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Prevalence and risk factors of cataract in type 2 Diabetes mellitus: A Cross sectional study

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Abstract
Background& Objective: To estimate the prevalence of cataract in patients with type 2 diabetes mellitus and the possible risk factors associated with it. **Methods:** Cross sectional study carried out at a tertiary eye care centre in North Karnataka from 2012 to 2014. Patients with type 2 diabetes mellitus 40 years and above were enrolled. A detailed history, including data on demographics, diabetes, and ocular history, was obtained from all patients. A detailed systemic and ocular examination was done. All patients underwent biochemical tests: Fasting Blood Sugar (FBS), glycosylated haemoglobin (HbA1c) and serum cholesterol. **Results:** Out of the 750 patients with Type 2 Diabetes Mellitus enrolled in our study, 492 patients had cataract and 258 had no cataract. 242(60.35%) were males and 250(71.63%) were females. Prevalence of cataract in Type 2 Diabetes was 65.60%. Patients on OHA's had higher incidence of cataract (P=0.0021). There was statistical significance between positive family history of diabetes and cataract (P=0.0271). There was no statistically significance between SBP (P=0.1108), DBP(P=0.0515) and cataract. Prevalence of diabetic retinopathy in cataract group was 78.80% and only 21.20% in non cataract group (P=0.0002). Mean FBS was 176.44mg/dl (P=0.00001) and mean HbA1c was 8.29% (P=0.00001) in cataract group and both were statistically significant. **Conclusion:** Nearly two thirds of the diabetic population showed evidence of cataract**.** Increasing age, female sex, longer duration of diabetes, positive family history of diabetes, diabetics on OHA's agent, poor glycemic control i.e. raised FBS and high HbA1c levels were risk factors for development of cataract. Modulation of these variables may delay the occurrence of cataract in population of type 2 diabetes mellitus.
Keywords: Cataract, Diabetes Mellitus, OHA

Introduction

Diabetes mellitus is a systemic disease characterized by chronic hyperglycemia and alteration of carbohydrate, fat and protein metabolism, with absolute or relative deficiency in insulin secretion and/or action[1]. Type 2 Diabetes Mellitus accounts for approximately 90% of all cases of Diabetes[2].

Cataract is opacification of crystalline lens. It is considered as a major cause of visual impairment in diabetic patients, as the incidence and progression of cataract is high[3]. The crystalline lens of an adult diabetic is said to be in the same condition as a non diabetic who is 15 years older. The pathogenesis for development of cataract is glycation, carbamylation of crystallins and increased oxidative damage to the lens[4].

Factors such as a long duration of diabetic, advanced age at the time of clinical diagnosis, advanced diabetic retinopathy, nephropathy, poor control of blood sugar level and even impaired fasting glucose (IFG), a pre-diabetic condition, are considered as risk factors for the development of cataract[5,6].

Diabetes and cataract pose an enormous health and economic burden, specially in developing countries like ours, where diabetes treatment is insufficient and cataract surgery often inaccessible[7]. Understanding how the interplay of clinical and biochemical variables influence the development of cataract and modulation of these variables may delay the development of cataract in type 2 diabetes mellitus.

Materials and methods

A cross sectional study to estimate the prevalence and risk factors for

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cataract in type 2 diabetes patients was conducted on 750 patients with type 2 diabetes attending the outpatient department of Ophthalmology and Medicine at Chigateri General Hospital and Bapuji Hospital attached to J. J. M. Medical College, Davangere from 2012 to 2014.

Inclusion criteria
Patients with type 2 diabetes mellitus 40 years and above diagnosed as per WHO criteria[8].

Exclusion criteria
Patients who are non-compliant, under 40 years, with type 1 diabetes mellitus, pregnant and lactating women, immunocompromised patients and those who had undergone bilateral cataract surgery were excluded

Method of collection of data
A detailed history, including data on demographics, diabetes, and ocular history, was obtained from all patients. A careful and detailed history regarding type, duration and treatment of Diabetes, family history and associated systemic diseases such as Hypertension was taken. Based on the occupation and amount of work they were classified into sedentary and non sedentary life style. The blood pressure (BP) was recorded, in sitting position, in the right arm; two readings were taken 5 minutes apart, and the mean of the two was taken as blood pressure. Data was collected on the basis of a predefined semistructured proforma. The project was approved by the institutional ethics committee.

