

# A Comparative study of Lipid Profile and Hematological Parameters in Young Smokers and Nonsmokers

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## ABSTRACT

**Background and Objective:** The present study provides a detailed profile of the plasma lipid level parameters according to cigarette smoking status (smoker and nonsmoker) and dosage [number of cigarette(s) smoked per day] in this part of Southern Rajasthan.

**Materials and Methods:** The study is being carried out in 100 healthy smokers and 100 healthy non smokers selected from from general public, patient attendants, hospital staff, medical students in RNT Medical College Udaipur (Rajasthan).

**Results:** Out of 100 patients in the present study the number of subjects in mild, moderate and heavy smokers group were 33(33%), 54(54%), 13(13%) respectively. Smokers had higher total cholesterol, plasma triglycerides, serum LDL. Lower levels of serum HDL compared to non-smokers which was statistically significant. Heavy Smokers had higher total cholesterol, plasma triglycerides, serum LDL compared to mild and moderate smokers which was statistically significant.

**Conclusion:** The present study provides a detailed profile of the plasma lipid level parameters according to cigarette smoking status (smoker and nonsmoker) and dosage [number of cigarette(s) smoked per day]. Smoking is associated with significant lower levels of serum HDL and high levels of serum cholesterol, serum triglycerides, serum LDL levels. Smoking in young adults induces dyslipidaemic state in the direction of increased risk for coronary artery disease. So it is strongly recommended to avoid smoking for the benefit of cardiac health.

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## INTRODUCTION

Tobacco is a serious threat to health and a proven killer and ranks second as a cause of death in the world, taking its toll by killing some 5 million people globally. Tobacco use is an emerging pandemic marching forward relentlessly. Evidences accumulating since early 1950s indicate that more than 25 diseases are now known or strongly suspected to be causally related to smoking WHO estimates that unless current smoking pattern reversed, tobacco will be responsible for 10 million deaths per year, by the decade 2020–2030, with 70% of them occurring in developing countries<sup>1</sup>.

In India tobacco kills 8–10 lakhs people each year and many of these deaths will occur in people who are very young. It has been estimated that an average of five-and a-half minutes of life is lost for each cigarette smoked. Deaths attributable to tobacco are expected to rise from 1.4% of all deaths in 1990 to 13.3% in 2022.<sup>2</sup>

Youth in general and adolescents in particular fall prey to this deadly habit with severe physical, psychological, and economic implications. A large number of risk factors which predispose to atherosclerosis and coronary artery diseases

have been identified. These include modifiable ones like hypertension, dyslipidemia, smoking, diabetes mellitus, changing lifestyle and non-modifiable ones like age and sex.<sup>3</sup>

Although smoking has been established as an independent risk factor<sup>4</sup> for coronary heart disease, the mechanism by which it increases the risk of coronary heart disease are unclear.

#### **Four explanations have been postulated.**

- i. The increased carbonmonoxide (CO)<sup>5</sup> in the blood of cigarette smokers may damage the endothelium and accelerate the entry of cholesterol into the wall of the artery promoting the development of atherosclerosis, thrombosis<sup>6</sup>,
- ii. The formation of carboxyhemoglobin creates relative anoxemia in the tissue, including the myocardium, Smoking enhances the platelet aggregation<sup>7</sup>,
- iii. The nicotine absorbed from cigarette smoke may induce cardiac arrhythmias through its pharmacologic action
- iv. An additional mechanism has been recently suggested that smoking adversely affects the concentration of the plasma lipids and lipoproteins. However, studies to date have revealed incomplete, inconclusive or conflicting results about the association of smoking on the plasma lipid and lipoprotein levels.

Strong epidemiological evidence links cigarette smoking to cardiovascular disease, cancer and chronic obstructive pulmonary disease (COPD), the exact mechanisms of these links remain poorly understood. Some of the adverse effects of smoking include: initiation of endothelial injury, acceleration of coronary progression, new lesion formation, overall alterations in lipid and hemostatic systems. Detecting endothelial damage may be the most useful step in the early diagnosis of atherosclerosis<sup>8</sup>.

The endothelium releases many molecules into the circulation and arterial wall, not all of them are specific to the endothelium and are therefore of limited research or diagnostic potential<sup>9</sup>.

