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STUDY OF ROLE OF CIRCULATING ANTIOXIDANTS IN DEVELOPMENT OF SENILE CATARACT

Biochemistry

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ABSTRACT

Introduction: Senile cataract is the commonest worldwide cause of treatable blindness, most often due to excess reactive oxygen species [ROS]. Anti-oxidant vitamins namely beta-carotene, ascorbate and tocopherol and enzymes like superoxide dismutase (SOD), constitute first line defenses against ROS assault, while malondialdehyde (MDA) levels indicate the total burden of lipid peroxidation in-vivo.

Objectives: We aimed to compare the levels of above five analytes in senile cataract patients in contrast to apparently healthy controls and also among smoking and non-smoking sub groups of both cases and controls.

Methods: A hospital-based case-control study, was conducted with 102 cases of senile cataract and 102 control subjects, following strict inclusion and exclusion criteria. Recruited individuals were sub-categorized into smokers and non-smokers. After overnight fasting (12 hours), 10 ml blood was drawn aseptically. Serum and plasma were separated and used for biochemical estimations of all five analytes, following established protocols. Levels were compared between cases and controls as well as between the smoking and non-smoking sub-sections of both groups.

Results: Significantly lower levels of plasma ascorbate and serum tocopherol were seen in cases as compared to controls (P=0.0078 and P<0.0001 respectively). Significantly lower levels of serum beta carotene (P<0.0001), tocopherol (P<0.0001), plasma ascorbate (P<0.0001), and SOD (P<0.0001). Significantly higher level of serum MDA (P= 0.0494) was seen in the smokers, as compared to non-smokers

Conclusions: Lowered serum tocopherol and plasma ascorbate were significant factors leading to senile cataract. Furthermore, smoking was found crucial in loss of anti-oxidant defenses and subsequent development of cataract.

KEYWORDS

Cataract, reactive oxygen species, beta-carotene, ascorbate, malondialdehyde

INTRODUCTION

Age related cataract is the commonest cause of treatable blindness and visual impairment in this world. In India, cataract accounts for almost 81 percent of cases of blindness, largely preventable (India today, 1987). Development of cataract is a multi-factorial event. However, one of the biggest culprits implicated in the development of senile cataract, is excess of reactive oxygen species [ROS]. Under normal circumstances, most of the ROS generated, is taken care of by the antioxidant defenses both exogenous and endogenous. These are constituted largely by enzymes and water and lipid soluble substances and vitamins, all of which act to inactivate free radicals. Usually the cellular milieu is fairly tolerant to mild oxidative stress and is self-reliant in up-regulating the synthesis of antioxidant arsenal, in an attempt to restore the balance. However, severe oxidative stress can lead to major cellular damage viz. DNA damage, raised intracellular free calcium and ferric ions, damage to membrane ion-transporters and outer proteins as well as wide-spread lipid peroxidation. This is in keeping with the quite commonly observed phenomena of increased production of free radicals, antioxidant consumption and oxidation of unsaturated lipids have been observed in several disorders, namely, diabetes mellitus, cardiovascular disorders, cancer and in cataractous lens (Ferrari et al. 1996).

The oxidation of lens proteins by free radicals is believed to play a crucial role in lens opacification (Kahn et al. 1977). Furthermore, lens proteins are susceptible to damaging effects of electromagnetic radiation, ionizing microwaves and infrared rays. There is also plenty of epidemiological evidence supporting the hypothesis that UV radiation from sunlight is an important independent risk factor in causing cataract (Hiller et al. 1977). This hypothesis also falls in concurrence with the observation of gradual yellowing of lens nucleus with ageing (Leman Megaw and Moran 1980).

It has been estimated that if cataracts can be delayed by a mere decade, the need for cataract extractions would be diminished by one half. In addition to considerable financial benefit, a delay in cataractogenesis could also usher in an enhancement in the quality of life as well as productivity, among the middle-aged and geriatric populations (Taylor et al. 1995). Till date there is no medical solution for the affliction. Many of the approaches that have been taken to mitigate the problem have thus been focused around preventive measures and towards delaying its onset and progression.

In this regard, antioxidant enzymes glutathione peroxide (GPX), superoxide dismutase (SOD) and catalase (CAT) form first line of defense against free radical chain reaction. Vitamin-E, Vitamin-C, Beta-carotene and glutathione act as a second line of defense.

