

## Plasma ascorbic acid levels in patients with subtypes of cataract

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### Abstract

**Objective:** Cataract is a vision impairing disease characterized by gradual, progressive thickening of the lens. It is one of the leading causes of blindness in the world today. Dietary antioxidant vitamins, in particular vitamin C can play a role in preventing the onset or progression of age related cataract. The aim of this study was to determine the plasma ascorbic acid levels in normal individuals and in patients suffering from various subtypes of cataract.

**Method:** The study was carried out on 100 subjects of either sex with the age ranging from 40-70 years. Out of these 50 were Cataract patients attending the Out-patient department (OPD) and wards of Ophthalmology Department, Ram Lal Eye Hospital, Amritsar. Fifty adult patients of either sex suffering from cataract were selected for study. Assessment of activity of disease was done on the basis of clinical signs and symptoms and slit lamp examination. The patients suffering from diabetes mellitus, malignancies, tuberculosis, hypertension, coronary artery disease or the patients taking antioxidant drugs were excluded from the study. It was case-control prospective study. The patients and the controls were screened for plasma ascorbic acid.

**Results:** The mean plasma ascorbic acid level in the test group was 0.60–0.8 mg/dl with mean±S.D of 0.68±0.09 and in control group was from 2.72–0.98 mg/dl with mean±SD of 0.85±0.09 mg/dl. The difference between the levels of control and patients was statistically highly significant with level of plasma ascorbic acid lower in cataract patients as compared to controls. Aging had a reverse relation with plasma ascorbic acid level.

**Conclusion:** This study revealed that plasma ascorbic acid level in cataract patients was lower than normal individuals. Since vitamin C can be made easily available to the elderly population and its beneficial effects popularized through educational and social instructions on the nutritional status of the food we eat, we can make the right decision to prevent or delay the initiation of cataract in developing countries like India.

### Introduction

Cataract is an important visual problem of older people and a substantial health care cost in developing countries like India. Compared to western countries, population-based studies have reported higher prevalence rates of cataract in India even after differing rates of cataract surgery are taken into account<sup>(1-3)</sup>. Many risk factors are known to cause senile cataract and the most important and preventable ones are ultraviolet (UV) rays especially UV-B rays exposure and nutritional deficiencies.<sup>(4,5)</sup>

Vitamin C is considered the most important antioxidant in extracellular fluids and the only endogenous antioxidant that can completely protect the lipids from detectable peroxidative damage induced by aqueous peroxy radical.<sup>(6)</sup> The role of Vitamin C is said to be beneficial for delaying the onset of cataract development in human beings therapeutically as well as nutritionally.<sup>(7)</sup>

Other epidemiologic studies also indicate possible protective roles for nutritional antioxidants in the risk of nuclear cataracts or cataract extraction.<sup>(8-30)</sup>

### Material and Method

The study was carried out on 100 subjects of either sex with the age ranging from 40-70 years. Out of these 50 were Cataract patients in age group 40-70 years, attending the Out-patient department (OPD) and wards of Ophthalmology Department, Ram Lal Eye Hospital

attached to Government Medical College, Amritsar. Fifty adult patients of either sex suffering from cataract were selected for study. Assessment of activity of disease was done on the basis of clinical signs and symptoms and slit lamp examination. The patients suffering from diabetes mellitus, malignancies, tuberculosis, hypertension, coronary artery disease or the patients taking antioxidant drugs were excluded from the study.

It was case-control prospective study. The patients and the controls were screened for plasma ascorbic acid.

The case history was recorded on the proforma and informed consent was taken from all the subjects under study. All the results were compared with those of normal healthy individuals and these results were expressed as mean SD. The comparison was done by using student 't' test on the number of variables for each parameter. The value of significance was evaluated with 'p' value.

**Collection and processing of blood samples:** 6 ml blood was collected in EDTA coated vials and plasma was separated by centrifugation at 3000 rpm for 10 minutes. Plasma Ascorbic acid was estimated by 2, 6 Dichlorophenolindophenol titration method (31) in all the patients and controls. Took 6 ml of blood in a EDTA coated vial separated plasma immediately. Mixed equal volumes i.e. 4 ml of plasma and trichloroacetic acid, centrifuged the test tubes, pipetted 200µl of dye solution

into a test tube and titrated the supernatant until the reddish colour disappeared.

