

# Effect of Cigarette Smoking on Intraocular Pressure in individual with Normal Blood Pressure

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## ABSTRACT

**Objective:** The purpose of this study was to determine the effect of smoking on intraocular pressure in individual with normal blood pressure and to compare the smoking effects on intraocular pressure in smoker and non-smoker.

**Material and Methods:** A hospital based descriptive cross sectional study was conducted at Aziz Fatimah Hospital Faisalabad including 480 patients of age between 20-50 years. The person with normal visual acuity and normal blood pressure were included in the study. After history taking and visual acuity measurement Ophthalmoscopy was performed to evaluate different eye conditions. After that the intraocular pressure of both eyes was measured by using Goldman Applanation tonometer.

**Results:** There were 192 (40%) patients of age 20-30 years, 160 (33.3%) patients of age 31-40 years of age, and 128 (26.6%) patients of age 41-50 years. The percentage of the subjects who smoke 1-5 cigarettes per day was 12.9% and for those who smoke 6-10 cigarettes per day was 37.08%. The mean IOP of smoker's right and left eye was 21.50±2.5 mmHg and 22.3±2.9 mmHg respectively. The mean IOP of non-smokers right and left eyes was 15.99±1.8 mmHg and 16.96±2.1 mmHg respectively.

**Conclusion:** There was a highly significant association of rise in intraocular pressure in smokers as compared to non-smoker. This study also concludes that intraocular pressure increases more in smokers left eye as compared to the left eye.

**Keywords:** Cigarette smoking, Intraocular pressure, Glaucoma, Ocular hypertension

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## INTRODUCTION

Nicotine is the primary active ingredient of cigarette which increases the level of catecholamine which is responsible for increases heart rate and blood pressure<sup>1</sup>. Cigarette Smoking is major cause of several ocular and systemic diseases. The toxin associated with cigarette smoking may decrease the blood flow or cause clot to develop within the eyes capillaries. Cigarette smoking also caused the expansion of fragmented molecules which could disrupt the normal function of healthy cells and lead to eye diseases<sup>2</sup>. Smoking also increases the platelet aggregation; thrombus formation and it release growth factors that lead to vascular smooth muscle cell proliferation that are responsible for macular degenerations. Decrease blood flow to retina due to smoking cause deterioration of macula which leads to loss of central vision<sup>1</sup>.

The World Health Organization declares that smoking is a long-established risk factor of many cancers, cerebro- and cardiovascular diseases and chronic obstructive pulmonary diseases<sup>3</sup>. Among the 1.3 billion smokers in the world, over 6 million die annually due to tobacco intake<sup>4</sup>. Several epidemiologic studies reported the association of cigarette smoking with glaucoma and increased of intraocular pressure<sup>5</sup>. When the intraocular pressure is greater than normal but the person does not show signs of glaucoma this is considered as ocular hypertension. Person with elevated intraocular pressure is considered as a glaucoma suspect<sup>6</sup>. The relatively high intraocular

pressure can cause optic disc damage and visual field defects<sup>3</sup>. Cigarette smoking adds to vascular sicknesses by obstructing arterial lumen with atherosclerosis plaque and intimal thickening. Retinal ganglion cell and trabecular meshwork cell damage due to smoking involving inflammation and apoptosis have been proved in glaucoma. Smoking also causes high oxidative stress because of oxidizing agents that produce free radicals which proves that smoking is responsible in pathogenesis of primary open angle glaucoma<sup>4</sup>.

The purpose of this study was to determine the effect of smoking on intraocular pressure in individual with normal blood pressure and to compare the smoking effects on intraocular pressure in smoker and non-smoker.