A thorough systemic examination was done followed by a detailed ophthalmic examination that included: Examination of adnexae and extraocular structures, recording of Best corrected visual acuity (BCVA) and intraocular pressure (applanation), anterior segment examination by slit lamp biomicroscopy and detailed fundus examination was done by indirect ophthalmoscopy and 90D

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Biomicroscopy. All patients underwent biochemical tests: Fasting Blood Sugars (FBS), glycosylated haemoglobin (HbA1c) and serum cholesterol.

Diagnosis of Diabetes was made in each case when Fasting Plasma Glucose (FPG) > 126 mg/dL (7.0 mmol/L) or 2hr Post Prandial Glucose > 200mg/dL (11.1 mmol/L) after a 75g glucose load or any patient with a history of Diabetes on Treatment. Hypertension was defined as the presence of Systolic Blood Pressure >120 mm Hg or a diastolic Blood pressure >80 mm Hg or on Antihypertensive Treatment at the time of examination[8].

Statistical analysis

Once data was collected and tabulated using MS Office Excel, the tabulated data was then analyzed on SPSS version 16.0. Descriptive Analysis was done using Percentages, Proportions, Mean and Standard Deviations and inferential Analysis was done using unpaired T-tests, chi-square.

Results

Out of the 750 patients with Type 2 Diabetes Mellitus, 492 patients had cataract and 258 had no cataract. Thus prevalence of cataract in Type 2 Diabetes was 65.60%.

Table 1: Study Population

Status of cataract	No of patients	% of patients
With cataract	492	65.60
Without cataract	258	34.40
Total	750	100.00

In our study, prevalence of cataract in 40-49yrs was 5.74%, 50-59yrs was 59.85%, 60-69yrs was 94.77% and in patients above 70yrs was 100%. Prevalence of cataract increased with the age of the patient(P=0.0001).

Table 2: Age Distribution of The Study Population

Age	With Cataract	%	Without Cataract	%	Total	%
40-49 yrs	12	5.74	197	94.26	209	27.87
50-59 yrs	79	59.85	53	40.15	132	17.60
60-69 yrs	145	94.77	8	5.23	153	20.40
>70 yrs	256	100.00	0	0.00	256	34.13
Total	492	65.60	258	34.40	750	100.00
Chi-square = 525.7182 P = 0.0001*						

In our study out of the 492 cases with cataract, 242(60.35%) were males and 250(71.63%) were females showing female preponderance in cataract group(P=0.0011). In our study 66.51% of patients in cataract group had sedentary life and 64.38% had non sedentary life. There was no association between nature of work and development of cataract.(P=0.5472) In our study positive family history of diabetes was seen in 59.07% patients in cataract group and 40.93% patients in non cataract group. There was statistical significance between positive family history and cataract group(P=0.0271).

Out of the 492 cases with cataract, 109 cases were newly detected (22.15%) and 383 cases had long standing diabetes(77.85%).
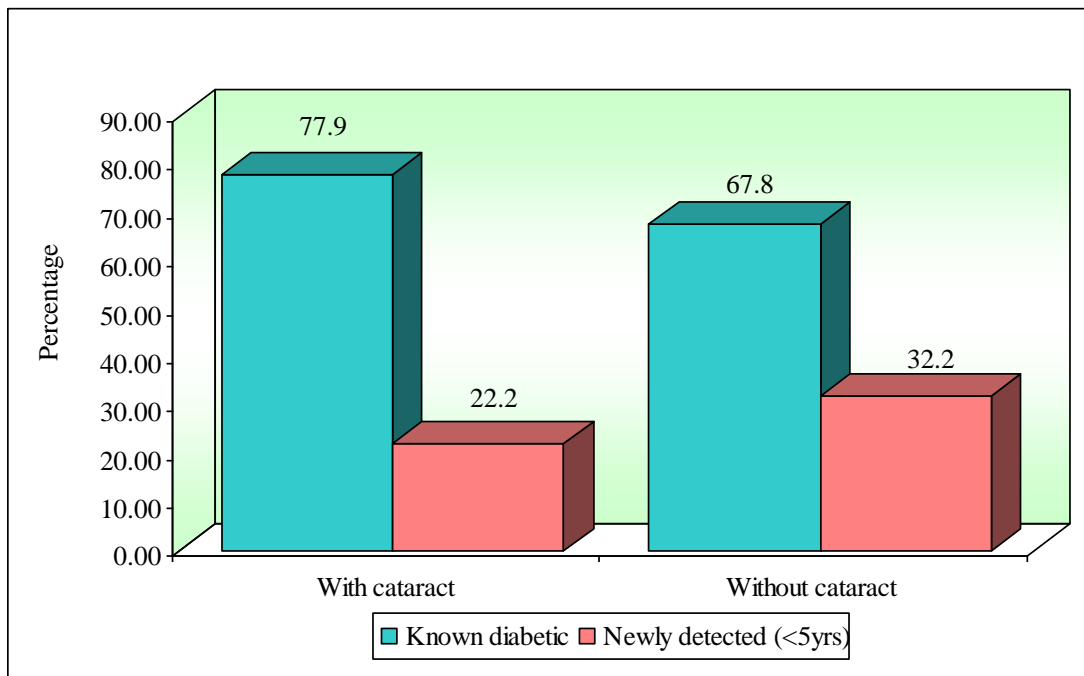
Fig. 1: Duration of Diabetes In The Study Population