**Calculation:** As 200 µl of dye = 8 µg ascorbate  
 Plasma ascorbate (mg/l) = 16/ml titration.

**Results**

Table 1 shows age-wise distribution of the subjects who were divided into three groups, group I included subjects in the age range of 40-50 years and there are 10 patients in this group. Group II included subjects in the age range of 51-60 years and there were 19 patients in this group. Group III included subjects in the age range of 61-70 years and there were 21 patients in this group.

Table 2 shows the distribution of the control and patients sex wise. There were 24 males and 26 females in the control group. There were 28 males and 22 females in the patients. It was seen that males were more in number as compared to females in the patients group.

Table 3 depicts that plasma ascorbic acid levels amongst controls range from 2.72–0.98 mg/dl with mean±SD of 0.85±0.09 mg/dl while in comparison the corresponding values amongst patients were 0.60–0.8/mg/dl with mean±S.D of 0.68±0.09. The difference between the levels of control and patients was statistically highly significant with level of plasma ascorbic acid lower in cataract patients as compared to controls.

Tables 4 shows the comparison of plasma ascorbic acid levels in male and female, amongst control and patients under study. In control male individuals (n=24) the range was 0.72–0.98 mg/dl with mean±S.D of 0.83±0.09 while levels in male patients range from 0.5–0.8 mg/dl with mean±S.D of 0.67±0.08. The difference between the levels was statistically highly significant. In case of female control (n=26) the levels range from 0.72–0.98 with mean ± S.D of 0.84±0.14 mg/dl while in

female patients (n=22) the levels range from 0.5–0.8 with mean±S.D of 0.69±1.10. The difference between the levels in controls and patients was statistically highly significant (p<0.001). The difference between the levels in males and females was statistically insignificant.

Table 6 shows mean plasma ascorbic acid levels in subtypes of cataract patients. The levels in case of cortical cataract were 0.69±0.09 mg/dl; in case of patients with nuclear cataract the levels were 0.64±1.0 mg/dl while in patients with posterior subcapsular type of cataract the levels were 0.69±0.09. The mean levels were same in case of cortical and posterior subcapsular type of cataract.

**Table 1: Age wise distribution of the subjects**

Group	Age (in years)	Controls	Patients
I	40-50	3	10
II	51-60	18	19
III	61-70	29	21

**Table 2: Sex wise distribution of the subjects**

Subject	Control	Patients
Male	24	28
Female	26	22

**Table 3: Comparison of plasma ascorbic acid level in controls and patients under study**

Subjects	No. of cases	Range ml/dl	Mean	±SD	S.E
Control	50	2.72-0.98	0.85	0.09	0.01
Patients	50	0.60-0.81	0.68	0.09	0.01

t=9.48  
 p<0.001\*  
 \*Highly Significant

**Table 4: Comparison of plasma ascorbic acid levels in male and female groups of controls and patients under study**

Plasma Ascorbic Acid Levels mg/dl								
Controls					Patients			
Sex	No. of Subjects	Range mg/dl	Mean ±SD	S.E	No. of Patients	Range mg/dl	Mean ±SD	S.E
Male	24	0.72-0.98	0.83±0.09	0.02	28	0.5-0.8	0.67±0.08	0.02
Female	26	0.72-0.98	0.84±0.14	0.03	22	0.5-0.8	0.69±1.10	0.23

**Controls**  
 M/F t = 0.30  
 p>0.05 NS

**Patients**  
 M/F t = 0.78  
 p>0.05 NS

**Control vs patients**

Male control/patients t = 6.85 p <0.001 Highly Significant  
 Female control/patients t = 4.25 p <0.001 Highly Significant

**Table 5: Comparison of plasma ascorbic acid in different age groups in control and patients**

Plasma Ascorbic Acid (mg/dl)								
Controls					Patients			
Age group (years)	No. of Subjects	Range	Mean ±SD	S.E	No. of Patients	Range	Mean ±SD	S.E
Group I (40-50)	3	0.82-0.94	0.86±0.07	0.040	10	0.6-0.8	0.69±0.08	0.025
Group II (51-60)	18	0.73-0.95	0.84±0.08	0.018	19	0.6-0.81	0.70±0.08	0.018
Group III (61-70)	29	0.72-0.98	0.86±1.10	0.204	21	0.5-0.8	0.65±0.10	0.021

