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Original Research Article

Role of Biochemical Markers for Evaluation of Oxidative Stress in Diabetic Cataract

Kim Sharma[1*], Dr. Yogita Soni[2]

[1]Ph.D. Scholar, Department of Biochemistry, Sardar Patel Medical College, Bikaner, Rajasthan, India
[2]Senior Professor and Head, Department of Biochemistry, Sardar Patel Medical College, Bikaner, Rajasthan, India

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***Corresponding author:** Kim Sharma

Abstract

Background: -Ocular complications are common in diabetes and cataract becomes the major cause of blindness in diabetic patients**.** ***Objective*****:** Oxidative stress was assessed by estimating lipid peroxidation product (LPO) in the form of MDA and non-enzymatic antioxidant vitamins C in the serum. ***Methodology:*** A number of 100 cases of diabetic cataract in the age group of 45-70 years, compared with 100 healthy controls. ***Results:*** Serum levels of MDA and Vitamin C between cataract cases and control groups were found to be statistically significant (P<0.0001). ***Conclusion:*** The present study revealed that low levels of antioxidants and increased oxidative stress may have a role to play in the etiopathogenesis of the diabetic cataract.

Keywords: Oxidative stress, Antioxidant, Diabetic cataract, MDA, Vitamin C.

INTRODUCTION

Cataract is considered a prime cause of visual impairment in diabetic patients as the prevalence and development of cataracts is increased in patients with diabetes mellitus [1]. The association between diabetes and cataract formation has been proven in clinical epidemiological and basic research studies. Due to rising numbers of type 1 and type 2 diabetics worldwide, the prevalence of diabetic cataracts steadily increases [2].

Visual power of an eye is affected by cataract, and so working and living of someone with cataract condition is hampered. Both diabetes and cataract pose a massive health and economic burden, mainly in developing countries, where treatment of diabetes is inadequate and cataract surgery is often difficult to get to [3].

There are multiple mechanisms proposed for pathogenesis of diabetic cataracts like the excess formation of free radicals and oxidative stress, anomalous glycations, advanced glycation end products formation, and increased sorbitol formation in the lens [4, 5].

Lipid peroxidation can be defined as the oxidative deterioration of lipids having any number of carbon-carbon double bonds. Lipid peroxidation is a normal process that takes place constantly at low levels in all cells and tissues. These peroxidation reactions are partly toxic to cell and membrane; as the cell membrane consists for the most part of lipids, uncontrolled lipid peroxidation converts polyunsaturated fatty acids (PUFA) present in the cell membrane to the primary product of lipid hydroperoxides and to secondary metabolites such as malondialdehyde and thus, causing cell injury and death via DNA strand breakage and membrane damage [6]. Malondialdehyde (MDA) is the significant indicator of lipid peroxidation [7]. This aldehyde is considered a convenient and appropriate marker of the peroxidation process [8].

Cellular defense mechanism plays a vital role in defense against cataractogenesis, because it protects the lens against the harmful effects of oxidative insult [9]. Antioxidants are compounds that clear out, scavenge and suppress the free radicals formation or oppose their actions [10].

Vitamin C is also an effective antioxidant soluble in water, so gets distributed to all parts of the body. Vitamin C has been suggested to make a contribution up to 24% of the total peroxy radicals trapping antioxidant activity in human plasma. Vitamin C acts as an antioxidant in biological fluids which scavenges reactive oxygen and nitrogen species [11].

MATERIAL AND METHODS

The study group consisted of 100 patients with diabetic cataracts. The control group consisted of 100 healthy subjects. Patients were randomly selected irrespective of their caste and creed.

Protocol of Study -These were the following conditions to select patients suitable for this study.

Inclusion criteria

1. Patients diagnosed as a case of diabetic cataract.
2. Normal healthy individuals as the control group.
3. Age group of 45 to 70 years.

Exclusion criteria

1. Participants taking alcohol, tobacco, oral contraceptives, and hormone replacement therapy.
2. Cataract due to any other etiology like trauma, radiation therapy, etc.
3. Any systemic diseases like hypertension, liver disease and acute or chronic renal failure, gout, rheumatoid arthritis were excluded from the study.
4. Any H/O drug intake like steroids, chemotherapy, and vitamin supplements that affect levels of antioxidant status were excluded from the study.

Measurements

Blood samples were obtained by vein puncture and collected in a clean dry centrifuge tube. Standard precautions for biochemical determination were taken, hemolysed samples were discarded. The blood was centrifuged at 3000rpm for 10 minutes and serum was separated and analyzed for Malondialdehyde (MDA) and Vitamin C.

MDA: MDA was estimated in serum according to the method of Buege and Aust [12]. Values were expressed in nmol/ml.

