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Original Research Article

Oxidative stress and antioxidant vitamins in cataract patients

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ABSTRACT

Background: In Pakistan age related vision disturbances are mainly due to cataract. Various studies have reported relationship of ocular lesion with senile changes and diabetes mellitus resulting in reduced quality of life due to vision. Oxidative stress is an important factor in the process of cataractogenesis. The pathogenesis of the cataract may involve decreased activity of antioxidant scavenging system which includes non-enzymatic natural antioxidants as biomolecules such as carotenoids and vitamins. So, it is planned to investigate the level of serum antioxidant vitamins in diabetic cataract patients and in non-diabetic cataract patients.
Methods: The study was conducted at Biochemistry department, Al-Tibri Medical College Karachi from October 2016 to October 2017. Ninety pre diagnosed cataract patients were selected from Al-Ibrahim Eye Hospital Karachi 40 normal control subjects were selected from the same population with same socioeconomic group. The demographic data was analyzed. The random blood sugar, antioxidant vitamins (C, A and E) and malondialdehyde were analyzed in the blood sample of control and cataract patients. The data was analyzed by SPSS version 20.
Results: There was no significant difference in the level of vitamin C, A, E and MDA between diabetic and non-diabetic cataract patients, but the blood levels of vitamins of control are higher as compared to the cataract patients. The level of MDA is significantly high in cataract patients as compared to control. Antioxidant vitamin E was negatively correlated with serum malondialdehyde in cataract patients.
Conclusions: It is concluded that in diabetic and non-diabetic cataract low level of serum antioxidant vitamins may be a contributory factor for cataractogenesis.

Keywords: Diabetic cataract, Malondialdehyde, Non-diabetic cataract, Oxidative stress, Vitamin A, Vitamin C, Vitamin E

INTRODUCTION

The senile cataract is the main cause of blindness all over the world.[1] The incidence of cataract is higher in developing countries including India and China.[2,3] The pathogenesis of cataract involves decreased activity of antioxidant scavenging system, high lipid per oxidation and non-enzymatic glycosylation.[4] It was reported that cataract was four times more common in diabetics as compared to non-diabetics in Pakistan.[5] Hyperglycemia also leads to increased reactive oxygen species (ROS) generation.[6] The lens crystalline structure undergo oxidative stress which may damage the crystalline proteins, lipids and nucleic acid.[7] The pathogenesis in the complications of ocular lesions among the ageing and diabetic patients is, whether similar or not, is yet to be explored.

Effective removal of the reactive oxygen species can be achieved by a number of enzymatic and non-enzymatic antioxidant mechanisms.[8] Non enzymatic antioxidant

includes vitamin C, A and E, glutathione, carotenoids and metal ions e.g. copper, Zinc and selenium. Lipid peroxidation, which generate free radicals, may be prevented by intake of antioxidant vitamins namely vitamin C and E, but their efficacy as anti-cataract vitamins is still to be investigated.[9]

In Pakistan cataract evolve earlier in life and the people are more exposed to excessive sun-light so the present study is aimed to estimate the status of blood antioxidants vitamins (C, A, and E) in ageing cataract both in diabetic and non-diabetic cataract patients, and the level of these vitamins will be correlated with the parameter of oxidative stress, malondialdehyde (MDA).

METHODS

It is a cross sectional, analytical comparative study. The pre diagnosed ninety diabetic and non-diabetic cataract patients (male 69, female 21) were selected from Al-Ibrahim Eye Hospital Karachi, during October: 2016 to October 2017. The approval for voluntary participation in the study was taken from healthy control and cataract patients. The ethical approval for the study was taken from the ethical committee of Isra University, Hyderabad. The diabetic and non-diabetic patients of age more than 40 years were included in the study. Whereas the persons below 40 years and having any other eye disease were excluded from the study. Forty healthy normal control subjects (male 20, female 20) without any disease were included in the study.

The demographic measurements and blood pressure of control and patients were taken. The BMI was calculated. After a written consent 10 ml blood sample was drawn out from each normal control and the cataract patients. The blood was analyzed for sugar by glucose oxidase kit method. (Kit supplied by Merk Pvt. Ltd. Pakistan). The serum vitamins A and E was analyzed by Kit supplied by glory science Co Ltd catalog 11345. The serum vitamin C and serum malondialdehyde was analyzed by Kit supplied by DRG. International USA (Reg: ENZ-4888). The data was analyzed by SPSS version 20. P-value ≤0.05 was taken as significant.