**Controls**

Group I/II t = 0.41  
 p>0.05 NS  
 Group I/III t = 0.41  
 p>0.05 NS  
 Group II/III t = 0.90  
 p>0.05 NS

**Patients**

Group I/II t = 0.32  
 p>0.05 NS  
 Group I/III t = 1.10  
 p>0.05 NS  
 Group II/III t = 1.73  
 p>0.05 NS

**Control vs patients**

Group I t = 3.29 p <0.01 Significant  
 Group II t = 6.11 p <0.001 Highly Significant  
 Group III t = 7.33 p <0.001 Highly Significant

**Table 6: Mean serum ascorbic acid levels in cataract patients according to type of cataract**

Type of cataract	Mean mg/dl	S.D	S.E
Cortical (n=20)	0.69	0.09	0.02
Nuclear (n=10)	0.64	0.10	0.03
Posterior subcapsular (n=20)	0.69	0.09	0.02

**Discussion**

The potential role of vitamins in preventing cataract is well documented especially ascorbic acid which plays an important part in lens biology, both as an antioxidant and as a UV filter.<sup>(32)</sup>

In our study we observed lower levels of plasma ascorbic acid (p<0.001) in cases as compared to controls (Table 5) which is similar to findings of others.<sup>(33)</sup> Plasma ascorbic acid levels in controls range from 0.72–0.98 mg/dl with mean±S.D of 0.85±0.09 mg/dl while in comparison the levels in patient were 0.60–0.81 mg/dl with mean±S.D. of 0.68±0.09. The difference between the levels of control and patients was statistically highly significant.

Ascorbic acid is considered the most important antioxidant in extracellular fluids and the only endogenous antioxidant that can completely protect the lipids from detectable peroxidative damage induced by aqueous peroxyl radical. Vitamin C acts as a Co-antioxidant by regenerating α-tocopherol from α-tocopheroxyl radical produced during scavenging of ROS.<sup>(34)</sup>

Ascorbic acid has multiplicity of antioxidant property and has been claimed to be most important antioxidant in human beings, because it disappears faster than other antioxidants when exposed to reactive oxygen species.<sup>(35)</sup>

The measurement of serum levels of ascorbic acid is the most commonly used and practical procedure for determining vitamin C nutritional status in individuals or population group.<sup>(36)</sup>

There is protective effect of ascorbate against oxidative stress in the mouse lens. It is seen that presence of high ascorbate appears highly beneficial in protecting the lens against oxidative damage and cataract formation. The findings appear to be significant from the point of view of using this nutrient for delaying the onset of cataract development in human beings therapeutically as well as nutritionally.<sup>(37)</sup>

Plasma ascorbic acid levels in males and females groups of controls and patients were compared (Table 4). The difference between the levels of ascorbic acid in males and females was statistically insignificant.

Plasma ascorbic acid levels of different age groups were compared in controls and patients (Table 5). It was seen that difference between the levels of plasma ascorbic acid in controls and patients in different age groups was statistically highly significant in group I, group II, group III (p<0.001).

Table 6 compares the plasma ascorbic acid levels in cataract patients according to type of cataract. The mean plasma ascorbic acid levels in cortical cataract were 0.69±0.09 mg/dl. In case of nuclear cataract the levels

were  $0.64 \pm 0.10$  mg/dl. The levels were  $0.69 \pm 0.09$  mg/dl in posterior subcapsular cataract cases.

**Jacques et al** reported decreased incidence of PSC with elevated vitamin C levels in blood. The study shows significantly decreased levels of vitamin C in all three morphological types of cataract which may be due to its utilization by counteracting ROS or due to its oxidation by  $O_2^-$ .

Since vitamin C can be made easily available to the elderly population and they can be educated on the beneficial effects of intake of foods rich in antioxidants like fruits and vegetables, we can prevent or delay the initiation of cataract formation.

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