#### **Aims And Objectives**

The present study is done to:

1. To study the effect of cigarette smoking on lipid profile in young smokers and nonsmokers.
2. To study the lipid profile with relation to duration of smoking.
3. To study the similar lipid parameters of appropriately matched controls. (Nonsmokers)

### **MATERIAL AND METHODS**

**Study Design:** Case control study

**Study Population:** Young smokers from general public, patient attendants, hospital staff, medical students in RNT Medical College Udaipur (Rajasthan).

**Sample Size-** 100 cases and 100 controls.

#### **Inclusion Criteria:**

1. Subjects who are Smokers age  $\geq 18$  years.
2. Subjects with BMI less than 25
3. Subject taking average indian diet

#### **Exclusion Criteria:**

1. Subjects having diseases mentioned below known to influence blood lipids was excluded from the study  
- Diabetes mellitus, Nephrotic syndrome, Alcoholism, Hypertension, Hypothyroidism, Cushing's syndrome, Chronic liver disease, Chronic kidney disease, Obesity.
2. Subjects who are on following drugs:  
- HMG CoA reductase inhibitors, Fibrin acid derivatives, Nicotinic acid, Beta blockers, Diuretics
3. Subjects who are on diet restriction
- 4 Case and Control who not given consent for study

**Study Method:** Subjects was enrolled in the study according to inclusion and exclusion criteria. After taking proper consent two groups each containing 100 subjects was formed first group containing Smokers which was classified in following categories-

- a) Mild smokers: 1-5 cigarettes per day for atleast 2 years or more
- b) Moderate smokers: 6-15cigarettes / day for atleast 2 years or more
- c) Heavy smokers: more than 15 cigarettes/ day for atleast 2 years or more.

Second group included Nonsmokers which is defined as subjects who have never smoked or those who left smoking atleast 2 years before the present study.

All these subjects was undergone detailed history, examination and investigated according to proforma. Special consideration on fasting for atleast 8-12 hours for lipid profile was made.

Both the groups was compared on the basis of lipid profile parameters and hypothesis was given.

**Statistical Analysis-** The statistical tests used in the study was:

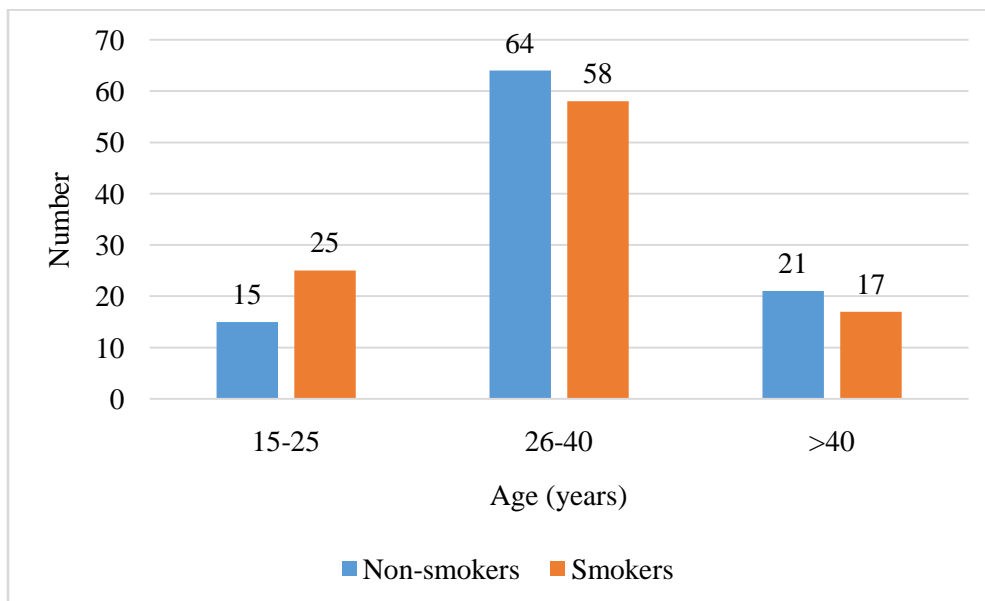
- 1. Standard deviation
- 2. x2 test (chi square test)
- 3. Mean
- 4. Diagrammatic presentation
- 5. The p value of 0.05 or less was considered as statistically significant