## MATERIAL AND METHODS

This cross sectional study was conducted in the ophthalmology department of Aziz Fatimah Hospital Faisalabad from December 2019 to August 2020. A total of 480 male subjects with the age limit 20-50 years were included in the study after informed consent was sought and obtained from each of them. One group was control (Non-smoker) and the other group was case (smokers). The smoking group was further dividing according to the consumption of cigarette smoking per day 1-5 cigarette per day and 6-10 cigarettes per day. The smokers with the history of smoking for at least one year with normal blood pressure 130/80 and visual acuity at least 6/9 were

included in this study with age matched non-smokers. A person with diabetes, hypertension, tuberculosis, pseudo exfoliation history of contact lens used, any eye surgery , glaucoma , cataract , current infectious eye disease or any other ocular and systemic history were excluded from the study.

Data were collected from the patients with the help of self-designed performa. After the history taking systolic and diastolic blood pressure was measured with sphygmomanometer and the status of diabetes was checked with glucometer, 80-130 mg/dl (random) was considered as normal individual. After that visual acuity of both eyes was measured with snellen chart at 6 meter distance. After the visual acuity measurement complete ocular eye examination was done in all subjects. Distant direct ophthalmoscope was performed to evaluate different eye conditions like cataract, keratoconus and refractive error and Slit lamp bio-microscopy was performed with +90D lens to evaluate pathological condition for the fulfillment of exclusion criteria. Intraocular pressure in each eye was assessed by using Goldman Applanation tonometer.

SPSS version 20 was used for statistical K analysis. Descriptive statistics was used to measure the effects of smoking on intraocular pressure to find out the mean and standard error of intraocular pressure in smokers and non-smokers. ANOVA test was used to explore the effect of smoking in smokers and non-smokers. P-value <0.05 was taken as significant.

## RESULTS

There were 192 (40%) patients of age 20-30 years, 160 (33.3%) patients of age 31-40 years of age, and 128 (26.6%) patients of age 41-50 years (Fig 1).

The frequency of subjects who used to smoke 1-5 cigarettes per day were 62 (12.9%) and the frequency of smokers who used to smoke 6-8 cigarettes per day were 178 (37.08%). Frequency of smokers who smoked from 1-2 years was 36 (7.5%), the frequency of smokers who used to smoke from 3-5 years was 146 (30.41%) and the frequency of smokers who used to smoke between 6-10 years of duration was 54 (12.08%) (Table 1).

Table 1: Data of smokers Cigarette consumptions

Cigarette consumptions	Frequency	Percentages
1-5 Cigarette	62	12.9%
6-10 Cigarette	178	37.08%
None	240	50%
1-2 years	36	7.5%
3-5 years	146	30.41%
6-10 years	58	12.08%

Table 2: Descriptive statistics IOP of smokers and non-smokers.

IOP R.E	N	Means	Standard deviation
Smokers	240	21.50	2.528
Non-smokers	240	15.90	1.896
Total	480	19.63	2.654
Smokers	240	22.30	2.980
Non-smokers	240	16.96	2.194
Total	480	19.34	3.574

The mean B value L of intraocular pressure of smoker's right eye was 21.50±2.5 and for non-smokers was

15.90±1.8. The mean value of intraocular pressure of left eye in smokers was 22.3±2.9 and in non-smokers was 16.96±2.4 (Table 2).

By using ANOVA test, the result shows the p value <0.05 of smokers and non-smokers R.E which mean statistically significant at the level of 5 % confidence interval, shows that there was statistically significant (p-0.01) effect of smoking on intraocular pressure. The results also shows p value <0.05 of smokers and non-smokers L.E which means there was a highly significant (p-0.01) effect of smoking on intraocular pressure. The intraocular pressure of smoker's right and left eye was relatively higher than the non-smoker right and left eye.

## DISCUSSION

Elevated intraocular pressure is a major risk factor for glaucoma. There is a conflicting epidemiological data on whether cigarette smoking affects IOP. Some studies show that there is no association between smoking and intraocular pressure and some studies reported that there is an association between smoking and intraocular pressure.