Vitamin C: Vitamin C was estimated in serum according to the method of Roe and Kuethe's [13], using 2, 4- di nitro phenyl hydrazine. Values were expressed in mg/dl.

STATISTICAL ANALYSIS

The data for biochemical analysis were expressed as mean ± SD. Student t-test was used to determine the significance of biochemical parameters between the patient and control groups. A p-value of <0.05 was considered significant.

RESULTS

Serum lipid peroxide concentration in the form of MDA was significantly increased in the diabetic cataract patients ($p<0.0001$) as compared with controls. The level of non-enzymatic antioxidant Vitamin C was significantly decreased in cataract patients ($p<0.0001$) compared to that in the controls (Table1).

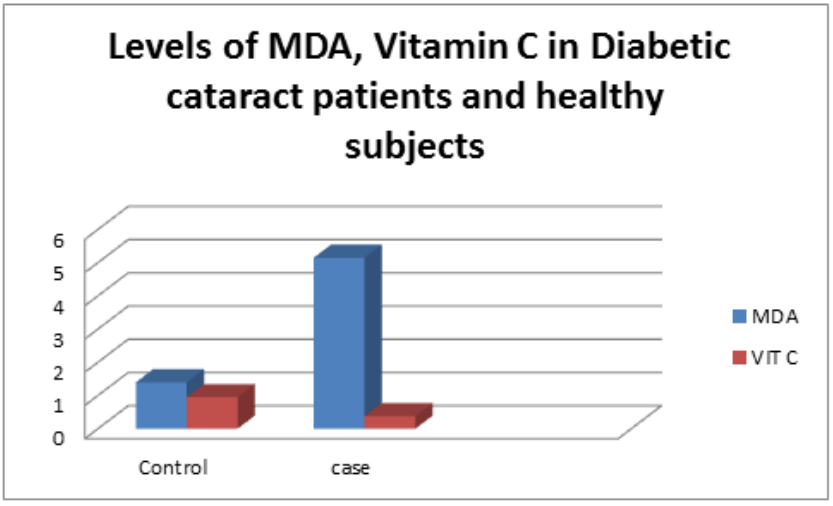
Table-1: Levels of MDA, Vitamin C in Diabetic cataract patients and healthy subjects

Parameter (unit)	Control n=100	Cases n=100	p-value
MDA (nmol/ml)	1.40±0.54	5.15±0.94	<0.0001(HS)
Vitamin C (mg/dl)	0.95±0.25	0.38±0.10	<0.0001(HS)

n= Number of cases or control groups

HS=highly significant

All values are expressed in mean ± SD



DISSCUSSION

The study had shown certain significant findings. Malondialdehyde the indicator of lipid peroxidation (LPO) was significantly elevated in diabetic cataracts when compared with the control group, suggesting that increased MDA and LPO may be considered as indicators of cataract formation. Prajna D'Silva *et al.* [14] reported a significant increase in

serum levels of lipid peroxidation products in the form of malondialdehyde in diabetic cataracts with respect to control groups.

Our findings in serum MDA follow similar trends as observed by Ghazala *et al*. [15] and Syeda Shahana Jalees *et al*. [16] Increased LPO was also observed in lens of cataract patients by Babizhayev *et al*. [17].

The increased levels of lipid peroxidation product (MDA) in diabetes are due to increased production of reactive oxygen species caused by hyperglycemic status, hyper insulemia and hyper lipidemia which are commonly associated with diabetes [18, 19].

Vitamin C levels in plasma were significantly decreased in diabetic cataracts when compared with control groups (P<0.0001). The dietary antioxidants vitamin C levels were significantly decreased in diabetic cataract patients may be due to increased oxidative stress. 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 peroxyl radical. Vitamin C acts as a co-antioxidant by regenerating α-tocopherol from α-tocopheroxyl radical produced during the scavenging of ROS [20].

A Study by Valero and co-workers observed that high plasma level of vitamin was associated with reduced risk of cataract in a Mediterranean population characterized by high intake of vitamin C. Studies suggest protective role of vitamin C on the ageing lens [21]. Level of vitamin C in serum was below normal in cataract patients, and the level was lowest in low-income patients [22].

The results of the present study related to low serum vitamin C level were similar with findings obtained by Ghazala *et al*. [15] and Prajna D'Silva *et al*. [14]. The decreased levels of vitamin C in diabetic cataract may be due to its utilization by counteracting ROS [23].

CONCLUSION

In conclusion, the present data indicate that oxidative stress as measured by pro-oxidant and antioxidant levels in blood may play an important role in diabetic cataract development. Antioxidant therapy may have a role to play in delaying the onset and progression of diabetic cataract.

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