

## Correlation of lipid profile with tobacco use in cataract patients

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### Abstract

**Introduction:** Human beings are blessed with five special senses and vision is the most precious. Cataract is the major cause of a visual impairment. Tobacco use is a modifiable risk factor for cataract. Dyslipidemia is associated with wide range of eye diseases. Therefore, we intended to study the relationship between the lipid profile and tobacco use in various forms of cataracts.

**Materials and Method:** The study was carried out on 156 cataract patients aged 45 to 65 years. It comprised of two groups: tobacco user group (78 patients) and tobacco non user group (78 patients). A complete ophthalmic examination was done and fasting serum lipid profile was estimated. Information on tobacco use was collected through the questionnaire.

**Results:** In this study, it was found that High Density Lipoprotein cholesterol (HDL-c) was lower in tobacco user group ( $P < 0.05$ ) than the tobacco nonuser group. Tobacco user group had higher values of Very Low Density Lipoproteins cholesterol (VLDL-c) ( $P < 0.05$ ) and Triglycerides (TG) ( $P < 0.05$ ) as compared to tobacco nonuser group. There is significant difference in various forms of cataract ( $P < 0.05$ ) between tobacco user group and tobacco nonuser group. However, no significant difference was found in total cholesterol, HDL-c, VLDL-c, TG and Low Density Lipoprotein cholesterol (LDL-c) in various forms of cataract irrespective of tobacco use.

**Conclusion:** The study shows that tobacco use adversely affects lipid profile and it is significantly associated with nuclear and cortical cataract. However, there is no association was found between the lipid profile and different forms of cataract. As our sample size was small, further study with larger sample size is required to find out correlation.

**Keywords:** Cataract, Dyslipidemia, Lipid profile, Tobacco use.

**Manuscript Received:** 10<sup>th</sup> May, 2017

**Manuscript Accept:** 15<sup>th</sup> June, 2017

### Introduction

Human beings are blessed with five special senses and vision is the most precious. We can see beautiful colors of nature with eyes. Without vision our life is dark. Cataract is defined as any opacity of crystalline eye lens or its capsule, developmental or otherwise with impairment of vision.<sup>(1)</sup> Cataract is the major cause of a visual impairment and virtually inevitable debility among the aged. It is estimated that 51% of blind cases and 33% of visually impaired patients have cataract,<sup>(2)</sup> and about 44% of the total blindness in India is due to cataract.<sup>(3)</sup> Also cataract occurs earlier in life and about 3 times more prevalent in India than in developed countries. The development of cataract is a complex, multifactorial process and risk factors for cataract include both non-modifiable factors such as age, gender, genetics; as well as modifiable factors such as smoking, alcohol, ultraviolet radiation, overweight, hypertension, hypercholesterolemia, diabetes and use of corticosteroids.<sup>(4)</sup>

Dyslipidemia is defined as abnormal amount either increased or decreased of lipids in the blood. It is a major systemic disorder and has pronounced adverse effect on many organs including eye. It has been directly or indirectly linked to a wide range of eye diseases, age-related macular degeneration, retinal vein occlusion and hypertensive & diabetic retinopathy including cataract. Serum lipid levels have been found

to increase the risk of cataract.<sup>(5-7)</sup> As lipid is one of the important structural components of cell membranes, change in its composition as in lipid peroxidation due to reactive oxygen species (ROS) and also may be due to changes in lipid composition of blood may lead to alteration in macromolecules like proteins, lipids and DNA leading to cataract.

In India tobacco is used for smoking e.g. cigarettes, bidis, etc. and also as smokeless tobacco in the form of chewing tobacco as gutkha, pan masala, mawa; snuff or mishri used as application to the teeth and gums.<sup>(8,9)</sup> Several studies<sup>(10-13)</sup> have investigated and reported the significant relationship between cigarette smoking and an increased risk of cataract development. Smoking is an independent risk factor for cataract with dose-response. There is an evidence that cataract develops at an earlier age in cigarette smokers than nonsmokers.<sup>(12)</sup> One study suggested that the major damaging mechanism in cataract patients using tobacco is oxidative stress induced by ROS generated by tobacco and tobacco smoke constituents.<sup>(10)</sup>

Smoking is also known to affect lipid profile adversely. Batic-mujanovic O et al observed that tobacco smoking for long period increases serum concentration of total cholesterol, triglycerides (TG), Low Density Lipoprotein- cholesterol (LDL-c), Very Low Density Lipoprotein- cholesterol (VLDL-c), and fall in the level of High Density Lipoprotein-cholesterol