A study was conducted by Kamble et al<sup>1</sup> to see the effects of tobacco smoke on the intraocular pressure. They found that the mean value of intraocular pressure of smoker right and left eye was 23.46±1.45 and 23.65±1.46 respectively and the mean value of non-smoker right and left eye was 19.38±1.55 and 19.39±1.53 respectively. Similarly, my study concluded that the mean value of smoker right and left eye was 21.50±2.50 and 22.30±1.8 respectively and for non-smoker the mean value of right and left eye was 15.90±2.9 and 16.96±2.1 respectively.

Another similar study conducted by Timothy et al<sup>2</sup> to determine the effect of smoking on intraocular pressure. The result showed the significant rise in intraocular pressure (p<0.01). The result of my study also show similar results that smoking effects on intraocular pressure P-0.01. They also concluded in their study that the mean value of intraocular pressure was higher in smoker left eye as compared to right eye.

My study result shows significant rise in intraocular pressure in smoker when compared to normal healthy individual. Another similar study conducted which also shows that the intraocular pressure of smokers was significantly elevated P-<0.001 when compared with controls<sup>7</sup>.

Yoshida et al. conducted a research to clarify the effect of smoking on intraocular pressure. The result of their study show a positive association of cigarette smoking with intraocular pressure in men (P < 0.05) and a negative association of cigarette smoking with intraocular pressure in women (P-0.06). In above study intraocular pressure was measured with non-contact tonometer which is different from my study design. In my study Goldman Applanation tonometer was used to measured intraocular pressure because accuracy of non-contact tonometer loss when intraocular pressure was higher than 21 mmHg. Another similar study conducted by Okoro and observed that there was a positive association of cigarette smoking on intraocular pressure<sup>8</sup>.

Previously, conducted research also noted the direct or passive effect of smoking on intraocular pressure and

on arterial blood pressure<sup>2,9,10</sup>. It was considered that both intraocular pressure and arterial blood pressure increases due to nicotine. There is also needed to be study the effect of smoking on arterial blood pressure to confirm the above statement on a larger scale.

## CONCLUSION

There was a highly significant association of rise in intraocular pressure with smoking. This study also concludes that intraocular pressure increases more in smokers left eye as compared to the left eye.

## REFERENCE

1. Kamble G, Rani J, Taranikanti M & Meka R. Intraocular changes in smokers and non-smokers. *Int J Med Sci Public Health*. 2016; 5:1823-25.
2. Timothy CO & Nneli RO. The effect of cigarette smoking on intraocular pressure and arterial blood pressure of normotensive young Nigerian male adults. *Nigerian J Physiol Sci*. 2007;22(1-2):31-35.
3. Yahida M, Take S, Ishikawa M, Kokaze A, Karita K & Harada M. Association of smoking with intraocular pressure in middle aged and older Japanese residence. *Environ Health Prev Med*. 2014;19:100-107.
4. Arcelus M, Toledo E, Gonzalez M, Calvo N & Montanes J. Smoking and incidence of glaucoma. *Medicine (Baltimore)*. 2017; 96(15):5761.
5. Lee AJ, Rohtchina E, Wang J, Healey PR & Mitchell P. Does smoking affect intraocular pressure? Finding from the Blue Mountains Eye Study. *J Glaucoma*. 2003; 12:209-212.
6. Mansouri K, Pajic B & Hafezi F. Effect of cigarette smoking on intraocular pressure. *J Cataract Refract Surg*. 2015; 4(3):682-683.
7. Afsheen A, Bhutkar M, Reddy R & Patil RB. Effect of chronic cigarette smoking on intraocular pressure. *Int J Biol Med Res*. 2012; 3(2):1763.
8. Okaro M. A comparative study of the effect of cigarette smoking on intraocular pressure of non-smoking and smoking healthy adults. Doctor of Optometry Thesis. Abia State University Uturu. 2004; 1-3.
9. Roy J, Ponsford E, Basu PK & Labarre R. Effect of cigarette smoking on intraocular pressure and vision. *Br J Ophthalmol*. 1978; 62:682-687.
10. Garhardt U, Han U & Hohage U. Influence of smoking on baroreceptor function 24 hour measurement. *J Hypertension*. 1999; 941-946.