### OBSERVATIONS AND RESULTS

**Table 1. Age distribution of non-smoker and smoker**

Age in years	Nonsmokers (%)	Smokers (%)
15-25	15	25
26-40	64	58
>40	21	17
Total	100	100

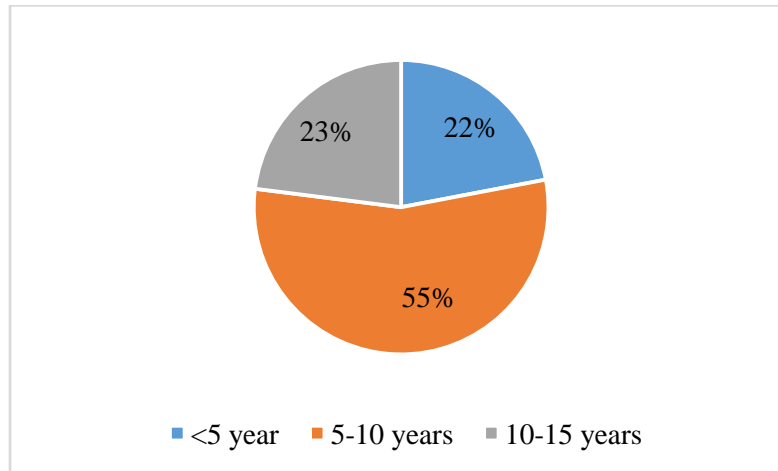
According to table 1 in the present study the number of non-smokers in 15-25, 26-40 and >40 age group was 15%, 64% and 21% respectively and number of smokers in 15-25, 26-40 and >40 was 25%, 58% and 17% respectively.



**Table 2. Duration wise distribution of smokers**

Duration of smoking	Number (No.)	%
<5 year	22	22.0
5-10 years	55	55.0
10-15 years	23	23.0
Total	100	100

According to table 2 in the present study the number of smokers in <5 year, 5-10 year and 10-15 year was 22%, 55% and 23% respectively.

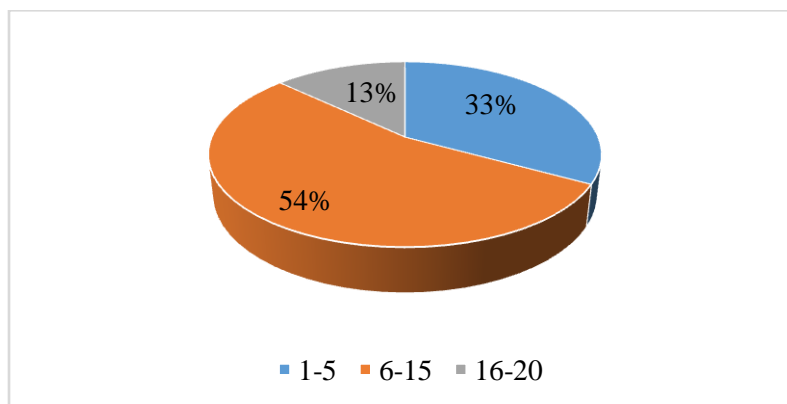


**Duration wise distribution of smokers**

**Table 3. Number of smokers based on number of cigarettes**

No. of cigarettes / day	Number (No.)	%
1-5(Mild Smoker)	33	33.0
6-15(Moderate Smoker)	54	54.0
16-20(Heavy Smoker)	13	13.0
Total	100	100

According to table 3 in the present study the number of smokers in 1-5(mild smoker),6-15(moderate smoker), 16-20(heavy smoker) No. of cigarettes / day 33%, 54%, 13% respectively