In this study the serum levels of dietary antioxidants (Vitamin-E, Vitamin-C, Beta-carotene), were estimated, to assess the role of dietary antioxidant vitamins in prevention of cataractogenesis. Superoxide dismutase (SOD) activity in plasma was also estimated, with the aim to assess its degree of up and down regulation, in presence of concomitant oxidative damage. The serum level of malondialdehyde (MDA) was estimated to study the total burden of lipid peroxidation in vivo, as lipid peroxidation, a key casualty of ROS induced damage, increases serum MDA level in body.

MATERIALS AND METHODS:

Study Design And Subjects:

The study was a hospital-based case-control study, undertaken in the Department of Biochemistry with collaboration of the Department of Ophthalmology, Burdwan Medical College & Hospital, Burdwan, West Bengal during the period January 2003 to February 2004. The patients and controls were selected from outpatient department (OPD) of Ophthalmology, Burdwan Medical College & Hospital, Burdwan, West Bengal. Briefly, 102 patients with established senile cataract, were recruited from the Ophthalmology outpatient department of Burdwan Medical College.Simultaneously, equal number of age and sex matched controls were recruited from the same Ophthalmology

outpatient department. All cases and controls were recruited adhering to set inclusion and exclusion criteria.

Selection Criteria Of Cases And Controls:

Inclusion Criteria:

Those individuals were chosen as cases who met the following inclusion criteria: a. Age between 40 to 75 years b. Both sexes and c. those with established senile cataract of any eye. Controls were age and sex matched individuals attending the Ophthalmology OPD only for correction of refractive errors.

Exclusion Criteria:

a. Individuals with history of diabetes mellitus, hepatic disease, bone disease, renal disease, alcoholism, any other major medical or surgical condition b. Individuals less than 40 and greater than 75 years of age.

Ethical Considerations:

The study was conducted after obtaining clearance from Institutional Ethics Committee. All eligible subjects were provided complete information regarding study and recruited only after obtaining their informed consent for participation.

Collection & Storage of Blood Sample:

After an overnight fasting of 12 hours, 10 ml of venous blood, was drawn using full aseptic measures and after obtaining consent for the same. 6 ml was collected in plain vials and the remainder in EDTA vials. Serum and plasma from respective vials, was separated within an hour, by centrifugation at 2000 g for 10 minutes and stored at -20°Cuntil further use.

Biochemical Investigations Conducted:

The following biochemical parameters were assayed for by standardized protocols: 1. serum beta-carotene, 2. plasma ascorbic acid, 3. serum Tocopherol, 4. plasma superoxide dismutase (SOD) and 5. serum malondialdehyde (MDA) estimation.

A. Estimation Of Serum Beta-carotene: Serum level of beta-carotene was estimated by the Bradley and Hornbeck method (Bradley and Hornbeck 1973). At the time of sample collection, care was taken to avoid hemolysis as well as undue exposure to light. Briefly, a protein free mixture of retinal and carotenes was prepared, by precipitating proteins using 95% ethanol (V/V). The retinal-carotene mixture was extracted into light petroleum. The intensity of the yellow colour due to carotenes was read spectrophotometrically at 450 nm.

Amount of β-carotene per ml was determined as follows:
*µg β-carotene/100ml serum=14gm β-carotene/ml*3*100*

[3.0=volume petroleum ether containing the β-carotene from 1mL of serum after extraction; 100=Conversion factor from µg/ml to µg/dl]

B. Estimation Of Plasma Ascorbic Acid:

Plasma ascorbic acid was estimated by photometric method. Briefly, ascorbic acid in plasma was oxidized by Cu^{2+} to form dehydroascorbic acid, which was subsequently made to react with 2,4 dinitrophenylhydrazine to form a red bis-hydrazine, measured at 520 nm.

C.estimation Of Serum Tocopherol:

Serum Tocopherols can be measured by Baker and Frank method[8] Briefly, tocopherols in serum were estimated by their ability to their reduce ferric iron to ferrous form, which them forms a red complex with αα'-dipyridyl. Tocopherols and carotenes being lipid soluble, were first extracted into xylene and the absorbance was read at 460 nm to measure the carotenes (Gowenlock and Janett 1968). A correction for the carotenes was made after adding ferric chloride and reading final absorbance at 520 nm.

