidant : tocopherols and tocotrienols, consisting of a group of substances that terminates the chain reaction of lipid peroxidation, found mainly in vegetable oils (Ahsan et al., 2014; Khadangi & Azzi, 2019). Both tocopherols and tocotrienols have similar crystal structures. The side chains of tocopherols are saturated, while those of tocotrienols have three double bonds.

Tocotrienols, members of the Vitamin E family, are natural compounds found in a few vegetable oils, wheat germ, barley, and certain types of nuts and grains. Like tocopherols, tocotrienols are also of four, such as, alpha (α), beta (β), gamma (γ) and delta (δ) (Fig. 2). Like tocopherols, tocotrienols are unsaturated and own an isoprenoid side chain. Tocopherols are lipophilic in nature and found in association with lipoproteins, fat deposits and cellular membranes and protect the polyunsaturated fatty acids from peroxidation reactions. The unsaturated chain of tocotrienol allows an efficient penetration into tissues that have saturated fatty layers such as the brain and liver. Alpha tocopherol is a tocopherol isomer that is the most prevalent form of vitamin E occurring in the body and the form administered as a supplement. In nature, it usually occurs with β- γ- and δ-tocopherols. The term is synonymous with Vitamin E. However, recent mechanistic studies indicate that other forms of Vitamin E, such as γ-tocopherol, δ-tocopherol, and γ-tocotrienol, have unique antioxidant and anti-inflammatory properties that are superior to those of α-tocopherol against chronic diseases (Ahsan et al., 2014).

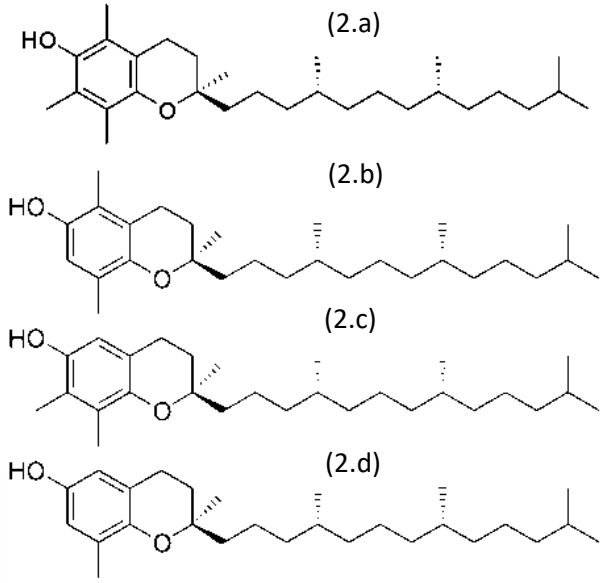

Fig. 2. (2.a.) α-Tocopherol, (2.b.) β -Tocopherol, (2 .c.) γ -Tocopherol, (2.d.) δ-Tocopherol

VITAMIN E NEUTRALIZES FREE RADICALS

During normal energy metabolism or oxidative processes (oxidation in biological system), electrons (e^-) are transferred from food to the electron transport chain in mitochondria to oxygen molecules, which accept electrons (e^-) and protons (h^+) to form water (H_2O). These

oxidative processes can generate unstable molecules, which are the starters of chain reaction that can cause damage of cells. For example, a superoxide radical is formed when oxygen accepts a single electron. Superoxide, like other free radicals, is highly reactive, and one reaction in which it can engage is dismutation, to form hydrogen peroxide. Hydroxide ions and reactive hydroxyl radicals are formed from hydrogen peroxide. Superoxide radicals, hydroxyl radicals, and hydrogen peroxide are the reactive oxygen species (ROS). If free radicals react with DNA, it can induce mutagenic alterations.

Antioxidant mechanisms have evolved to stop the oxidative processes, by terminating the chain reactions initiated by free radicals. Some antioxidants are enzymes that destroy superoxide radicals (superoxide dismutase) and peroxides (peroxidases and catalase). Vitamin E interrupts the chain of membrane lipid peroxidation and is thus a chain breaking antioxidant. The reaction of a lipid peroxyl radical with a Vitamin E molecule interrupts peroxidation by producing a hydroperoxide and Vitamin E radical, both of which are relatively unreactive. The Vitamin E radical if reacts with another Vitamin E radical, with alkoxy radical, or with a peroxyl radical, the result is unreactive products with no further free radical scavenging activity or it can be reduced back to a functional Vitamin E molecule by Vitamin C (Blokhina, Virolainen, & Fagerstedt, 2003; Kohri & Fujii, 2013)

CONCLUSION

In summary, antioxidants of Vitamin C and E may play important role as real preventive medicine to lower the risk of certain diseases by neutralizing the free radicals in the oxidative processes.

COMPETING OF INTEREST

The authors declare that they have no competing of interest.

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