Our study showed that prevalence of cataract increased with increase in duration of diabetes(P=0.0032). In our study 23.33% of patients had diabetes for > 10yrs and 76.67% had for < 10yrs.

In our study population 70.12% of cataract group were on OHA, 23.37 were on both(insulin and OHA) and 6.50% were on insulin. Patients on OHA's had higher incidence of cataract (P=0.0021).
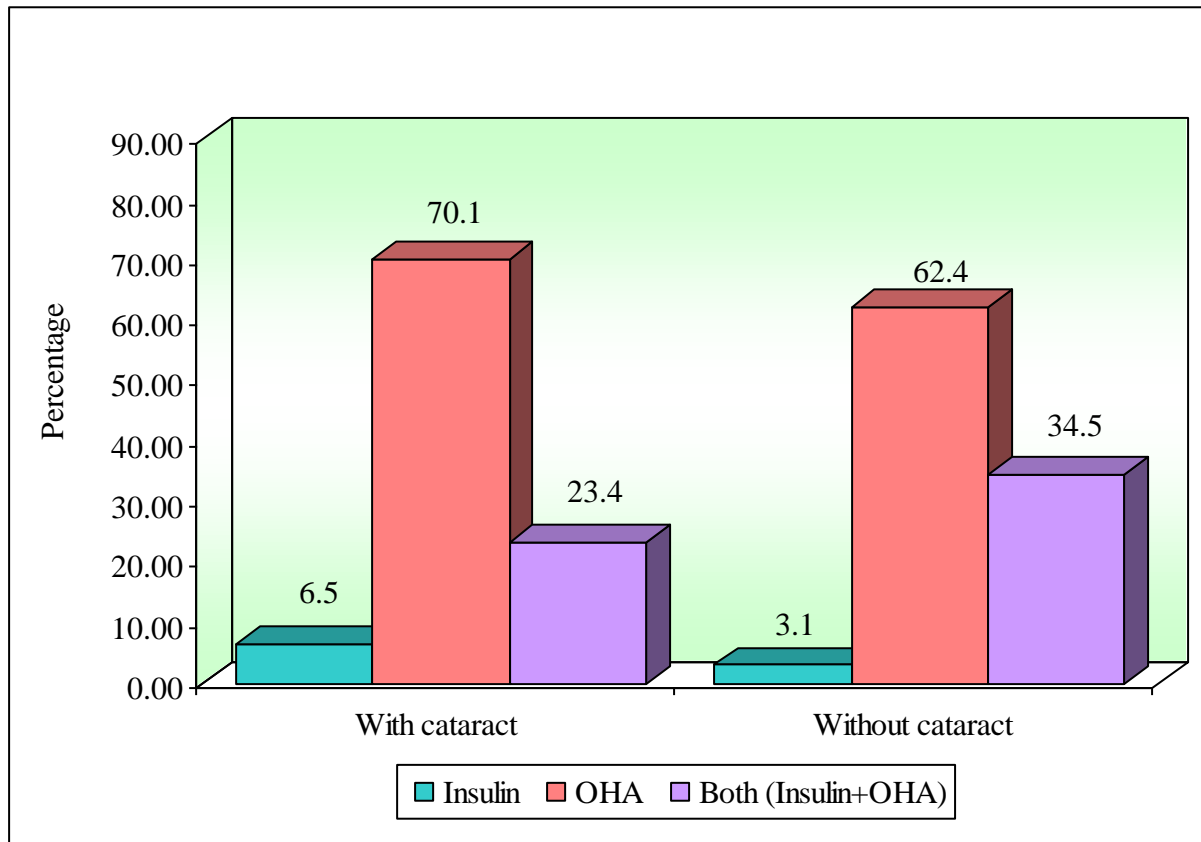
Fig. 2: Diabetic treatment history of the study population

Among the 401 males in the study group, 82 gave positive history of smoking of which 49 belonged to cataract group and 33 belonged to non cataract group.