The serum tocopherol was calculated using the following formula:
*Serum Tocopherols(mg/L)=(A' of unknown*10)/A' of standard*
Where $A' = (A_{520} - A_{460})*0.29$

D. Estimation Of Plasma Superoxide Dismutase [SOD]:

SOD estimation was done as described previously (Kakkar et al. 1984). Briefly, the method involved generation of a chromogen using phenazine methosulphate (PMS) and nitroblue tetrazolium (NBT) in presence of SOD enzyme.

The activity of SOD in plasma was calculated as a Percentage of inhibition in mixtures with sample in respect to blank and expressed as unit of enzyme/ml of plasma.

1 unit of activity of SOD was defined as the amount of enzyme that inhibits the rate of reactions by 50% under specified conditions.

Percent inhibition of rate of reaction=[(Blank-Sample)/Blank]*100
50% inhibition =1 unit of SOD
Amount of SOD = X/50 unit/50mL
= Y unit/µl of plasma

E. Estimation Of Serum Malondialdehyde [MDA]:

Polyunsaturated fatty acid reacts with molecular oxygen to undergo destructive free radical mediated anti-oxidation. During this process numerous peroxide and aldehyde compounds are formed. This non-volatile compounds decompose to form MDA during the acid heating in laboratory. MDA reacts with thiobarbituric acid (TBA) is an acidic medium to form a colored product (Dahle et al. 1962).

PUFA
⬇
Endoperoxides
⬇
On heating in acidic medium
⬇
MDA
⬇
Addition of TBA and heating
⬇
Colored Compound
⬇
Extracted in Butanol
⬇
Measured by spectrophotometer at 532 nm

Statistical Analyses:

All statistical test were performed using Graphpad Prism v.5.0. The data were expressed as Mean±S.D. the normality of the sample distribution was tested by D'Agostino & Pearson omnibus normality test. As the levels of the tested analytes in both the case and control populations did not follow Gaussian distribution, for comparison of analyte levels (serum bet-carotene, plasma ascorbic acid, serum tocopherol, plasma SOD and serum MDA) between cases of senile cataract and age and sex-matched apparently healthy controls, Mann Whitney U test was applied. For comparison of the analyte levels across four sub-groups (smoker cases, non-smoker cases, smoker controls and non-smoker controls) Kruskal-Wallis test was applied. In all statistical analyses a P value of <0.05 was considered statistically significant.

RESULTS

***Patient Profile*:**

A total of 102 patients with senile cataract, were recruited into the study, according to the set inclusion and exclusion criteria, after obtaining informed consent. Simultaneously 102 age and sex matched controls were also recruited into the study. In both groups majority of the individuals were males **[Table 1].** Among the cases 48 were smokers while 41 out of the total recruited control individuals indulged in smoking**[Table 1].**The serum levels of all the biomarkers under study were estimated in all recruited cases and controls and tabulated separately for both smokers and non-smokers. **Table 2** depicts the mean levels of the studied biomarkers in smoker and non-smoker subsets among cases and controls.

Table 1 : General Characteristics Of Cases Of Senile Cataract And Apparently Healthy Controls Along With Their Serum Levels Of Beta Carotene, Tocopherol, Malondialdehyde (MDA) And Plasma Levels Of Ascorbic Acid And Superoxide Dismutase (SOD)

		Parameters (Mean ± SD)									
Cases of senile cataract		Serum beta-carotene (mcg/dl)		Plasma ascorbate (mg/dl)		Serum tocopherol (mg/dl)		Plasma superoxide dismutase (IU/ml)		Serum malonaldehyde (nmol/ml)	
Smoker	Non-smoker	115.7 ± 28.11	138.9 ± 58.7	0.36 ± 0.07	0.48 ± 0.09	6.7 ± 1.3	7.8 ± 1.9	2.9 ± 0.60	3.9 ± 0.54	7.1 ± 1.6	6.3 ± 1.2

Age & sex matched controls		Serum beta-carotene (mcg/dl)		Plasma ascorbate (mg/dl)		Serum tocopherol (mg/dl)		Plasma superoxide dismutase (IU/ml)		Serum malonaldehyde (nmol/ml)	
Smoker	Non-smoker	121.3 ± 17.33	134.5 ± 15.20	0.39 ± 0.07	0.49 ± 0.08	7.6 ± 1.7	9.8 ± 1.9	3.0 ± 0.29	3.8 ± 0.43	7.1 ± 1.3	7.0 ± 1.1

Table 2 : Mean Levels Of Serum Of Beta Carotene, Tocopherol, Malondialdehyde (MDA) And Plasma Ascorbic Acid And Superoxide Dismutase (SOD) Among Smoker And Non-smoker Sub-sections Of Both Cases Of Senile Cataract And Age And Sex-matched Apparently Healthy Controls.

