Research Article

Clinical Relationship of Blood Vitamin-C Levels and Age Related Cataract

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Abstract: Background: Cataract is an extremely important and ground source of the curable blindness around the globe. Lenticular Vitamin C is actual important ultraviolet filter and antioxidant that decreases entry of the light rays into lens and therefore preventing the lens from oxidative damage. Keeping this in sight, higher intake of the vitamin c and by consuming the diet rich in vitamin c can prevent the age-related cataract. The motive of this study is to analyze if high vitamin C levels can lead to decrease in the percentage of cataract in patients.

Objective: To determine occurrence of the senile cataract among Vitamin C deficient subjects and compare mean vitamin C levels among senile cataract and controls.

Materials and Methods: This comparative cross-sectional study was conducted at The Department of Ophthalmology, PIMS (Pakistan Institute of Medical Sciences), Islamabad, Pakistan, after being accepted by Ethical review Committee. Individuals were selected, in the age range between 45 to 75 years of age from the patients who visited Eye OPD, PIMS, and Islamabad. All participants undergone detailed ophthalmic examination that included visual acuity assessment through the Snellen's chart, anterior segment examination on the slit lamp. Blood vitamin C level was assessed in both cases and controls. Information was recorded in the designated Proforma and data was analyzed using SPSS 23.0 version.

Results: We enrolled 100 patients 50 in each group. Average age of our individuals in our case set was 60.96±9.57 years and in control set remained 59.66±8.92 years. In study group 25(50.0%) remained male and 25(50.0%) remained female. similarly, in control group 19(38.0%) were male and 31(62.0%) were female. The mean value of level of serum vitamin C in study group was 0.55±0.06 mg/dl and average value of level of the serum vitamin C in control group was 0.87±0.07 mg/dl. There was significant difference as p value is less than level of implication ($p < 0.05$). In cataractous individuals the level of the serum vitamin C was low as compared to control set.

Conclusion: In this study, researchers determined that blood vitamin C may be a preventive component towards cataract development that is likely influenced by vitamin C consumption.

Keywords: Senile cataract, Vitamin C levels, Controls, Blindness, Ophthalmology, Genetic diseases.

INTRODUCTION

Cataracts are a very significant source of treatable blindness worldwide. Cataract is defined as a progressive clouding of the lens of the eye and results in blurred vision. Cataracts are divided into two types: acquired and congenital. Age-related (senile) is the most common clinical picture of acquired cataract. Most cataracts are also related to medical conditions such as diabetes, genetic diseases, and several other factors such as poor nutrition, radiation exposure, smoking, alcohol use, long-term steroid use, eye trauma [1]. According to research, the global incidence of severe to moderate vision problems and blindness is 288 million, with age-related cataracts accounting for 41% of vision decline. Most of the people who go blind from cataracts were from developing countries. Lenticular vitamin C is an extremely important ultraviolet filter and antioxidant that limits the penetration of light rays into the lens, thus preventing the lens from oxidative damage. Vitamin C is found in concentrations about 20 to 30 times higher in the lens than in plasma, and in even higher concentrations in the vitreous. Earlier studies show that normal lenses have a higher concentration of vitamin C than lenses with mature cataracts.

Vitamin C is a powerful reducing agent that helps protect the lens from oxidative stress and also maintains the antioxidant activity of glutathione by acting synergistically with vitamin E [2]. Our eye is constantly exposed to oxidative stress. As and when the level of pro-oxidants exceeds the antioxidant defense capacity of the cell, lens proteins are modified, denatured and aggregated, all of which lead to the formation of cataracts [3]. Antioxidants such as vitamin C, vitamin E, GSH (glutathione) actually prevent the formation of free oxygen radicals and thereby reduce photo-oxidative damage, which can prevent cataracts.

According to the study, fruits and vegetables rich in vitamin C, E, and A along with multivitamiwn supplements, are helpful in preventing cataracts. Among them, vitamin C has good scav-

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enging activity because it is present intracellularly and extracellularly [4].

A 2018 meta-analysis that took into account a number of cohort, cross-sectional and case-control studies as well as subgroup analysis by cataract type also demonstrated the benefits of high vitamin C intake for the prevention of senile cataracts. Therefore, elderly people are advised to increase their intake of vitamin C to prevent cataract formation [5]. Regarding vitamin C levels, cross-sectional studies clarify that higher vitamin C levels have a protective effect on senile cataracts. Higher intakes of vitamin C and serum ascorbate may confer benefits in the prevention of age-related cataracts, especially nuclear cataracts. For the prevention of cataracts, it is recommended that the elderly population increase their intake of vitamin C [6]. A reduced risk of cortical cataracts and a 40% reduction in the risk of nuclear cataracts are reported in patients who have higher plasma vitamin C levels compared to patients who have reduced plasma vitamin C levels [7]. As life expectancy increases worldwide, the number of individuals affected by cataracts is rising, especially in underdeveloped countries where cataract treatment is difficult to obtain. Therefore, we need to find a cheap pharmacological alternative to manage this disease. The "India Study of Age-related eye disease" published in 2011 provided credible evidence that high plasma vitamin C levels and high dietary vitamin C intake are associated with lower incidence of age-related cataracts [8].

