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A Dietary Intervention in Cataract Care: An Integrative Perspective

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Abstract- Cataract, a major cause of vision impairment globally, primarily affects the aging population. While surgery remains the only curative treatment, recent studies emphasize the role of diet and nutrition in delaying cataract onset and progression. This paper explores *Ayurvedic* and modern perspectives on cataract, its stages, and the impact of essential nutrients on eye health. A structured dietary guideline based on scientific sources is proposed to help reduce the risk of cataract development.

Keywords: Cataract, Nutrition, *Ayurveda*, Vitamins.

INTRODUCTION

Ayurveda, the ancient Indian system of medicine, emphasizes a holistic approach to health that integrates and seeks to harmonize body, mind and spirit through lifestyle management.[1] It was originated with the intention of helping and serving the mankind in both healthy and diseased conditions. Among its eight branches, *Shalakya Tantra* specializes in orodentistry, ENT, and ophthalmology.[2] This branch was developed and forged by *Acharya Nimi*, the king of *Videha* who belongs to *Ikshvaku dynasty*.

Ayurveda has identified 76 different kinds of eye conditions, with cataracts being the most prevalent in older adults nowadays.[3] Since it is located in the fourth *patal* - the *asthi ashrit patal* - as stated in the *Sushruta Samhita*, it can be associated with *kaphaj linganasha*.[4]

The word 'cataract' literally means 'waterfall' and is derived from the Greek word 'katarraktes'.[5] It is characterized by the formation of an aberrant humour in front of the lens that reduces vision. The most recent study defines cataract as the development of any opacity in the lens or its capsule, either as a result of the formation of opaque lens fibres or as a result of a degenerative process that causes the regularly generated transparent lens fibres to become opacified. It could result in altered vision, uniocular polyopia, blurred or foggy images, or total blindness.

Now, the lens is a major factor and plays a key role in cataract development. The lens of the eye is a transparent, crystalline structure. It is separated into various components, including fibres, a capsule, and a few suspensory ligaments. We are able to see clearly because lenses are of transparent nature. Avascularity, a densely packed lens, protein organization, semi permeability, a pump mechanism that maintains relative dehydration, autooxidation, and a high concentration of reduced glutathione are some of the elements that keep the lens clear and transparent.[6] Opacification of the lens and its fibres impairs our normal eyesight. Oxidative stress is brought on by the breakdown and buildup of proteins, which results in lens opacity.[7]

Cataracts are among the leading causes of vision impairment worldwide, particularly in aging population. Approximately, 46.53% of people are accounting for global blindness. According to a survey of 2025, the WHO poll estimated around 100 million people worldwide suffer from vision impairment out of which 17% have cataracts.[8] A recent study by Lancet Global Health predicts that near 74 million people in India could experience significant vision loss by 2025, with cataract remaining a significant contributor.[9] According to NPCB data, a startling 10.5 million cataract procedures are anticipated in 2024-25.[10]

There are several forms of cataracts, with senile cataract being the most prevalent. It is a degenerative cataract that is related to ageing. Three stages of cataract development are also distinguished: immature,

mature, and hyper mature.[11] According to modern ethics, surgery can clearly reverse the process, and *Ayurvedic* texts state that suppressive drugs *(samshaman)* and detoxifying agents *(samshodhan)* can do the same. However, eating a balanced diet can also readily prevent it.

AIM AND OBJECTIVES

1. To identify nutritional deficiencies contributing to cataract formation.
2. To outline natural supplements and dietary guidelines to prevent or delay cataract progression.

MATERIALS AND METHODS

Nutrition is essential element for the health of a human being. Meanwhile vitamin A and protein plays a vital role in ocular health.[12] While no single nutrient causes cataract, deficiencies in multiple vitamins, minerals and trace elements collectively contribute to its development. Vitamin C mitigates oxidative damage in the lens, while vitamin E protects lens fibres.[13] B-complex vitamins, particularly B2 and B3, help maintain lens metabolism and protect glutathione - a crucial antioxidant - along with calcium and sodium. Vitamins D and A in combination with zinc, reduce age-related nuclear cataract risk. Selenium combats oxidative damage, and carotenoids like lutein and zeaxanthin are associated with reduced cataract risk.[14] Carbohydrates, except refined carbs, are also meant to reduce the risk. Crystalline, the lens protein responsible for transparency, diminish with aging and inadequate nutrition causing cataract. Although simple dietary changes cannot reverse cataracts, it can stop emerging and further progression if the disease occurs. Here is the list of recommended food items that can be used to prevent cataract.[15]

Food sources of Vitamin A

Category	Food items	IU per 100 g	% RDA
Vegetables	Carrot Sweet potato Spinach Bell peppers Broccoli Pumpkin Zucchini Cucumber	17033 14187 9380 2332 1100 8513 250 105	67 561 700-1000 40-50 20-25 245 10-15 3-5
Fruits	Mango Peach Apricot Papaya	1082 300-400 1000-1200 950	50-70 10-15 30-40 50-75
Fish	Salmon Tuna	1000-1500 40-100	30-50 1-3
Legumes and nuts	Green pea Pistachio Almond	500-700 40-50 0-20	15-30 1-2 1
Dairy products	Cheese Milk Yoghurt Butter	200-250 500 250-300 400	7-8 17-20 8-12 10-15