Parameters	Cases of senile cataract	Controls
Number	102	102
Gender (M/F)	57/45	54/48
Age in years (Mean ± SD)	61.5 ± 5.5	54 ± 8.2
Smoker/Non-smoker	48/54	41/61
Serum beta carotene [Range,(Mean ± SD)]	[30 - 500, (128 ± 48.07)] mcg/dl	[68 -220,(129.2 ± 17.29) mcg/dl
Plasma ascorbic acid [Range,(Mean ± SD)]	[0.24 - 0.71, (0.42 ± 0.01) mg/dl	[0.28 - 0.68, (0.45 ± .01) mg/dl
Serum tocopherol [Range,(Mean ± SD)]	[2.2 - 15, (7.28 ± 1.79)] mg/dl	[3.2 - 15.6, (8.95 ± 2.12)] mg dl
Plasma SOD [Range,(Mean ± SD)]	[2.2 - 4.8, (3.43 ± 0.73)] IU/ml	[2.1 - 4.7, (3.51 ± 0.05)] IU/ml
Serum MDA [Range,(Mean ± SD)]	[3.75 - 10.2, (6.71 ± 1.43)] nmol/ml	[4.25 - 10.2, (7.05 ± 1.22) nmol/ml

Association between occurrence of senile cataract and serum level of beta carotene:

The serum beta carotene level was assessed in cases of senile cataract as well as in age and sex matched controls.**Table 1** summarizes the comparison of beta carotene levels among cases and age & sex matched controls, and separately among the smokers and non-smoker sub-groups of both segments **[Table 2].** While no significant difference in the serum level of beta carotene among cases and controls **[Fig 1A],** there was a significant difference in serum levels between the smoker and non-smoker sub-groups both for cases of senile cataract as well as age & sex matched controls **[Fig 2A].**

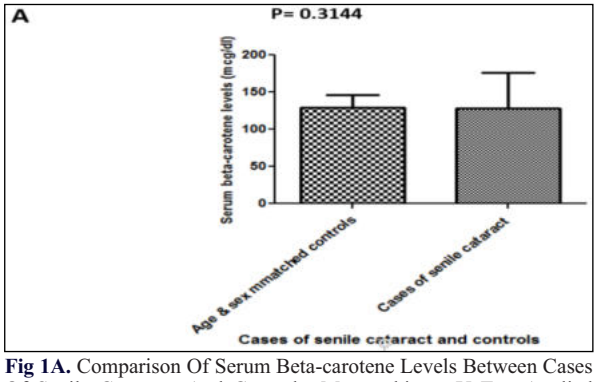

Fig 1A. Comparison Of Serum Beta-carotene Levels Between Cases Of Senile Cataracts And Controls. Mann-whitney U Test Applied Between Two Groups. No Significant Difference Noted In Serum Beta-carotene Levels Between Two Groups (P= 0.3144)

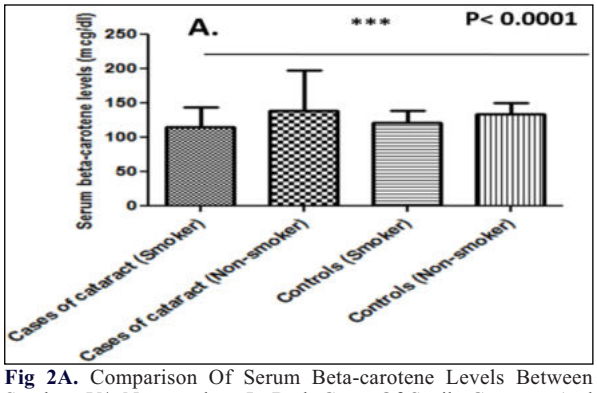

Fig 2A. Comparison Of Serum Beta-carotene Levels Between Smokers V/s Non-smokers In Both Cases Of Senile Cataracts And Controls. Kruskal-wallis Test Applied Across Groups. Significantly Lower Levels Of Serum Beta-carotene Observed In Smoking Sub-section Of Cases And Controls In Comparison To Non-smokers (P<0.0001)

Association Between Occurrence Of Senile Cataract And Plasma Level Of Ascorbic Acid :