The mean SBP in cataract and non cataract group was 134.96mm of Hg and 133.41mm of Hg respectively. There was no statistical significance between cataract and SBP (P=0.1108).

In our study the mean DBP in cataract group was 89.12mm of Hg and 87.91mm of Hg in non cataract group. There was no statistical significance between cataract and DBP(0.0515).

Prevalence of diabetic retinopathy in cataract group was 78.80% and only 21.20% in non cataract group. Our study showed that diabetic retinopathy was more common in patients with cataract (P=0.0002).

Mean FBS in cataract group was 176.44mg/dl and 163.71mg/dl in non cataract group. FBS was significantly higher in cataract group (P=0.00001).

In our study mean HbA1c in cataract group was 8.29% and in non cataract group was 7.85%. HbA1c was significantly higher in cataract group (P=0.00001).

Mean cholesterol levels in cataract group was 184.34mg/dl and in non cataract group was 183.67mg/dl. There was no statistical significance between serum cholesterol level and cataract (P=0.5208)

Discussion
This study presents the prevalence of cataract in a cohort of 750 South Indian type 2 diabetic patients from a tertiary level health care centre.

Prevalence of cataract
In our study out of the 750 diabetic patients evaluated, 492 had cataract and 256 of the individuals showed no cataract and were included in the non cataract group. Prevalence of cataract in diabetic patients was 65.60%. Our results were consistent with various other studies.

Study conducted by Raman et al showed similar results with 65.7% of the patients presenting with cataract[9].

Nearly two of three persons with diabetes >40 years of age had cataract. Thus indicating that the incidence of cataract was higher in diabetic population when compared to normal population.

Age and sex distribution in study population
In our study prevalence of cataract was 5.74% in 40-49yrs, 59.85% in 50-59yrs, 94.77% in 60-69yrs and 100% in patients above 70yrs. Incidence of cataract increased with the age of the patient(P=0.0001). Similar results were showed in other Beaver Dam Eye Study that showed increase in incidence of cataract with increase in age[10].

Data from the Framingham study showed a three to fourfold increased prevalence of cataract in patients with diabetes under the age of 65[12].

In our study out of the 492 cases with cataract, 242(60.35%) were males and 250(71.63%) were females showing female preponderance in cataract group(P=0.0011).

Study done by Kim et al showed higher incidence of females(63.5%) in cataract group than control group(56%)[5].

This could be probably explained on the basis of study done by Donnelly et al[12]. who noted differences in the albumin/total protein ratio and serum triglyceride level, especially in women, predisposing them to cataract. Postmenopausal estrogen deficiency may also be a contributing factor in development of cataract.

Life style and cataract
In our study 66.51% of patients in cataract group had sedentary life style and 64.38% had non sedentary life style.
Study done by Raman et al showed higher incidence of cataract in unemployed subjects when compared to employed (59.9% vs. 45.3%)[9].
However in our study there was no association between nature of work and development of cataract (P=0.5472). Because of fewer studies on cataract profile in diabetic populations the correlation of this risk factor in development of was cataract couldn't be correlated.

Family history and cataract
In our study positive family history of diabetes was seen in 59.07% patients in cataract group and 40.93% patients in non cataract group. There was statistical significance between positive family history and cataract (P=0.0271).
Positive family history of diabetes was a risk factor for cataract in a study conducted by Kareem et al on 2540 Iraqi diabetic patients with P<0.001in cataract and non cataract group[13].
A positive family history led to early development of diabetes in subjects and eventually higher incidence of cataract in these individuals when compared to subjects with negative family history of diabetes.