Food sources of Vitamin B

Category	Food items	IU per 100 g	% RDA
Vegetables	Mushroom Leafy greens Avocado	1.19 0.71 0.39	31-36 15-23 8-10
Fruits	Banana	0.21	4-5
Non veg	Meat Shell fish Eggs	10.1 1.2 1.34	31-36 8-10 35
Legumes	Lentils Beans	0.21 0.3	8-9 8-9
Dairy products	Milk Cheese	0.54 1.34	14-15 30-36
Others	Whole grain	0.75	19

Food sources of Vitamin C

Category	Food items	IU per 100 g	% RDA
Vegetables	Red bell pepper Tomato Broccoli	2171 233 1516	143 15 99
Fruits	Citrus fruits Strawberry Kiwi Guava Mango Blackcurrant Kakadu plums Acerola Cherry Pineapple	904 1000 1576 3881 1785.3 455-643 38,300 1,68,000 119 813	35 65 103 254 40 201 2555 12.3-98.3 9 53
Legumes	Green pea	680	44

Food sources of Vitamin D

Category	Food items	IU per 100 mg	% RDA
Vegetable	Mushroom	8	4
Fish	Cod liver oil Salmon Tuna fish	1360 447 154	340 70 34
Dairy products	Milk Yoghurt	40-50 40-80	7-8 7-13
Others	Cereals Eggs	40-100 37	7-17 6

Food sources of Vitamin E

Category	Food items	IU per 100 g	% RDA
Vegetables	Avocado	2.98	14
	Spinach	3.02	13
	Red pepper	158	13
Fruits	Kiwi	2.18	9
Nuts	Almonds	38.14	170
	Peanuts	7.34	55.3
	Sunflower seeds	52.4	235
Others	Wheat germ oil	222	993
	Sunflower oil	61.24	274

Food sources of Selenium

Category	Food items	mcg per 100 g	% RDA
Non veg	Oyster	20-40	36-73
	Shell fish	30-50	55-91
	Eggs	15-20	25-37
Legumes and nuts	Chickpea	6	11
	Brazil nuts	68-91	100-165
	Pumpkin seeds	5-6	10
Others	Brown rice	19	35

Food sources of Lutein and Zeaxanthin

Category	Food items	mg per 100 g	% RDA
Vegetables	Spinach	12-13	-
Non veg	Egg yolk	6-10	-
Legumes	Corn	0.5	-
	Peas	0.7	-

DISCUSSION

The data emphasizes how nutrition has a supportive and preventive role in the treatment of cataracts. Oxidative stress, which weakens the structural integrity of lens proteins and reduces their transparency, is the main cause of cataractogenesis. Carotenoids, selenium, vitamins A, C, E and other nutrients are essential for shielding the lens from oxidative damage.[16] Vitamin A preserves the integrity of the epithelium, vitamin C protects aqueous humour from oxidative damage, and vitamin E stabilizes cell membranes. B-complex vitamins preserve glutathione, an essential antioxidant whose depletion speeds up the formation of cataracts.[17] Involvement of lutein and zeaxanthin is particularly important since, in addition to their antioxidant properties, they also filter blue light, preventing photo-oxidative damage.[18] Similar to contemporary antioxidant-focused nutrition, dietary *Rasayana* therapy is emphasized in *Ayurvedic* texts as a holistic approach.[19] When paired with lifestyle modifications and metabolic control, such an integrative approach might provide improved protection. Addressing some detrimental eating habits that should be avoided is also crucial. Excessive consumption of processed and fried foods, sugary foods, trans fats, and refined carbs may worsen oxidative stress and lens protein glycation.[20] Additionally, because of their systemic oxidative effects, alcohol and tobacco use have been associated with an increased incidence of cataracts. It is impossible to overestimate the importance of antioxidants from a dietary perspective. The first line of defense against reactive oxygen species (ROS) is made up of vitamins A, C and E. Their combined effects are crucial for preserving metabolic stability and lens transparency. Lens metabolism and lowered glutathione levels depend on B-complex vitamins, particularly riboflavin (B2) and niacin (B3).[21] Strong endogenous antioxidant glutathione is essential for detoxifying hydrogen peroxide and preserving the redox condition of lens proteins.[22] One of the main causes of nuclear cataract production is its deterioration with age and poor diet. By stimulating antioxidant enzymes such as glutathione peroxidase and superoxide dismutase, trace elements and macular pigments like zinc and selenium work with vitamins to further improve lens protection. Furthermore, the body cannot synthesize carotenoids like lutein and zeaxanthin, thus they must be received through diet. These substances build up in the lens and macula, where they filter blue light and offer antioxidant defense. It is crucial to stress that although dietary modifications cannot stop cataracts from developing, they can significantly slow its advancement, particularly when it is still in its early immature stages.[23] Dietary measures focused on vitamin C and E, carotenoids, and omega-3 fatty acids help maintain lens metabolism and transparency while delaying the degeneration at this point, when vision is still functional. Anti-inflammatory and antioxidant foods may have a supplementary role in regulating systemic diseases including hyperglycemia and oxidative load throughout the mature period, when eyesight is markedly compromised. On the other hand, surgery is the only effective treatment for irreversible lens opacification that occurs in the hyper mature stage. Nonetheless, pre- and post-operative nutritional supplementation remains essential for promoting