RESULTS

The age of control subject is less than the cataract patients but there is no statistical difference between diabetic and non-diabetic patients. The BMI of cataract patients is higher as compared to control subjects. The blood pressure of diabetic cataract and non-diabetic cataract patients is significantly high as compared to control normal subjects (Table 1). The random blood sugar is high as compared to control in diabetic and non-diabetic cataract patients. There was no significant difference in the blood level of vitamins C, A, E and malondialdehyde between diabetic and non-diabetic cataract patients but the levels of vitamins of control is higher as compared to the cataract patients in both diabetic and non-diabetics. The level of serum malondialdehyde in normal control is significantly low as compared to cataract patients (Table 2). The serum level of antioxidant vitamin E showed a negative correlation with serum malondialdehyde whereas vitamin A and vitamin C had shown no correlation with serum malondialdehyde (Figure 1).

Table 1: Demographic variables and blood pressure of control and cataract patients.

Variable	Groups	Mean±SD	95% confidence interval		F-value	P-value
			Lower boundary	Upper boundary		
Age (Year)	Control Subject	52.50±9.71	49.39	55.60		
	Cataract	61.19±5.65	59.44	62.92	12.540	0.001
	Diabetic Cataract	56.09±8.12	53.70	58.46		
BMI (kg/m^2)	Control Subject	20.63±4.87	19.06	22.18		
	Cataract	24.25±4.93	22.86	25.92	11.609	0.001
	Diabetic Cataract	25.18±4.06	23.98	26.36		
Systolic blood pressure (mmHg)	Control Subject	121.83±10.38	118.50	125.14		
	Cataract	132.79±22.18	126.18	139.85	6.613	0.002
	Diabetic Cataract	135.91±20.77	129.81	142.01		
Diastolic blood pressure (mmHg)	Control Subject	78.63±9.06	75.72	81.52		
	Cataract	81.37±9.98	78.30	84.44	3.059	0.050
	Diabetic Cataract	84.13±11.64	80.71	87.54		

p- Value ≤0.05 is Significant as compared to control

Table 2: Serum random blood sugar (RBS), malondialdehyde (MDA), vitamin C, A and E in control, and cataract patients.

Variable	Groups	Mean±SD	95% confidence interval		F-value	P-value
			Lower boundary	Upper boundary		
RBS mg/dl	Control	124.75±9.47	121.72	127.77	20.297	0.001
	Cataract	112.58±34.55	101.88	123.18		
	Diabetic cataract	167.19±62.42	148.86	185.51		
MDA µM/L	Control	1.59±0.44	1.44	1.72	12.642	0.001
	Cataract	3.37±2.24	2.63	4.00		
	Diabetic cataract	3.60±2.48	2.86	4.34		
Vitamin C µM/L	Control subject	41.45±9.71	38.34	44.55	10.640	0.001
	Cataract	32.15±16.62	27.59	37.86		
	Diabetic cataract	28.81±11.26	25.49	32.11		
Vitamin A µM/L	Control subject	1.24±0.41	1.10	1.36	11.986	0.001
	Cataract	1.00±0.36	0.73	0.90		
	Diabetic cataract	0.98±0.45	0.85	1.11		
Vitamin E µM/L	Control subject	15.65±3.88	14.41	16.89	15.224	0.001
	Cataract	12.34±3.14	9.91	12.53		
	Diabetic cataract	11.24±4.27	11.44	13.32		