Duration of diabetes and cataract
Out of the 492 cases with cataract, 109 cases were newly detected i.e. ≤ 5years (22.15%) and 383 cases had long standing diabetes > 5years (77.85%). Our study showed that prevalence of cataract increased with increase in duration of diabetes (P=0.0032). 23.33% of patients had diabetes for > 10yrs and 76.67% had for ≤10yrs. . Prevalence of cataract was high in patients with diabetes for >5yrs duration
The Blue Mountains Eye done 2900 patients with diabetes showed that risk of cataract increases with increasing duration of diabetes and severity of hyperglycemia[14].
Study done by Dedov et al[15], Kirby DB[16], Chan AW[17] have shown that the incidence of cataract increases proportionately with the degree and the period of the diabetes mellitus.
Thus suggesting that a more prolonged influence of biochemical cataractogenic stimuli i.e. hyperglycemia for a longer duration was responsible for development of cataract.

Treatment of diabetes and cataract
In our study population 70.12% of cataract group were on OHA, 23.37% were on both(insulin and OHA) and 6.50% were on insulin. Patients on OHA's had higher incidence of cataract (P=0.0021) when compared to those on insulin alone or on both OHA's and Insulin.
Study done by Raman et al showed higher incidence of cataract in patients who were on only OHA's or only Insulin[9].
This may probably be because of poor glycemic control in individuals only on OHA's.

Smoking history and cataract
Among the 401 males in the study group, 82 gave positive history of smoking of which 49 belonged to cataract group and 33 belonged to non cataract group.
The WESDR showed that in older onset diabetic patients smoking status(current, ex) were associated with increased risk of cataract[18].
However our study showed no significance between smoking and cataract.

Systemic hypertension and cataract
The mean SBP in cataract and non cataract group was 134.96mm of Hg and 133.41mm of Hg respectively. In our study the mean DBP in cataract group was 89.12mm of Hg and 87.91mm of Hg in non cataract group.
Study done by Schaumberg DA et al. showed association between SBP and cataract (P=0.04) and no association between cataract and DBP(P=0.33)[19].

There was no statistical significance between cataract and SBP (P=0.1108) and DBP(0.0515) in our study.

Diabetic retinopathy and cataract
Prevalence of diabetic retinopathy in cataract group was 78.80% and only 21.20% in non cataract group. Our study showed that diabetic retinopathy was more common in patients with cataract(P=0.0002). Study done by Kim et al showed diabetic retinopathy was seen in 75.53% of those with cataract and in 37.41% of those without cataract[12]. Study done by Kirby showed that diabetic retinopathy was found in 53% of individuals in cataract group and 40% of those in non cataract group. Many other studies reported higher incidence of retinopathy in patients with cataract[17].
Thus signifying that retinopathy was an influential factor on the degree of cataract.

FBS and glycosylated hemoglobin (Hba1c) levels and cataract
Mean FBS in cataract group was 176.44mg/dl and 163.71mg/dl in non cataract group. FBS was significantly higher in cataract group(P=0.00001). In our study mean HbA1c in cataract group was 8.29% and in non cataract group was 7.85%. HbA1c was significantly higher in cataract group(P=0.00001).
Blue Mountains study showed a twofold higher 5-year incidence of cortical cataract in participants with impaired fasting glucose[15].
Study done by Kim et al showed that the level of blood sugar after fasting was higher in the cataract group than in the control group
The Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR) showed a direct relationship between glycosylated hemoglobin and cataract[19].
Thus poor glycemic control was a risk factor for development of cataract. A more aggressive management of glycemia could reduce the development and progression of cataract.

Serum cholesterol and cataract
In our study Mean cholesterol levels in cataract group was 184.34mg/dl and in non cataract group was 183.67mg/dl. Study done by Tsutsumi K, however has shown a positive correlation of cataract with high plasma levels of total cholesterol, triglycerides, and low plasma levels of HDL cholesterol[20].
However there was no statistical significance between serum cholesterol level and cataract(P=0.5208) in our study. Although our study did not include other parameters of lipid profile.