wound healing and lowering inflammation. A nutrient-dense, well-hydrated diet also aids in the healing process. It is impossible to reduce cataract development to its three stages. Only two of the three can be slowed down, and the only treatment available for the third is surgery. Due to its ability to neutralize free radicals in the lens, vitamin C intake has been widely linked to a lower risk of cataract development; some studies have indicated a 33% reduction in cataract advancement.[24] Carotenoids and vitamin E are also protective. The effects of vitamin E supplements alone are less reliable, whereas dietary vitamin E is associated with an 80% decreased risk of cataracts. Intake of lutein and zeaxanthin is associated with lower incidence and extraction requirements. Antioxidant-rich foods offer a diverse nutritional matrix that seems to be more advantageous than high-dose individual supplements. Clinical evidence suggests that while large doses of vitamin C (more than 500 mg/day) may raise the incidence of cataracts, modest intakes (less than 100 mg/day) are helpful. The integrative method provides a powerful strategy for cataract management by fusing contemporary nutritional science with Ayurveda's preventive eyesight and dietary recommendations. *Rasayana* (rejuvenating foods and herbs), detoxification and lifestyle changes are all advised by Ayurvedic principles; these recommendations are in line with current theories of anti-inflammatory and antioxidant diets. It is crucial to understand that although diet can slow the advancement of cataracts, it cannot correct opacities that have already developed. Lens proteins frequently sustain structural damage that cannot be repaired. Furthermore, age, intestinal health, and genetic variables all affect an individual's vitamin absorption. As a result, customized dietary advice and occasionally, supplements may be necessary. All things considered, the evidence suggests that cataracts have a complex but changeable etiology and that certain dietary interventions can be non-invasive, reasonably priced and broadly applicable interventions in public health frameworks, particularly in environments with limited resources.

OBSERVATION

Important nutritional factors that affect cataract development and progression are identified in this review. The examination of several dietary groups showed that: Foods high in vitamin A have a substantial impact on eye health;[25] depending on the source, their levels can range from 250 IU to over 17,000 IU per 100 g, or 10–100% of the RDA. Citrus unusual sources were discovered to contain significant levels of vitamin C, with some containing over 1,000,000 IU per 100 g. Nuts and oils are rich sources of vitamin E, which meets more than 200% of the recommended daily allowance. B-complex vitamins, particularly B2 and B3, played a significant role in promoting lens cell antioxidant and metabolic activities.[26] Selenium is a crucial trace element that occasionally contributes more than 100% of RDA. Eggs were the main source of the powerful macular pigments lutein and zeaxanthin.[27] A well-balanced diet that prioritizes these nutrients may be able to meet or above the recommended dietary allowances (RDA) required for lens protection, according to nutritional research. The results validate that a higher incidence of age-related cataracts is linked to dietary deficits, especially those involving antioxidants. Dietary support is more helpful in the early stages of the disease and is only useful in supportive roles after surgery. The results of this analysis highlight how important nutritional treatments are for both preventing and treating cataract development. Of all the nutrients, vitamin A is the most important for preserving eye acuity and lowering the incidence of cataracts. In order to counteract oxidative stress, the main pathophysiological mechanism causing cataract formation, diets high in antioxidants—especially those that contain vitamins C, E, B-complex, lutein, zeaxanthin, and selenium—are crucial. Common misconceptions should also be cleared up. After a cataract is successfully removed, it does not reoccur; instead, posterior capsule opacification (PCO), a treatable side effect of cataract surgery, is sometimes confused with recurrence. In order to inform patients and direct postoperative care, this distinction is essential.

CONCLUSION

Globally, cataracts continue to be the primary cause of avoidable blindness, imposing a significant burden on healthcare systems and ageing populations. It is evident that nutritional techniques provide a powerful, evidence-based means of delaying the onset and progression of disease, even though surgery is still the

gold standard for treatment in advanced stages because no medicine has been demonstrated to work. This integrative review highlights the power of a preventive but not curative nutritional approach, especially when implemented during early prognosis. Diets enriched with antioxidants, trace minerals, and ocular-protective phytonutrients can slow lens degeneration and complement existing medical treatments. Such interventions are particularly valuable in communities with limited access to ophthalmic surgery, offering a realistic and proactive means to reduce vision loss. Ultimately, a dual strategy—combining timely surgical care with sustained nutritional support—presents the most effective paradigm for comprehensive cataract management. Future policies and patient education initiatives should emphasize this holistic model to alleviate the growing global burden of cataract-related blindness.

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