The plasma ascorbic acid level was assessed in cases of senile cataract as well as in age and sex matched controls. **Table 1** summarizes the comparison of ascorbic acid levels among cases and age & sex matched controls, and separately among the smokers and non-smoker sub-groups of both segments **[Table 2].**The plasma level of ascorbic acid was found to be significantly lower in cases of senile cataract as compared toage & sex-matched controls **[Fig 1B].**In addition, significantly lower plasma levels weredetected in the smoker sub-groups both for cases as well as controls, in contrast to their non-smoker counterparts **[Fig 2B].**

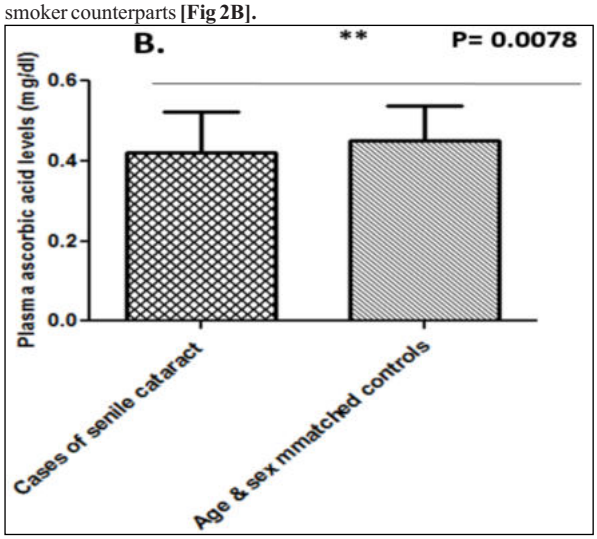

Fig 1B. Comparison Of Plasma Ascorbic Acid Levels Between Cases Of Senile Cataracts And Controls. Mann-whitney U Test Applied Between Two Groups. Significantly Lower Levels Of Plasma Ascorbic Acid Seen In Cases As Compared To Controls. (p= 0.0078)

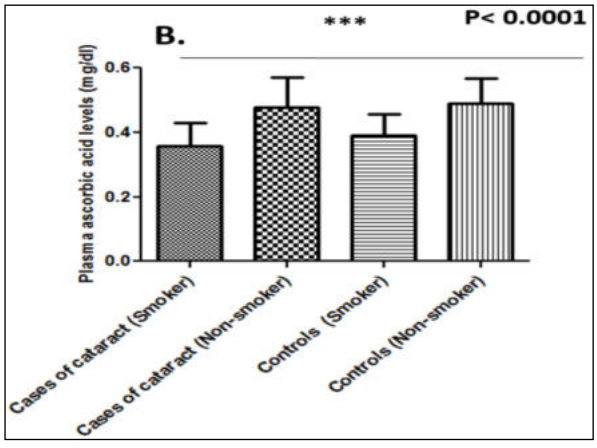

Fig 2b. Comparison Of Plasma Ascorbic Acid Levels Between Smokers V/s Non-smokers In Both Cases Of Senile Cataracts And Controls. Kruskal-wallis Test Applied Across Groups. Significantly Lower Levels Of Plasma Ascorbic Acid Observed In Smoking Sub-section Of Cases And Controls In Comparison To Non-smokers (p<0.0001)

Association Between Occurrence Of Senile Cataract And Serum Level Of Tocopherol :

The serum tocopherol level was assessed in cases of senile cataract as well as in age and sex matched controls. **Table 1** summarizes the comparison of tocopherol levels among cases and age & sex matched controls, and separately among the smokers and non-smoker sub-groups of both segments **[Table 2].**A significant difference was found to exist between in the serum level of tocopherol among cases and controls **[Fig 1C],** there was a significant difference in serum levels

between the smoker and non-smoker sub-groups both for cases of senile cataract as well as age & sex matched controls **[Fig 2C].**