Conclusion
The incidence of cataract is higher in diabetic population when compared to normal population. Our study showed the high prevalence of cataract, nearly two of three persons >40 years of age with type 2 DM had cataract. Increasing age, female sex, longer duration of diabetes, positive family history of diabetes, diabetics on OHA's agent had higher risk of development of cataract.
Our study helps in understanding how the interplay of clinical and biochemical variables influence the development of cataract and its subtypes. So far this aspect had not been studied extensively. Modulation of these variables may delay the occurrence of cataract in population of type 2 diabetes mellitus

References
1. Kahn CR, Weir GC. Prevalence and Epidemiology of Diabetes Mellitus. In: Joslin's Diabetes mellitus. 13th edn, India; Waverly BI Pvt Ltd, 193
2. American Optometric Association, Care of the Patient with Diabetes Mellitus, Optometric Clinical Practice Guideline, available at: www.aoa.org/x4813.xml accessed May 2009

3. Javadi MA, Ghanavati SZ .Cataracts in Diabetic Patients. J Ophthalmic Vis Res 2008; 3 (1): 52-65
4. Parson's Diseases of Eye; Sihota R, Tandon R.Lens. In: Parson's Diseases of Eye. 21ˢᵗ edition:2006, Elsevier; 263
5. Kim SI, Kim SJ. Prevalence and Risk Factors for Cataracts in Persons with Type 2 Diabetes Mellitus. Korean J Ophthalmology.2006:20(4):201-204.
6. Saxena S, Mitchell P, Rochtchina E. Five-year incidence of cataract in older persons with diabetes and pre-diabetes. Ophthalmology Epidemiology 2004;11:271-277.
7. Tabin G, Chen M, and Espandar L, "Cataract surgery for the developing world," Current Opinion in Ophthalmology, vol.19, no. 1, pp. 55–59, 2008
8. F. Ederer, R. Hiller, and H. R. Taylor, "Senile lens changes and diabetes in two population studies," American Journal of Ophthalmology, vol. 91, no. 3, pp. 381–395, 1981
9. Raman R, Pal SS, Adams JSK, Rani PK, Vaitheeswaran K, Sharma T.. Prevalence and risk factors for in diabetes: Sankara Nethralaya Diabetic Retinopathy Epidemiology and Molecular Genetics Study report no 17. Investigative Ophthalmology and visual science.2010;51(12):6253-6261
10. B. E. Klein, R. Klein, Q. Wang, and S. E. Moss, "Older-onset diabetes and lens opacities. The Beaver Dam Eye Study," Ophthalmic Epidemiology, 1995;2(1): 49–55.
11. Kahn HA, Leibowitz HM, Ganley JP. The Framingham Eye Study.II. Association of Ophthalmic Pathology with single variable previously measured in the Framingham Heart Study. Am J Epidemiol 1977;106:33–41.
12. Donnelly CA, Seth J, Clayton RM, Phillips CI, Cuthbert J, Prescott RJ. Some blood plasma constituents correlate with human cataract. Br J Ophthalmol. 1995;79(11):1036–1041.
13. Kareem BA, Abdul RY, Ali HA, Abbas MF . Prevalence and Risk Factors for Eye Problems among 20-65 Years Old Iraqi Diabetics Patients. J Fac Med Baghdad 2008;50(2):1.
14. N. Rowe, P. Mitchell, R. G. Cumming, and J. J. Wans, "Diabetes, fasting blood glucose and age-related cataract: the BlueMountains Eye Study," Ophthalmic Epidemiology, 2000;7(2): 103–114.
15. Dedov I, Maslova O, Suntsov Y, Bolotskaia L, Milenkaia T, Besmertnaia L Prevalence of Diabetic Retinopathy and Cataract in Adult Patients With Type 1 And Type 2 Diabetes in Russia The Review of diabetic studies 2009;6(2):1.
16. Kirby DB. Cataract and diabetes. Arch Ophthalmol 1933;9:966-73.
17. Chan AW, Ho YS, Chung SK, Chung SS. Synergistic effect of Osmotic and oxidative stress in slow-developing cataract formation. Exp Eye Res. 2008; 87(5):454–461
18. Klein BEK, Klein R, Moss SE: Prevalence of cataracts in a population-based study of persons with diabetes mellitus. Wisconsin Epidemiologic Study of Diabetic Retinopathy. Ophthalmology1985; 92:1191-96.
19. Schaumberg DA, Glynn RJ, Christen WG, Ajani UA, Stürmer T, Hennekens CH A prospective study of blood pressure and risk of cataract in men. Ann Epidemiol. 2001 Feb;11(2):104-10.
20. Tsutsumi K, Inoue Y, Yoshida C. Acceleration of development of diabetic cataract by hyperlipidemia and low high density lipoprotein in rats. Biol Pharm Bull. 1999; 22: 37–41.

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