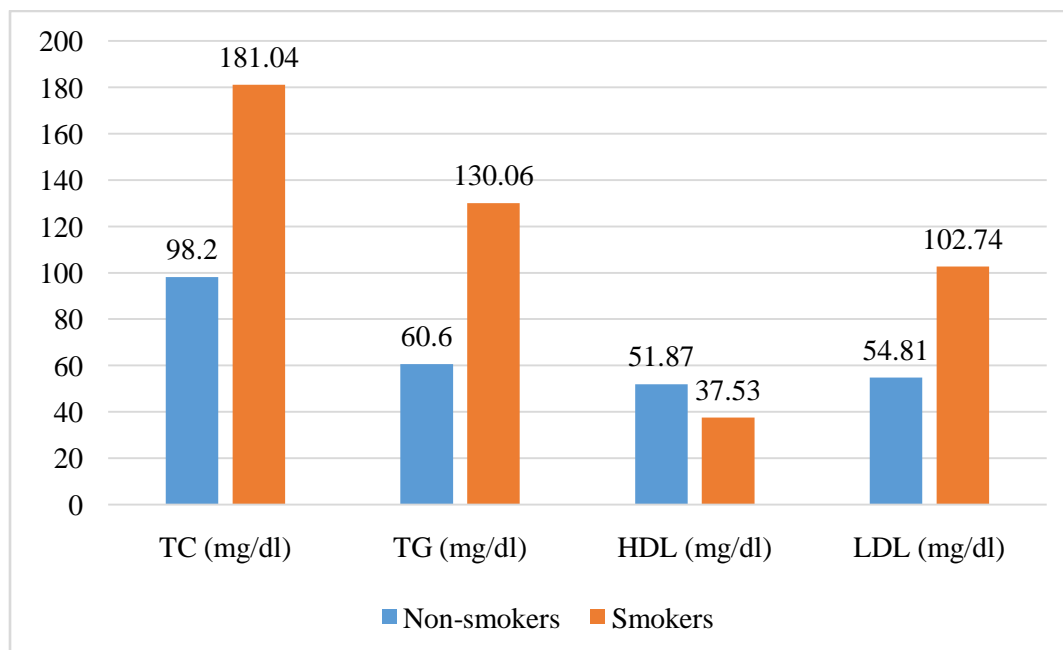


**Duration of smokers based on number of cigarettes**

**Table 4. Lipid profile of non-smoker and smoker**

Lipid profile	Non-smokers	Smokers	P value
Total Cholesterol(TC) (mg/dl)	98.20±13.50	181.04±38.93	0.0001
Triglycerides(TG) (mg/dl)	60.60±25.91	130.06±31.15	0.0001
High Density Lipoprotein(HDL) (mg/dl)	51.87±6.22	37.53±9.20	0.0000
Low Density Lipoprotein(LDL) (mg/dl)	54.81±16.08	102.74±25.88	0.0001

According to table 4, smokers had higher total cholesterol levels compared to non-smokers (181.04 ±38.93 versus 98.20±13.50) this difference was statistically significant. Smokers had higher plasma triglyceride level compared to non-smokers (130.06±31.15 versus 60.60±25.91) this difference was statistically significant. Smokers had higher serum LDL levels compared to non-smokers, (102.74±25.88 versus 54.81±16.08) this difference was statistically significant. Smokers had lower levels of serum HDL compared to non-smokers (37.53± 9.20 versus 51.87±6.22) and this difference was statistically significant.



**Table 5. Lipid profile of smokers in relation with number of cigarettes**

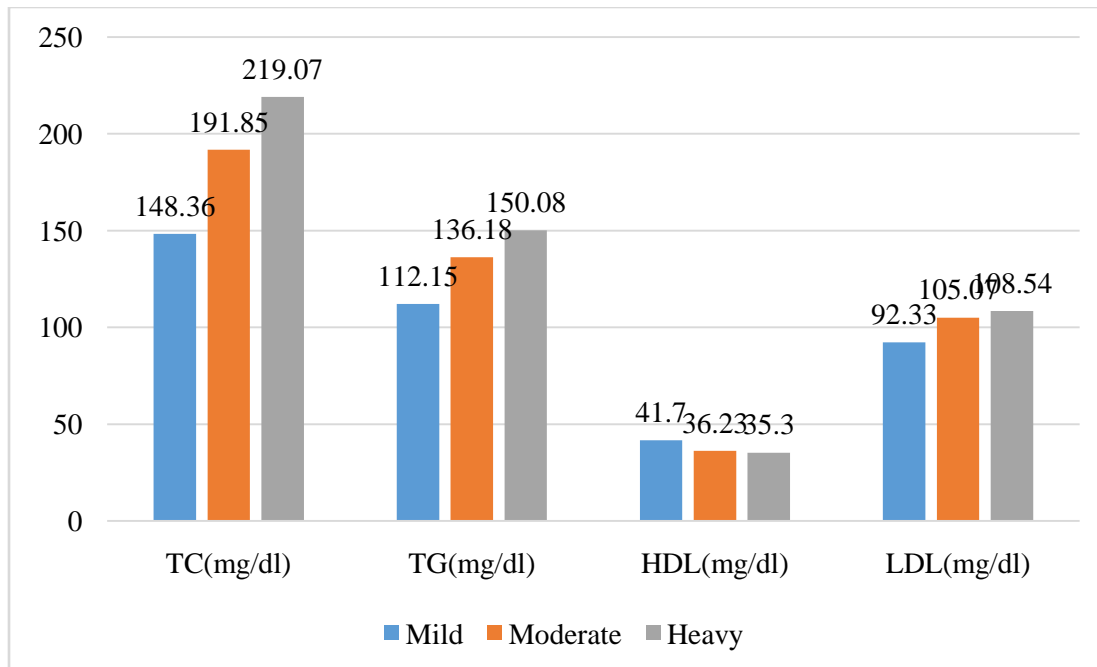
Lipid profile	No. of cigarettes per day			P value
	1-5(Mild smoker)	6-15(Moderate smoker)	16-20(Heavy smoker)	
TC (mg/dl)	148.36±36.55	191.85±27.56	219.07±21.68	0.000
TG (mg/dl)	112.15±34.27	136.18±24.49	150.08±24.96	0.000
HDL (mg/dl)	41.70±10.07	36.23±9.56	35.30±7.52	0.005
LDL (mg/dl)	92.33±27.16	105.07±24.43	108.54±23.35	0.016