(HDL-c).<sup>(14)</sup> Tobacco smoking has been found to alter lipid metabolism by stimulating sympathetic adrenal system leading to increased secretion of catecholamines resulting in increased lipolysis and increased concentration of plasma free fatty acids.<sup>(15)</sup>

Most of the studies usually addressed the relationship between smoking and cataract or tobacco use and cataract or lipid profile and cataract, without taking into account about inter-relationship between tobacco use, lipid profile and various forms of cataract. Also most of these studies were conducted in western population, in which risk factors, prevalence of cataract and dyslipidemia may be different from Indian population. The proposed study is being undertaken to find out the effect of tobacco use on lipid profile in cataract patients and to compare with non-tobacco user cataract patients and, also to find out which of the lipid components in blood have association with different types of cataract.

Knowledge about risk factors for cataract can give opportunity for prevention and treatment of it and ultimately decreasing the public health burden.

### Aim and Objectives

#### Aim

- To estimate and compare lipid profile in tobacco user and tobacco nonuser patients with various forms of cataract to find out correlation.

#### Objectives

- To estimate lipid profile in tobacco user cataract patients
- To estimate lipid profile in tobacco non-user cataract patients
- To compare lipid profile in tobacco user and tobacco nonuser patients with various forms of cataract to find out correlation.
- To compare lipid profile in various forms of cataract.

### Materials and Method

It is a cross sectional observational study conducted in the department of Biochemistry in collaboration with department of Ophthalmology in KIMS, Karad for one year. Cataract patients, coming to ophthalmology OPD were taken as cases.

**Inclusion criteria:** Patients who have been diagnosed with cataract having age 45-65 years

**Exclusion criteria:** Patients with

- Congenital cataract, complicated cataract, traumatic cataract
- Operated for cataract (Pseudophakia, surgical aphakia)
- Preexisting ocular diseases like glaucoma, uveitis, corneal opacity
- Diabetes Mellitus, hypertension, on steroid and on diuretics

The study was carried out after getting approval from Institutional Ethical Committee of KIMS DU, Karad. Group A includes 78 tobacco user cataract cases in the age group 45-65 years and Group B includes age and sex matched 78 tobacco nonuser cataract cases. Written consent was taken after proper explanation of need of study and a proforma was used to collect the base line data. Information on tobacco use was collected through the questionnaire. Detail history was taken and proper systemic and ocular examination was done. Complete ophthalmic examination, including best-corrected visual acuity, tonometry, grading of lens opacities using slit lamp and the Lens Opacities Classification System III (LOCS III) and fundus examination, after dilatation of pupil. Pure nuclear, cortical, and posterior sub-capsular (PSC) cataract subgroups have isolated cataract without the presence of other types. Mixed cataract includes a combination of nuclear, cortical or PSC cataract. The opacity grade of the worse eye was considered for analysis.

8 ml fasting venous blood samples were collected in plain bulbs and fluoride tubes for estimation of lipid profile, fasting blood sugar. The estimation of fasting blood sugar by GOD-POD method to rule out diabetes mellitus, total cholesterol by CHOD-PAP method, TG by GOP-PAP method, HDL-c by Phospho-tungstic acid method was done using EM360 Transasia automatically, LDL-c, VLDL-c were calculated by Fried- Wield's formula. The reference range of serum lipid profile was taken as total cholesterol 150-200 mg/dl, triglyceride 50-150 mg/dl, HDL 40-60 mg/dl, LDL 60-130 mg/dl, and VLDL 10-30 mg/dl.

**Statistical analysis:** The data was analyzed by unpaired student's T test, Chi-square test and SPSS 20. Differences with a p value less than 0.05 were considered to be statistically significant.

### Results

The group A consists of 78 tobacco user cataract cases which were in the age group 45-65 years with mean age and standard deviation of  $55.16 \pm 6.20$ . There were 37 males and 41 females. The group B consists of 78 tobacco non user cataract cases which were age group 45-65 years with mean age and standard deviation of  $54.37 \pm 5.89$ . There are 34 males and 44 females. Table 1 shows age distribution and the P value was 0.630 ( $P > 0.05$ ) which was not significant.