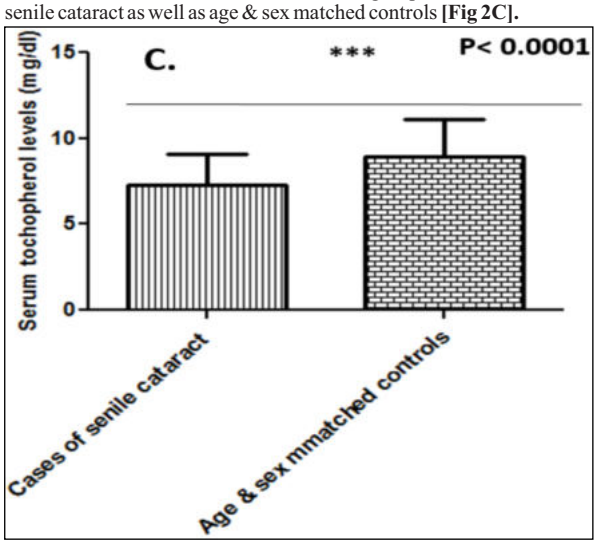

Fig 1c. Comparison Of Serum Tocopherol Levels Between Cases Of Senile Cataracts And Controls. Mann-Whitney U Test Applied Between Two Groups. Significantly Lower Levels Of Serum Tocopherol Seen In Cases As Compared To Controls. (p<0.0001)

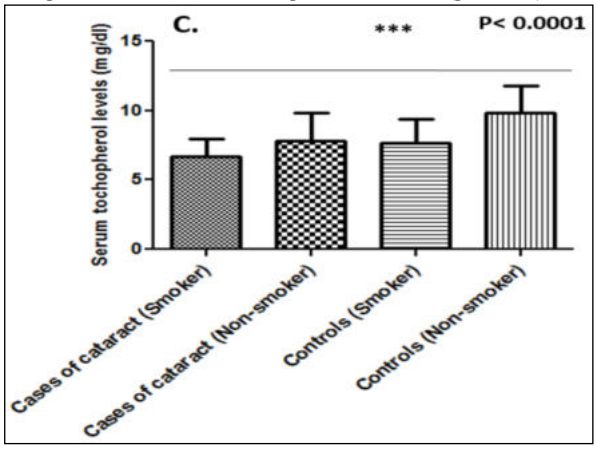

Fig 2c. Comparison Of Serum Tocopherol Levels Between Smokers V/S Non-smokers In Both Cases Of Senile Cataracts And Controls. Kruskal-wallis Test Applied Across Groups. Significantly Lower Levels Of Serum Tocopherol Observed In Smoking Sub-section Of Cases And Controls In Comparison To Non-smokers (P<0.0001)

Association between occurrence of senile cataract and plasma level of superoxide dismutase [SOD]:

The plasma superoxide dismutase level was assessed in cases of senile cataract as well as in age and sex matched controls. **Table 1** summarizes the comparison of superoxide dismutase levels among cases and age & sex matched controls, and separately among the smokers and non-smoker sub-groups of both segments **[Table 2].** A significant difference was found to exist between the plasma level of superoxide dismutase among cases and controls **[Fig 1D],** there was a significant difference in serum levels between the smoker and non-smoker sub-groups both for cases of senile cataract as well as age & sex matched controls **[Fig 2D].**

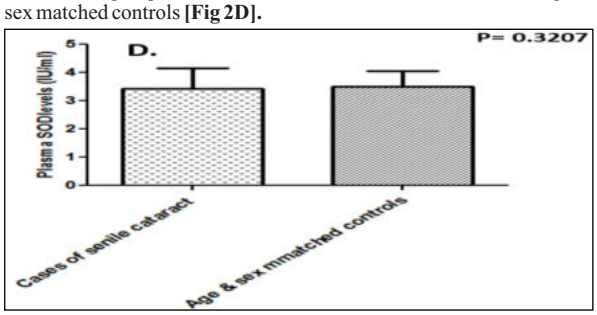

Fig 1D. Comparison Of Plasma Superoxide Dismutase (SOD) Levels Between Cases Of Senile Cataracts And Controls. Mann-whitney U Test Applied Between Two Groups. No Significant Difference Noted In Plasma Sod Levels Between Two Groups (P= 0.3207)