Third world nations like Pakistan lack affordable and easy access to cataract surgery. With this in mind, age-related cataracts can be prevented with a higher intake of vitamin C. The aim of the research is to regulate whether high levels of vitamin C can lead to a reduction in the percentage of cataracts in patients. If so, increasing oral vitamin C intake may reduce the number of cataracts in individuals, reduce the economic burden, and improve quality of life. Therefore, vitamin C can be used as a protective factor to increase the quality of life of the elderly. Very few studies have been conducted in Pakistan to investigate the role of vitamin C in the prevention of cataracts.

MATERIALS AND METHODS

The above research was conducted at The Department of Ophthalmology, PIMS (Pakistan Institute of Medical Sciences), Islamabad, Pakistan, after approval from Ethical Review Board from 23-12-2020 to 22-06-2021. Individuals were selected in age range between 45 to 75 years of age from patients who came to eye OPD, PIMS. Informed consent was taken on a proforma.

We enrolled 100 patients 50 in each group using WHO sample size calculator. All individuals who met the inclusion criteria, that included both sexes through any form of cataract for the research group and individuals of approximately the same age without any cataract for the control group, were chosen. Individuals with Co-morbidities like DM, HTN, connective tissue disorders and traumatic cataract were excluded.

A comparative cross-sectional study was carried out with Non probability consecutive sampling technique. All participants were examined by a qualified Ophthalmologist, and undergone detailed ophthalmic examination that included visual acuity evaluation through Snellen's chart, anterior segment examination on slit lamp.

Blood sample was drawn from any peripheral vein of the patients from which serum was separated using centrifugation. This separated serum was utilized to assess vitamin C levels in both study and control groups. Data was recorded in the Proforma.

STATISTICAL ANALYSIS

Data was analyzed using SPSS 23.0 version. Descriptive statistics were used to measure both qualitative and quantitative variables. Quantitative variables like age, vitamin C levels of patients with cataract and control were measured as average with standard deviation. Qualitative variables like the gender was measured as frequencies with percentages. T-test was utilized to compare vitamin C levels between the two groups. P-value of <0.06 remained taken as substantial. The differentiation of age and gender determined the impact moderators.

RESULTS

In our study we enrolled 100 patients 50 in every group. The average age of individuals in our case set was 60.96±9.57 years in addition in control set was 59.66±8.92 years. The p value for age in both groups was insignificant.

We categorize age in three groups. In study group 16(32.0%) patients were from 45-55 years age group, 16(32.0%) patients were from 56-65 years age set and 18(36.0%) patients were from 66-75 years age group.

Similarly in control group 17(34.0%) patients were from 45-55 years age group, 19(38.0%) patients were from 56-65 years age group and 14(28.0%) patients were from 66-75 years age group. The p value was insignificant that showed no significant difference in patients regarding age group.

In study group 25(50.0%) were male and 25(50.0%) were female. similarly in control group 19(38.0%) were male and 31(62.0%) were female. There was no significant difference among the two groups ($p= 0.227$).

The mean value of serum vitamin C level in study group was 0.55±0.06 mg/dl and average value of serum vitamin C level in control group was 0.87±0.07 mg/dl.

When we compare the serum vitamin C level in both group by applying independent sample t-test we find significant difference as p value remains less than level of consequence ($p<0.001$). In cataractous patients the level of serum vitamin C is low as compared to control set.

The stratification results of serum vitamin C level showed sig-

nificant results between both the groups in terms of mean and standard deviation regarding age group.

The stratification results of serum vitamin C level showed significant results among both sets regarding gender in terms of mean and standard deviation (Tables **1-3**).

Table 1. Frequency Distribution of Age and Gender in Groups.

Age Groups	Groups		Total	p value
	Group 1 (Study Group)	Group 2 (Control Group)		
45-55 years	16 (32%)	17 (34%)	33 (33%)	0.675
56-65 years	16 (32%)	19 (38%)	35 (35%)	
66-75 years	18 (36%)	14 (28%)	32 (32%)	
Total	50 (100%)	50 (100%)	100 (100%)	
Gender				
Male	25 (50%)	19 (38%)	44 (44%)	0.227
Female	25 (50%)	31 (62%)	56 (56%)	
Total	50	50	100	
	(100.0%)	(100.0%)	(100.0%)	

Table 2. Descriptive Statistics and Independent Sample T Test of Serum Vitamin C Level (mg/dl) in Groups.

Groups	N	Mean	SD	t test	p value
Group 1 (Study Group)	50.00	0.55	0.06	-26.22	0.000
Group 2 (Control Group)	50.00	0.87	0.07		

Table 3. Stratification Results of Serum Vitamin C Level (mg/dl) in Groups with Respect to Age and Gender Groups.

