Antioxidant and eye diseases

Rahman M

It is my personal privilege to present the paper on "Role of Antioxidants in Prevention of Blindness" organized by a joint venture of M.A.I Institute of ophthalmology, Islamia Eye Hospital and Medical Services Department, Orion Laboratories Ltd.

Of all the causes of blindness, cataract is claimed to be the number one cause of reversible blindness world-wide and age-related macular degeneration is another leading cause of irreversible blindness. Cataract is a disease where crystalline lens inside the eye becomes gradually opaque and light can not pass into the retina, sentient layer of the eye and the patient becomes gradually blind. Age-related macular degeneration (AMD) is a disease where most important part of retina i.e. macula undergo some pathological changes and the patient becomes gradually blind.

There are about 45 million blind people world-wide\(^1\). Though there is no statistical data available in Bangladesh, it is claimed that about 1.2 million people are blind and 60% of blindness is due to cataract.

The Aim of "VISION in 2020" I a project of the World Health Organization (WHO) is to eliminate preventable blinds by 2020. It is only possible if appropriate measures are taken in right time.

A patient with cataract in an otherwise healthy eye can get back his full sight if operated in time with success. But due to illiteracy, poverty and ignorance many patients in Bangladesh with cataract do not get treatment in time. They become blind and remain blind longer than in any developed country.

Age-related cataract is a sequence of aging process in old age. Other cataract due to genetic defect, complications of eyes and systemic diseases could probably be prevented by taking appropriate measures such as genetic counselling, treating systemic and eye diseases in time.

But the age-related cataract- the so called senile cataract and age-related macular degeneration (AMD) could probably be much delayed by some agents which are known as antioxidants.

Investigators observed through various researches that in our normal physiological process in the body some free radicals are released which attack the cells and damage them. Biomedical researchers found some agents which can combat these attacks from which the term antioxidant come.

From where does this idea of oxidation and antioxidants come: About a century ago\(^2\) it was observed that some organic compounds such as rubber looses its life time when they come in contact with atmospheric oxygen. The contact of oxygen with lipid materials is known as auto- oxidation\(^3\). The auto-oxidation can be divided into

A. Initiation reaction: Where single oxygen when mixed with I lipid material releases hydroperoxide radical.
B. Propagation reaction: Where lipid radicals mix with oxygen I molecule release hydroperoxide.
C. Termination reaction: Where two radicals combine to produce a stable product.

Auto-oxidation of lipid radical produces toxic radicals which destroy the vital elements of cell in the absence of antioxidants.

Antioxidants are microingredients present in all foods and prevent oxidation of lipid material in our body. These are vitamin A, C, E, Selenium, Zinc, Folic acid, Lecithin etc.

Prof. Mustafizur Rahman, D.O, FRCS (I), FRCS (E), FRC Ophth (E), FCPS, Director, M.A.I. Institute of Ophthalmology and Chief Consultant, Islamia Eye Hospital; Ophthalmologist, Bangladesh Armed Forces
Antioxidants are of two types

A. Primary or chain-breaking antioxidants: They react with lipid radicals and convert them to more stable products. Primary antioxidant is a molecule that is able to donate hydrogen atom to lipid radical. β-carotene at low oxygen pressure in human tissue act as antioxidant by preventing formation of hydroperoxide.

B. Secondary antioxidants: Compound that retard the rate of auto-oxidation of lipid and thereby converting free radicals to more stable specimen in the presence of metal ions and reducing agents such as ascorbic acid are known as secondary antioxidants. Oxygen is essential for life. But complex oxidation reaction that occur in human tissue produce some toxic radicals which in the absence of antioxidants would soon destroy the vital elements of the cells.

Tocopherols (vitamin E), ascorbic acid (vitamin C) and carotenoids react with free radicals notably peroxyl radicals and with single mplecular oxygen which is the basis for their function as antioxidants. A more broad definition of all antioxidant is any substance that, when present at low concentrations compared with those of an oxidisable substrate, significantly delays or inhibits oxidation of that substrate.

There are studies by various authors on the role of antioxidants such as vitamin C and trace minerals which suggest that they have the properties that prevent the onset and progress of cataract and age related macular degeneration in POLA study group 4 done by Delcourt-C et al published in Arch-opthalmol., Oct.1999, suggest that vitamin E may provide protection against age-related macular degeneration. No association were found with plasma retinol and ascorbic acid levels or with red blood cells glutathione values.

In another study by POLA group published in Ophthalmology February, 1999 issue suggest that there is a strong association of high levels of plasma glutathione peroxidase (PLGX) with age related macular degeneration and high levels of erythrocyte superoxide dismutase (SOD) were also associated with increase risk of nuclear cataract. So it is evident that antioxidant has some role in the prevention of AMD and nuclear cataract.

Christen-WG suggest that oxidative mechanisms may play an important role in the pathogenesis of cataract and age-related macular degeneration, the two most important causes of visual impairment in elderly age group. These findings raise the possibility that vitamins and trace minerals with antioxidant properties can be of benefit in preventing age-related macular degeneration and cataract.

According to the study by Lyle et a serum level of carotenoids and tocopherols and their link with the incidence of age-related nuclear cataract were compatible with the possibility that nuclear cataract may be linked inversely to plasma concentration of vitamin E. But neither strongly supported nor rejected the hypothesis of inverse association of nuclear cataract with serum carotenoids.

Another study by Xue-AN et al published in Biomed-Environ. Sci.1996 september on the antioxidant status in persons with and without senile lens changes. The result suggest that appropriate amount of antioxidant nutrients might be helpful to prevent or retard the process of lens changes. Although potentially important benefit of vitamin supplementation
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in eye diseases will emerge mainly from well designed large scale, randomized trials.

Combination of vit-E and C were found to inhabit glycation at physiological concentration and more effective than either vitamin, suggesting that synergistic antioxidant effect of these two nutrients may have contributed to the inhibition of glycation in diabetes mellitus. Thus this combination is helpful in the prevention of diabetic retinopathy, which is also an important cause of blindness worldwide.

In the body, highest amount of Zinc is present in the retina. It is directly involved in absorption, metabolism and mobilization of vit- A. Zinc also influences the Oxidation-Reduction of Vit-A in the retina. Thus Zinc deficiency causes impaired dark adaptation leading to night blindness. Zinc is also a strong antioxidant. As a part of it's anti-degenerative process, it has a protective mechanism in the prevention of age-related macular degeneration (AMD). Antioxidant is gaining popularity like burgers have. gained the popularity world wide. The role of antioxidant in eye till now is mainly focused to cataract, diabetic retinopathy and age-related macular degeneration (AMD). We predict, in future, antioxidant may play an important role in prevention of many other eye diseases. From the studies of different authors, it can be concluded that vitamins such as vitamin E, C and also some trace minerals with their antioxidant properties have some positive role in preventing the onset and progress of cataract, age-related macular degeneration (AMD) and diabetic retinopathy, the three important causes of reversible and irreversible blindness.

"The ORION" Medical Journal is undoubtedly playing an important role in bringing this issue to the doctors community-who can play a vital role by implementing this knowledge at the community level thereby preventing at least three major causes of blindness in Bangladesh.

References
