

Cataract Forestalling by Antioxidant Activity of Vitamin C; Amelioration of Cataract by Nutritional Intervention

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Abstract

Cataract is the ocular disease that lessens the vision by making the lens opaque. It is a dysfunction of the lens resulting from opacification, which impedes the transmission of light. Oxidative stress is the main culprit of this disease which leads to clouding of the human lens. The prevention of the oxidative stress and other factors that worsen this disease can be minimizing by the intake of vitamin c and its anti-oxidative activity is helpful in reducing its outbreak in future. Whereas increase intake of vitamin C in the diet may have increases the availability in the fluid around the lens, providing extra protection.

Keywords: Oxidative stress; Cataract; Opacification; Antioxidant; Vitamin C

Introduction

Eye comprehend of lens as an anterior part, posterior to lens iris and cornea are present both directs light on the retina. Whilst the lens is the only part aid to accommodate the objects. Mostly one-third refractive power of eye delivers by lens. This accommodation power taper down with age. If patient do not take it serious there is a great chance of loss of transparency (opacification) and lead to develop a condition known as cataract.

Lens Physiology

Aqueous humour is soaks in the lens and it consists of amino acids, antioxidants (ascorbic acid) and lactic acid also disposes off by this fluid it is avascular. Nutrition and homeostasis of the lens are recouping by the presences of water and ion channel. With age the passage of water and water-soluble transport declines thru lens epithelium. Oxidant damage in the lens might be occurring due to the decline in water-soluble transport which is act as antioxidant transport and it results in cataract formation.

In the anterior segment of eye two endogenous antioxidants are present (ascorbic acid and glutathione), aid in fixing any kind of damage that is develop because of generation of free radical formation or reactive species.

Exogenous supply of vitamin C is mandatory because of human body cannot synthesize this vitamin due to lacking of enzyme l-gulonolactone oxidase. Ascorbic acid protects the cation pump of the lens. And prevent lipid peroxidation of membrane. Latest researches manifest that the transport of vitamin C might be regulates by aquaporin 0 [1].

Antioxidant virtue of ascorbic acid (Vitamin C)

Vitamin C stalk the free radical formation develop by ROS, and it reinstate by forming a Ascorbate Free Radical (AFR) serves as one

electron donor dependent on NADH and NADPH dependent reductase and it destroy the free radical formation by its potent reducing agent (Figure 1). The cytoprotective effect of vitamin C reveals the restrain the DNA mutation caused by oxidation and protein integrity is restores by repair of oxidized amino acid [2].

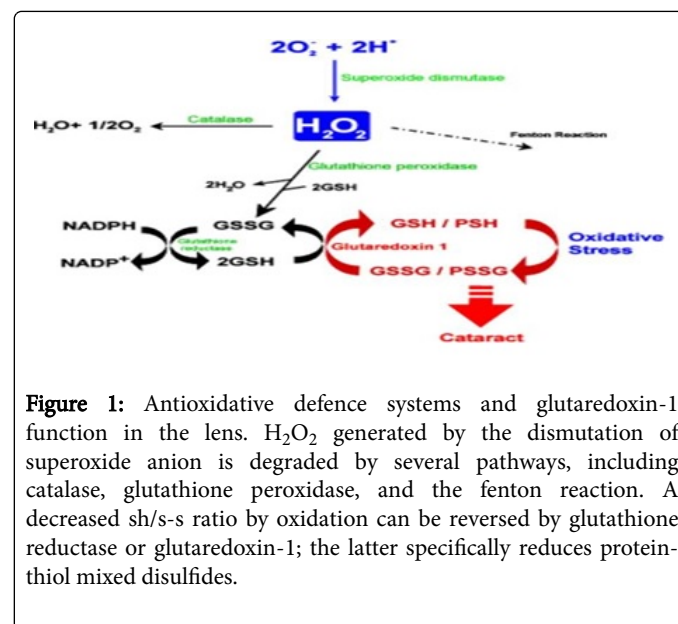


Figure 1: Antioxidative defence systems and glutaredoxin-1 function in the lens. H_2O_2 generated by the dismutation of superoxide anion is degraded by several pathways, including catalase, glutathione peroxidase, and the fenton reaction. A decreased sh/s-s ratio by oxidation can be reversed by glutathione reductase or glutaredoxin-1; the latter specifically reduces protein-thiol mixed disulfides.

More than 50 folds of ascorbic acid found in lens and aqueous humour whereas on the other hand in mammalian system, ascorbate deems as the most identifiable antioxidant which is effective and least toxic. It supports to enhance the antioxidant activity of vitamin E. Many researches reveal that there is decline seen in ascorbate level in the lens which also limits the physiological function of lens [3].

With old ages the proteins of lens gets blur because of observing the paucity. These proteins are in turn more prone to get exposed to UV light and visible light. Latest study detects that those African diabetics who expose to sunlight have increase chances of getting cataract.

Damaging of ozone layer also lead to causes cataract. Followings are the risk factors that confer the cataract are increase age, sex, status, smoking habit, diabetes mellitus and increase weight of person [4].