#### Lipid profile analysis in tobacco user and tobacco nonuser cataract patients

Table 2 shows lipid profile analysis in tobacco user and tobacco nonuser cataract patients. The mean and standard deviation (SD) of serum total cholesterol level in tobacco user cataract cases was  $174.70 \pm 33.13$  mg/dl and in tobacco non-user cataract cases was  $167.82 \pm 33.86$  mg/dl with P value 0.201 ( $P > 0.05$ ) which was not significant. The mean and SD of serum TG level in tobacco user cataract cases was  $175.92 \pm 74.46$  mg/dl and in tobacco non-user cataract cases was  $143.71 \pm$

54.04 mg/dl, higher values in tobacco user than tobacco nonuser cataract cases; with P value 0.002 (P<0.05) which was very significant. The mean and SD of serum VLDL-c level in tobacco user cataract cases was 35.19 ± 14.88 mg/dl and in tobacco non-user cataract cases was 28.74 ± 10.77 mg/dl, higher values in tobacco user than tobacco nonuser cataract cases; with P value 0.002(P<0.05) which was very significant. The mean and SD of serum HDL-c level in tobacco user cataract cases was 47.74 ± 10.24 mg/dl and in tobacco nonuser cataract cases was 51.88 ± 12.30 mg/dl, lower values in tobacco user than tobacco nonuser cataract cases; with P value 0.024(P<0.05) which was significant. The mean

and SD of serum LDL-c level in group A cataract cases was 88.96 ± 29.14 mg/dl and in group B cataract cases was 89.46 ± 27.40 mg/dl with P value 0.912(P>0.05) which was not significant.

**Table 1: Age distribution table**

Group	N	Mean± Std. deviation
Tobacco user	78	55.16±6.20
Tobacco nonuser	78	54.37±5.89

**Table 2: Comparison of mean and standard deviation of the plasma lipids in both the groups**

Plasma lipids (mg/dl)	Tobacco user(N=78)	Tobacco nonuser(N=78)	P value
Total cholesterol	174.70±33.13	167.82±33.86	0.201(P>0.05)
Triglycerides	175.92±74.46	143.71±54.04	0.002(P<0.05)*
VLDL	35.19±14.88	28.74±10.77	0.002(P<0.05)*
LDL	88.96±29.14	89.46±27.40	0.912(P>0.05)
HDL	47.74±10.24	51.88±12.30	0.024(P<0.05)*

**Table 3: Different types of cataract in tobacco user and tobacco non-user groups**

Type of cataract		Group		Total
		Tobacco user	Tobacco nonuser	
Psc	count	13	14	27
	% within the group	16.7%	17.9%	17.3%
Cortical	count	8	6	14
	% within the group	10.3%	7.7%	9.0%
Nuclear	count	17	5	22
	% within the group	21.8%	6.4%	14.1%
Mixed	count	40	53	93
	% within the group	51.3%	67.9%	59.6%
Total	count	78	78	156
	% within the group	100.0%	100.0%	100.0%

P value was 0.034 (P<0.05) which was significant.

**Table 4: Comparison of mean and standard deviation of the plasma lipids in different types of cataract**

Plasma lipids	PSC (N=27)	Cortical(N=14)	Nuclear(N=22)	Mixed(N=93)	P value
Total cholesterol	165.22±35.73	181.50±30.87	166.09±30.43	172.69±34.00	0.415
Triglyceride	149.44±69.25	160.64±60.30	180.90±72.98	157.72±65.55	0.405
VLDL	29.88±13.92	32.21±12.05	36.18±14.66	31.53±13.04	0.403
LDL	86.74±27.67	99.35±31.16	81.50±22.39	90.22±28.96	0.287
HDL	49.70±11.42	50.14±9.73	48.86±10.82	50.02±12.02	0.979

P > 0.05 which was not significant.

#### Analysis of different types of senile cataract in tobacco user and tobacco nonuser groups

The summary of different types of senile cataract in two groups is shown in Table 3. P value was 0.034 (P<0.05) which was significant. In tobacco user group nuclear and cortical were more common than tobacco nonuser group. Mixed cataracts were more common in tobacco nonuser group.

### Analysis of Lipid profile in different types of senile cataract

To find out where a specific type of dyslipidemia is responsible for specific type of cataract, we compared the values of serum lipids among different types of cataract as shown in Table 4. P values in all lipid parameters in different types of cataract are more than 0.05, which was not significant. There was no significant association between plasma lipids and different types of cataract irrespective of tobacco use. Only mean triglycerides levels were slightly more in nuclear and cortical cataract.

### Discussion

Cataract is the most common cause of curable blindness and is conventionally treated with surgery. In developing countries like India, the magnitude of the problem is overwhelming.<sup>(3)</sup> The etiology of cataract is multifactorial. Tobacco and hypercholesterolemia are identified as modifiable risk factors by many studies. This study was done to find out association between tobacco use, lipid profile and different types of cataract in rural population.