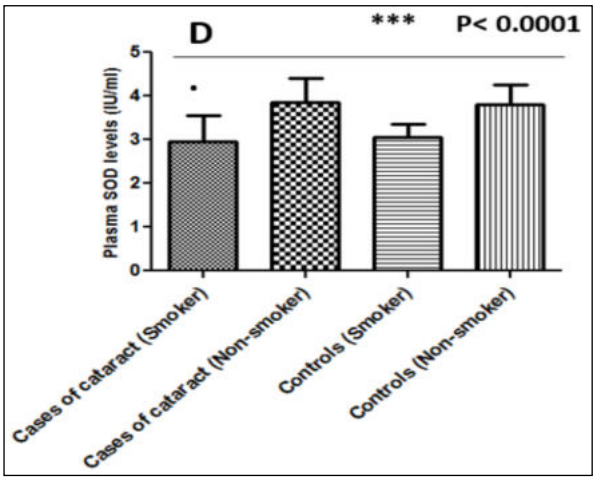

Fig 2D. Comparison Of Plasma Superoxide Dismutase (SOD) Levels Between Smokers V/s Non-smokers In Both Cases Of Senile Cataracts And Controls. Kruskal-wallis Test Applied Across Groups. Significantly Lower Levels Of Plasma Sod Observed In Smoking Sub-section Of Cases And Controls In Comparison To Non-smokers (P<0.0001)

Association Between Occurrence Of Senile Cataract And Serum Level Of Malondialdehyde [MDA]:

The serum malondialdehyde level was assessed in cases of senile cataract as well as in age and sex matched controls. **Table 1** summarizes the comparison of malondialdehyde levels among cases and age & sex matched controls, and separately among the smokers and non-smoker sub-groups of both segments **[Table 2].** A significant difference was found to exist between the serum level malondialdehyde among cases and controls **[Fig 1E],** there was a significant difference in serum levels between the smoker and non-smoker sub-groups both for cases of senile cataract as well as age & sex matched controls **[Fig 2E].**

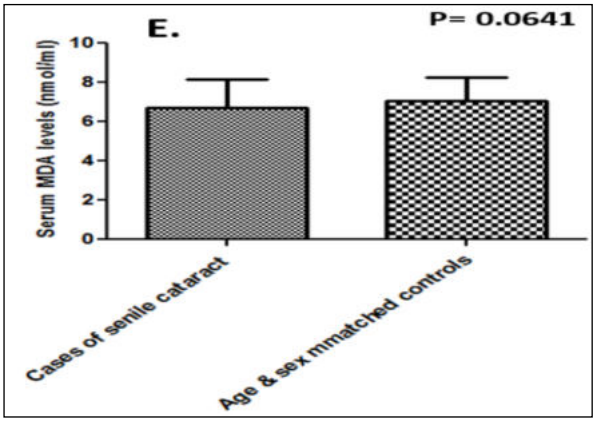

Fig 1e. Comparison Of Serum Malondialdehyde (MDA) Levels Between Cases Of Senile Cataracts And Controls. Mann-whitney U Test Applied Between Two Groups. No Significant Difference Noted In Serum Mda Levels Between Two Groups (P= 0.0641)

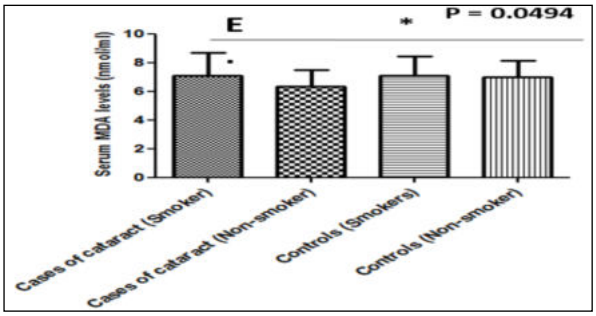

Fig 2e. Comparison Of Serum Malondialdehyde (MDA) Levels

Between Smokers V/S Non-smokers In Both Cases Of Senile Cataracts And Controls. Kruskal-wallis Test Applied Across Groups. Significantly Higher Levels Of Serum MDA Observed In Smoking Sub-section Of Cases And Controls In Comparison To Non-smokers (P= 0.0494)

DISCUSSION:

Age is the single most crucial deciding factor in senile cataract and this is corroborated well from the epidemiological point of view (Cumming et al. 1997). However, if appropriate nutritional supplementations can be started at early age, it often becomes possible to defer senile cataract by upto ten years (Harman 1993). This often sadly lacking in the vast majority of population, particularly in developing countries such as ours. Our study, conducted in a tertiary care hospital of India, where subjects between ages of 40 to 75 years were included, exhibited most study subjects to be in their sixth decade, with mean age being 61.5 ± 5.5 years as opposed to controls (54 ± 8.2 years).

This propensity to cataract formation in the geriatric population might be directly related to duration of exposure to sunlight and breakdown of antioxidant defense mechanism of body inclusive of lens (Cumming et al. 1997). Moreover the effective cumulative duration of smoking increased with increased lifespan, which subsequently influenced the development of cataract (Klein et al. 1994). To probe into the effect of smoking on development of senile cataract, we sub-classified both the study as well as control populations into smokers and non-smokers.