Instead, of these factors there is a more likelihood to get this disease in those patients treated with *in vitro* hyperbaric oxygen therapy. *In vitro* this experiment did by take mice that were expose to 100% oxygen twice weekly for 3 h and hyperbaric oxygen provided to guinea pigs. Permit the oxidation reaction to done, found high level of oxidized form of the antioxidant Glutathione (GSH) that is glutathione disulfides and there is an aggregation of disulphide proteins upon aging and oxidative stress [5].

Increase level of ascorbate has beneficial role in cataract. In all individuals the daily consumption of vitamin c is 75 mg. Increase level of vitamin c helps to taper off the oxidative stress Thiobarbituric Acid Reactive Substances (TBARS) but this information had only been given to mouse model thorough glyceration, did not administered in human had cataract disease. Escalating amount of vitamin C that is beyond to 200 mg declines the exposure of cataract and it is confess by different pre-existing epidemiologic researches [4].

Circulatory system do not useful to develop a concentration gradient in the lens which is regulates by ample amount of antioxidant in the aqueous humour [1].

Pathophysiology of cataract formation and its progression

Antioxidant presences in lens inhibit the generation of free radical that is responsible for cataract formation. The pathophysiology has been confirmed by development of two models that gives the formation of cataractogenesis is model-selenite model and the diabetic cataract model [6].

If cataract is not treated earlier, Posterior Capsular Opacification (PCO) is the main complication that might develop during cataract surgery. Research revealed that proliferation and migration of epithelial cells of lens that is the main culprit of the disease could be prevented by using ascorbic acid and it also declines the function of HIF- α by increases the proline hydroxylation HIF- α by inhibiting there action that could be beneficial to treat cataract. Overwhelm of HIF-1 α increase the proliferation and migration of human lens epithelial cells increases the risk of cataract formation whilst it could treat cataract by inhibiting the expression of EMT transcription because it will destabilizes HIF-1 α [7].

Conducted Researches on Cataract

There are a lot of researches indicates that risk of cataract that could be improves by the intervention of nutrition whilst the role of antioxidant plays the very effectual role [8].

Collective data showed that since 2007, data covered by taken 110,000 subjects who took part in evaluate the role of vitamin C in ophthalmic health. The concord observed that the risk of cataract declines by the presences of at least 49 μ m or 135 mg/day intake. Even

the paucity amount presences also decrease this vulnerable disease. Data collected since 2007 till now exhibit that the role of vitamin C has effective effect to relieve cataract [9].

Most of the geriatrics who has suffered from cataract not affords cataract surgery as a preventive treatment to stop its progression whilst the nutritional intervention could also decreases the costly treatment [10].

Latest research conducted in Spanish Mediterranean population by deemed the effect of nutritional value to diminish the cataract prevalence and showed that the increase amount of vitamin C consumption up to 107 mg/day decreases this incidence [11].

Conclusion

Summarily the role of vitamin C is essential for the ocular function and it is also very important in reducing many diseases in the body except the cataract. So, the healthy diet is mandatory to overcome the eruption of cataract in geriatrics.

References

1. Abdelkader H, Alany RG, Pierscionek B (2015) Age-related cataract and drug therapy: opportunities and challenges for topical antioxidant delivery to the lens. J Pharm Pharmacol 67: 537-550.
2. Grosso G, Bei R, Mistretta A, Marventano S, Calabrese G, et al. (2013) Effects of vitamin C on health: a review of evidence. Front Biosci 18: 1017-1029.
3. Moise MM, Benjamin LM, Doris TM, Dalida KN, Augustin NO (2012) Role of Mediterranean diet, tropical vegetables rich in antioxidants, and sunlight exposure in blindness, cataract and glaucoma among African type 2 diabetics. Int J Ophthalmol 5: 231-237.
4. Chang JR, Koo E, Agron E, Hallak J, Clemons T, et al. (2011) Risk factors associated with incident cataracts and cataract surgery in the Age-related Eye Disease Study (AREDS): AREDS report number 32. Ophthalmology 118:2113-2119.
5. Tarwadi KV, Chiplonkar SA, Agte V (2008) Dietary and nutritional biomarkers of lens degeneration, oxidative stress and micronutrient inadequacies in Indian cataract patients. Clin Nutr 27: 464-472.
6. Thiagarajan R, Manikandan R (2013) Antioxidants and cataract. Free Radic Res 47: 337-345.
7. Zhao L, Quan Y, Wang J, Wang F, Zheng Y, et al. (2015) Vitamin C inhibit the proliferation, migration and epithelial-mesenchymal-transition of lens epithelial cells by destabilizing HIF-1 α . Int J Clin Exp Med 8: 15155-15163.
8. Chiu CJ, Taylor A (2007) Nutritional antioxidants and age-related cataract and maculopathy. Exp Eye Res 84: 229-245.
9. Dherani M, Murthy GV, Gupta SK, Young IS, Maraini G, et al. (2008) Blood levels of vitamin C, carotenoids and retinol are inversely associated with cataract in a North Indian population. Invest Ophthalmol Vis Sci 49: 3328-3335.
10. Weikel KA, Garber C, Baburins A, Taylor A (2014) Nutritional modulation of cataract. Nutr Rev 72: 30-47.
11. Pastor-Valero M (2013) Fruit and vegetable intake and vitamins C and E are associated with a reduced prevalence of cataract in a Spanish Mediterranean population. BMC Ophthalmol 13: 52.