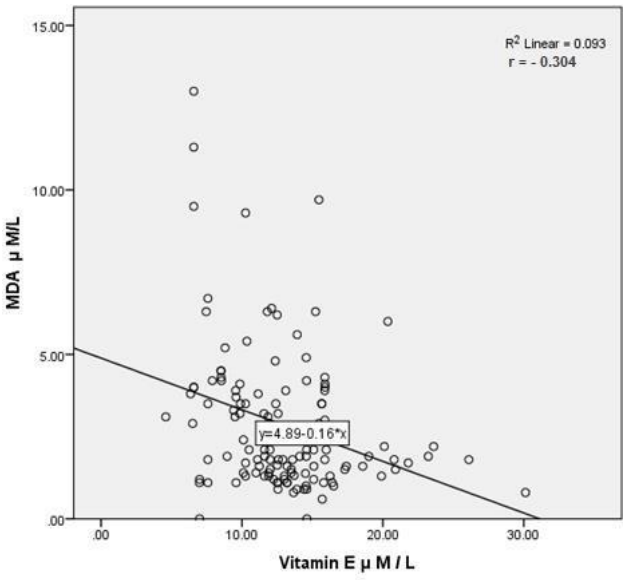

Figure 1: Correlation of serum MDA with vitamin E, in cataract patients.

DISCUSSION

The present study includes normal control subjects and 47 diabetic cataract and 43 non diabetic cataract patients. The mean age of the three groups of patients in the present study were 52.50±9.71 years controls, 61.19±5.65 years cataract patients without diabetes mellitus and 56.09±8.12 years cataract persons having diabetes mellitus. Cheng et al, reported the mean age of 67.92±9.89 years of controls.[8] Wang et al, reported the mean age 63.2±0.2 years of cataract cases, who have or have not cataract surgery, which is in the range of the finding of present study.[10] In the present study the mean of BMI was 21.81±4.56kg/m^2 in control and 24.25±4.93kg/m^2 in cataract patients without diabetes mellitus and 25.18±4.06kg/m^2 in cataract patients with diabetes mellitus. The previous studies also reported higher BMI in cataract patients.[8,11] The mean blood pressure (BP) of patients was 132/81mmHg in cataract patients without diabetes mellitus and 136/84 mmHg in cataract patients with diabetes mellitus. Hamid et al, also reported normal range of blood pressure which is in accordance to the finding of present study.[12]

The mean random blood sugar (RBS) in the present study was 112.58±34.55mg/dl in cataract patients without diabetes mellitus and 167.19±62.42mg/dl in cataract patients with diabetes mellitus. Ishaq et al, reported the mean RBS of 270 ±108 mg/dl and 280±104mg/dl in male and female diabetic patients which show comparatively higher values in diabetic patients with cataract when compared to the present study.[13] The cataract patients' serum MDA level is higher in diabetic cataract patients as compared to normal control subjects (Table 2). The higher MDA level in cataract and diabetic patients were also reported in the earlier studies.[12,14,15]

In the present study the antioxidant vitamins C, A and E were investigated. Vitamin C (ascorbic acid) level in blood were considerably lowered in diabetic cataract patients as compared to control subject, these result are in agreement of the previous finding.[16,17] A higher value of serum vitamin A had been found in control subjects as compared to cataract patients. Dherani also had found low levels of serum retinol in cataract patients and also reported an inverse correlation with cataract.[16] Antioxidant vitamin E may play a defensive role in the process of development of cataract; because it can inhibit lipid peroxidation in lens cell membrane. The level of

blood vitamin E had shown no significant difference between the diabetic cataract and non- diabetic cataract, (Table 2) whereas the serum vitamin E level significantly decreased in diabetic and non-diabetic cataract patients as compared to normal control subject. Dherani also had found low level of vitamin E in cataract patients.[16] Low serum concentration of vitamin E increases the risk of cataract formation.[18] Serum vitamin E level was significantly correlated with the age-related cataract.[19]

The oxidative stress as measured by serum MDA (a lipid per oxidation) is significantly high in diabetic cataract and non-diabetic cataract patients as compared to control. Present study shows a slightly higher but not significant level of MDA in cataract patients with diabetes as compared to non-diabetic cataract patients, which suggest that oxidative stress in diabetics is more, which may play a role in cataractogenesis.[20] The antioxidant vitamins A, E and C are depleted in diabetic and non-diabetic cataract. Serum level of vitamin E was negatively correlated with MDA. So, it is concluded that, in senile cataract, role of oxidative stress and status of vitamins in cataract patients is important, both in diabetic and non-diabetic subjects.