In our study, 47.0% (48/102) of study subjects turned out to be smokers as opposed to 40.0% (41/102) of age and sex-matched apparently healthy controls. Furthermore we found significantly lower levels of our tested analytes viz. serum beta-carotene (P<0.0001), plasma ascorbic acid (P<0.0001), serum tocopherol (P<0.0001), and plasma superoxide dismutase (P<0.0001), in smoker sub-sections of both study subjects and controls as compared to their non-smoking counterparts.

However in case of the serum malondialdehyde (MDA), we found a significantly higher level in both of the smoking sub-sections, as compared to the non-smokers (P=0.0494). The reason for the unexpectedly higher level of MDA in smokers is attributable to the fact that MDA is produced as a result of degradation of poly unsaturated fatty acids (PUFAs) by ROS assault. MDA is known to act as a direct biomarker of oxidative stress, which in turn is far more in smokers vis-a-vis non-smokers (Nagaraj et al. 2014). In cataractous lenses very high levels of MDA level are often observed which in turn might be the result of lipid peroxidation of lens membrane produced locally or might be as a consequence of migration of lipid peroxidation product from the retina which was very rich in polyunsaturated fatty acids (Ozmen et al. 1997).

However, when the individual analyte levels were compared between the total study population and the total number of controls (102 in each group), it was seen while the mean level of all analytes was lower in cases of senile cataract, only in case of plasma ascorbic acid (P=0.0078) and serum tocopherol (P<0.0001), the levels in cases were significantly lower as opposed to controls.

One study by Paul et al showed that prevalence of nuclear opacification to be significantly less with high dietary intake of vitamin C (P<0.001) and vitamin E (P=0.02). The same study plasma also demonstrated adequate serum levels of these vitamins as protective against development of nuclear opacities (Jacques et al. 2001). Another study exhibited that long term intake of antioxidant vitamins and carotenoids reduced the prevalence of cortical and posterior sub capsular cataract (Taylor et al. 2002).

However, lower level of the other analytes in the cases, although not significant, can be indicative of disease progression, especially in the setting of certain mineral deficiencies namely zinc. The enzyme requires zinc for its optimum activity (Rotilio et al. 1972). A case in point is that of plasma level of SOD. In our study, mean level of plasma SOD in cases was found to be 3.43 ± 0.73 IU/ml while that of controls was found to be 3.51 ± 0.05 IU/ml. One study has established the normal reference interval for plasma SOD in individuals between 40 to 70 years of age as ranging between 13.24±1.68 units/ml (Kim et al. 1986).

In our study the actual range for plasma SOD, for cases of senile cataract was much lower (2.2 - 4.8 IU/ml), with significantly lower values (P<0.0001), in the smoking subsection (2.9 ± 0.60 IU/ml) than in the non-smoking section (3.9 ± 0.54IU/ml). Added to the oxidant stress brought about by smoking, levels of the enzyme can actually be lowered even more in the presence of zinc deficiency (Rotilio et al. 1972). Depletion of SOD activity might be primarily due to inadequate availability of zinc in blood enzymes. This has been confirmed by one clinical study by Ozmen D et al in the year 1997 that supplementation of zinc could help by increasing erythrocyte SOD levels in smokers and aged individuals. Diminution in sight also may be due to the competition with cadmium as the latter was reported to accumulate in the lens of the smoker (Valero et al. 2001).

One double blinded study conducted by W. Christen et al in 2002, observed no effect of β-carotene supplementation on the development of cataract but significant impact of smoking on β-carotene levels (Christen et al. 2002). Our study too showed no significant differences in serum beta-carotene levels among cases of senile cataract and controls (P=0.3144), although significantly lower levels were seen among smoker sub-sections of both cases and controls as compared to their non-smoking counterparts(P<0.0001).

CONCLUSIONS:

Our study thus revealed that barring ageing, lowered serum vitamin E (Tocopherol) and plasma vitamin C (Ascorbate) levels were the two most important factors leading to development of senile cataract. Furthermore, a smoking habit was found to be one of the most important factors for oxidant stress and as subsequent development of cataract, with practically all protective antioxidant levels getting significantly reduced in habitual smokers.

Conflict Of Interest:

The authors declare they have no conflicts of interest.

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