Tobacco is the cheapest, easily and legally available addictive substance but population at large is unaware of its side effects. India is the second largest consumer and third largest producer of tobacco in the world.<sup>(16)</sup>

#### Effect of tobacco use on lipid profile

Smoking can alter lipid profile by various mechanisms like: a) Nicotine in tobacco stimulates sympathetic adrenal system leading to increase secretion of catecholamines resulting increased lipolysis and increased concentration of plasma free acids (FFA), which further results in increased secretion of hepatic FFAs and hepatic triglyceride along with VLDL-c in the blood stream;<sup>(14)</sup> b) Fall in estrogen levels occurs due to smoking which further leads to decreased HDL-c;<sup>(17)</sup> c) Presence of hyperinsulinaemia in smokers leads to increased cholesterol, LDL-c, VLDL-c and TG due to decreased activity of lipoprotein lipase.<sup>(18)</sup>

#### Effect of tobacco use on the eye lens

Systemic absorption of tobacco and its smoke constituents that can reach the lens where turnover is slow; this possibly leads to chronic accumulation of toxic chemicals and generates ROS endogenously causing oxidative damage to the lens molecules, resulting in cataract.

In this study when we compared serum lipid profile of tobacco user and tobacco nonuser senile cataract patients, the result showed that no significant difference between mean total cholesterol and LDL-c in both tobacco user and tobacco non user cataract groups, but triglycerides and VLDL-c were significantly high ( $P < 0.05$ ) in tobacco users than tobacco nonuser group and HDL-c was significantly low ( $P < 0.05$ ) in tobacco user than tobacco nonuser group. Willett et al

reported that cigarette smoking affects cholesterol metabolism; it lowers protective high density lipoprotein (HDL) cholesterol.<sup>(19)</sup> Batic-mujanovic O et al also reported that total cholesterol, TG, VLDL-c and LDL-c were significantly high and HDL-c was significantly low in smokers as compared with nonsmokers.<sup>(14)</sup> But these studies did not consider the effect of smokeless tobacco use on lipid profile which we have done in our study.

In our study we found that in tobacco user group nuclear and cortical were more common than tobacco nonuser group. Mixed cataracts were more common in tobacco nonuser group. Also, several studies have shown the association of nuclear and cortical cataract with smoking.<sup>(20-25)</sup> Other population based studies have reported an association between cigarette smoking and cataract. The Andhra Pradesh Eye Disease Study was carried out in an urban setting and did not find a relationship between bidi smoking and cataract.<sup>(22)</sup> The study by P. Raju et al showed that smokeless tobacco use was significantly associated with nuclear cataract.<sup>(26)</sup>

In our study, there was no significant association found between serum lipids and different types of cataract irrespective of tobacco use. When we compared the values of serum lipids among different types of cataract, it was evident that mean triglyceride was high in nuclear and cortical type of cataract patient and highest in nuclear type of cataract. Hiller et al,<sup>(6)</sup> and other studies<sup>(27)</sup> showed association between high TG and PSC cataract. Rajiv Raman showed high TG as a risk factor for nuclear cataract.<sup>(28)</sup> Hiller et al found association between low HDL-c and PSC cataract.<sup>(6)</sup>

### Limitations of study

1. Study group was from OPD.
2. Number of patients with some form of cataract e.g. cortical cataract was small so that the statistical power was not sufficient to exclude a weak association between it and dyslipidemia.
3. Our study was a cross-sectional approach so we could not comment about longitudinal relationship.

Several studies indicate that smoking is a risk factor for cataract, but very few studies have been done to find the effect of smokeless tobacco on the eye. In rural populations awareness of the hazards of tobacco use is low. In fact, many people believe that tobacco in smokeless form has medicinal value in curing toothache. Hence an awareness programme educating people on the ill effects of tobacco use may help in promoting healthy behavior, thereby reducing tobacco-related conditions. Since tobacco use and dyslipidemia, are modifiable risk factors, maintenance of normal lipid profile and avoiding use of tobacco may prevent early development of cataract.

## Conclusion

The study shows that tobacco use adversely affects lipid profile thereby increasing risk of cataract and it is significantly associated with nuclear and cortical cataract. However, no association was found between the lipid profile and different forms of cataract irrespective of tobacco use. Though our study proposes the relation of tobacco and lipid profile in cataract, as our sample size was small, further study with larger sample size need to be done to draw a conclusion in establishing relation between the tobacco use and lipid profile as a risk factor in the development of cataract.

## Conflicts of interest

No conflict of interest is associated with the work.

## Contribution of authors

We declare that this work was done by the authors named in this article and all liabilities pertaining to claims to the content of this article will be borne by the authors.

## Acknowledgment

We thanks Biochemistry laboratory staff and Ophthalmology department for help in conducting the study and KIMSDU, Karad for funding the study.

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