Groups	Age Groups	N	Mean	SD	p value
Group 1 (Study Group)	45-55 years	16.00	0.54	0.05	0.000
	56-65 years	16.00	0.54	0.07	
	66-75 years	18.00	0.56	0.05	
	Total	50.00	0.55	0.06	
	Gender	**N**	**Mean**	**SD**	
	Male	25.00	0.57	0.05	
	Female	25.00	0.53	0.06	
	Total	50.00	0.55	0.06	
Group 2 (Control Group)	**Age Groups**	**N**	**Mean**	**SD**	0.000
	45-55 years	17.00	0.87	0.07	
	56-65 years	19.00	0.88	0.07	
	66-75 years	14.00	0.87	0.06	
	Total	50.00	0.87	0.07	
	Gender	**N**	**Mean**	**SD**	
	Male	19.00	0.88	0.06	
	Female	31.00	0.87	0.07	
	Total	50.00	0.87	0.07	

DISCUSSION

About 2.2 billion people worldwide have vision problems. In at least 1 billion of these cases, vision impairment was preventable or required attention. Cataracts are the leading cause of blindness, counting for 50 of blindness worldwide [9]. The burden caused by cataracts is multifarious, which contributes to its designation as an important cyclopedic public health problem [10]. Although the cause of cataract conformation isn't clear, recent data suggest that changes in biochemical labels may beget cataractogenesis [11]. There have been numerous studies that have shown that either antioxidants, including vitamins C and E, may play a part in the development of cataracts. They show similar data with several studies showing an important inverse relationship between cataract and multivitamins including serum vitamin C situations [12, 13]. Cataracts are darkness in the lens or their capsule that either develop or have been developed. They're also causally divided into acquired and natural forms. Age- related (senile) cataract has a complicated etiology and pathophysiology due to the commerce of heritable and environmental aspects. The prevalence of senile cataract increases with age, reaching 67 in the 50 – 59 age group and 100 in the 80 age group [14]. The offer of vitamin C and cataracts has been batted in numerous inquiries. Some RCTs show that the threat of cataractogenesis wasn't affected by systemic input of multivitamins together with ascorbate [15]. In the study by Hirsch, *et al*. [16], the gender distribution was nearly equal in both groups, with group 1 having 69 males and 62 ladies (131 aggregate) and group 2 having 67 males and 64 ladies. Age was typically distributed across subjects with mean 60.79 and SD 6.92. Other comorbidities similar as DM, ischemic heart complaint, and bronchial asthma were inversely distributed in both gender groups with hypertension slightly more in group 1. These findings were in agreement with the results of our study. Lim JC, *et al*. [17] set up normal ascorbate situations in the general population to be0.6-2.00 mg/ dL. In both groups, ascorbate situations were on the lower side in our study population. Half of the subjects in group 1 had serum ascorbate situations of 0.61 mg/ dL. In the alternate group (control, group 2) it was0.77 mg/ dL. Angirekula, *et al*. [1] conducted exploration to control serum vitamin C situations in cases with senile cataract, a common preventable source of blindness worldwide. They used an analogous methodology to our study. They find low situations of vitamin C in the cases. They also showed a significant difference between the two groups in terms of vitamin C situations. Our exploration chose the methodology of allocation of successive subjects meeting the addition criteria, the age comparison of subjects in both groups wasn't performed. Thus, although the mean age in group 1 remained 60.96 times and in group 2 it remained 59.66 times, which wasn't considered statistically significant. Still, studies with age- matched groups may have further clinically accurate results than ours, and we suggest the lack of age comparison is a pitfall of our methodology. We set up that the tube position of vitamin C in our study population was on the lower side of the normal range, which was harmonious with the results of Valero MP, *et al*. [18]. Despite the overall lower serum vitamin C position in our study, the odds rate revealed a significant drop in the odds of cataract at situations above 0.6 mg/ dL compared with situations below this arrestment.

A significant difference ($p < 0.05$) was noted when comparing the mean serum levels of vitamin C between subjects in groups 1 and 2. These were consistent with the results of a cross-sectional study conducted in a Chinese population in 2013 [19].

Cataracts can be surgically removed and replaced with an artificial intraocular lens to restore vision, although several individuals remain blind due to a lack of surgical equipment or expensive operating costs. Oxidation of lens proteins and lens opacity [20].

CONCLUSION

In this study, we determined that blood vitamin C may be a preventive factor against cataract development that is likely influenced with vitamin C consumption. As a result, more research in the Pakistani population is needed to determine a minimal level of blood vitamin C, that will enable us formulate a quantity of dietary supplementation that'd postpone the formation of visually significant cataracts.

AUTHORS' CONTRIBUTION

- **Fehmina Nazir**: Concept, Design review.
- **Hafiz Muhammad Jahan Zaib**: Data collection, Literature review, Summarization, Statistical analysis.
- **Nida Armoghan Khan**: Data collection, Statistical analysis, Manuscript preparation.
- **Mariam Noor**: Data collection, Data entry, Review.
- **Amina Khalid**: Data collection, Manuscript preparation, Literature review.

CONFLICT OF INTEREST

Declared none.

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