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REFERENCES

1. Liu J, Li J, Li WJ, Wang CM. The role of uncoupling proteins in diabetes mellitus. J Diabetes. 2013;585897.
2. Vashist P, Talwar B, Gogoi M, Maraini G, Camparini M, Ravindran RD, et al. Prevalence of cataract in an older population in India: the India study of age-related eye disease. Ophthalmology. 2011;118(2):272-8.
3. Duan XR, Liang YB, Wang NL, Wong TY, Sun LP, Yang XH, et al. Prevalence and associations of cataract in a rural Chinese adult population: The handan eye study. Graefes Arch Clin Exp Ophthalmol. 2013;251(1):203-12.
4. Zheng Selin J. Oxidative stress and age-related cataract. Karolinska Institutet; 2015.
5. Memon AF, Mahar PS, Memon MS, Mumtaz SN, Shaikh SA, Fahim MF. Age-related cataract and its types in patients with and without type 2 diabetes mellitus: A Hospital-based comparative study. J Pak Med Assoc. 2016;66(10):1272-6.
6. Johansen JS, Harris AK, Rychly DJ, and Ergul A. Oxidative stress and the use of antioxidants in diabetes: Linking basic science to clinical practice. Cardiovascular Diabetology. 2005;4(5):1-11.
7. Turko IV, Marcondes S, Murad F. Diabetes-associated nitration of tyrosine and inactivation of succinyl-CoA: 3-oxoacid CoA-transferase. Am J Physiol Heart Circ Physiol. 2001;281(6):H2289-94.
8. Chang D, Zhang X, Rong S, Sha Q, Liu P, Han T, Pan H. Serum antioxidative enzymes levels and oxidative stress products in age-related cataract patients. Oxid Med Cell Longev. 2013;2013:1-7.
9. Thiagarajan R, Manikandan R. Antioxidants and cataract. Free Radic Res. 2013;47(5):337-45.
10. Wang W, Schaumberg DA, Park SK. Cadmium and lead exposure and risk of cataract surgery in U.S. adults. Int J Hyg Environ Health. 2016;219(8):850-6.
11. García-Layana A, Ciufo G, Toledo E, Martínez-González MA, Corella D, Fitó M, et al. The Effect of a Mediterranean Diet on the Incidence of Cataract Surgery. Nutrients. 2017;9(5):E453.
12. Hamid S, Gul A, Hamid Q. Relationship of cytokines and AGE products in diabetic and non-diabetic patients with cataract. Int J Health Sci (Qassim). 2016;10(4):507-15.
13. Ishaq H, Ali M, Kazmi N, Naqvi BS, Shaikh D, Prevalence of diabetic retinopathy in type II diabetic patients in a health facility in Karachi, Pakistan. Trop J Pharm Res. 2016;15(5):1069-76.
14. Miric DJ, Kisic BM, Zoric LD, Miric BM, Mirkovic M, Mitic R. Influence of cataract maturity on aqueous humor lipid peroxidation markers and antioxidant enzymes. Eye (Lond). 2014;28(1):72-7.
15. Jalees SS, Rosaline M. Study of malondialdehyde and estimation of blood glucose levels in patients with diabetes mellitus with cataract. Int J Clin Biochem and Res. 2017;4(3):319-23.
16. Dherani M, Murthy GV, Gupta SK, Young IS, Maraini G, Camparini M, et al. Blood levels of vitamin C, carotenoids and retinol are inversely associated with cataract in a North Indian population. Invest Ophthalmol Vis Sci. 2008;49(8):3328-35.
17. Pradhan AK, Shukla AK, Reddy MVR, Garg N. Assessment of oxidative stress and antioxidant status in age related cataract in a rural population. Indian J Clin Biochem. 2004;19(1):83-7.
18. Varma SD, Morris SM, Bauer SA, Koppenol WH. In vitro damage to rat lens by xanthine- xanthine oxidase: Protection by ascorbate. Exp Eye Res. 1986;43:1067-76.
19. Gale CR, Hall NF, Phillips DI, Martyn CN. Plasma antioxidant vitamins and carotenoids and age-related cataract. Ophthalmol. 2001;108(11):1992-8.
20. Weikel KA, Garber C, Baburins A, Taylor A. Nutritional modulation of cataract. Nutr Rev. 2014;72(1):30-47.

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