In table 5, smokers were further subdivided into mild, moderate, heavy group based on number of cigarette smoked and the values of each group were compared.

Total cholesterol value was highest in heavy smokers (219.07±21.68), less in moderate smokers (191.85±27.56) and least in mild smokers (148.36±36.55). The difference of these values with non-smokers was statistically significant.

The triglyceride levels were highest in heavy smokers (150.08±24.96), less in moderate smokers (136.18±24.49) and least in mild smokers (112.15±34.27). The difference of these values with non-smokers was statistically significant.

The serum LDL level were highest in heavy smokers (108.54±23.35), less in moderate smokers (105.07±24.43) and least in least in mild smokers (92.33±27.16).The difference of these values with nonsmoker was statistically significant. The serum HDL level was lowest in heavy smoker group (35.30±7.52), higher in moderate smoker group (36.23±9.56) and highest in mild smoker group (41.70±10.07). The difference of these values compared to non-smoker group was statistically significant.



**Lipid profile of smokers in relation with number of cigarettes**

**Table 6. Comparison of lipid profile in smokers with duration of smoking**

Duration of smoking	TC	TG	HDL	LDL
<5 year	151.14±35.82	104.82±32.13	47.36±9.36	77.45±30.39
5-10 years	180.58±30.61	134.87±24.65	36.51±6.89	104.16±21.12
10-15 years	210.57±34.22	142.96±30.43	30.75±5.24	125.04±19.65
P value	<0.00001	0.000015	<0.00001	<0.00001

**In table number 6 shows :-**

- 1) TC value was 151.14±35.82 in smokers with a smoking history of <5 year and 180.58±30.61 in smokers with a smoking history of 5-10 year and 210.57±34.22 in smoker with smoking history of 10-15 year. It was observed that the TC value increased with increase duration of smoking. There was statistically significant that increase in the level of TC in with increase duration of smoking (P value <0.00001).
- 2) TG value was 104.82±32.13 in smokers with a smoking history of <5 year and 134.87±24.65 in smokers with a smoking history of 5-10 year and 142.96±30.43 in smoker with smoking history of 10-15 year. It was observed that the TG value increased with increase duration of smoking. There was statistically significant that increase in the level of TG in with increase duration of smoking (P value 0.00001).
- 3) HDL value was 47.36±9.36 in smokers with a smoking history of <5 year and 36.51±6.89 in smokers with a smoking history of 5-10 year and 30.75±5.24 in smoker with smoking history of 10-15 year. It was observed

- that the HDL value decrease with increase duration of smoking. There was statistically significant that decrease in the level of HDL in with increase duration of smoking (P value <0.00001).
- 4) LDL value was 77.45±30.39 in smokers with a smoking history of <5 year and 104.16±21.12 in smokers with a smoking history of 5-10 year and 125.04±19.65 in smoker with smoking history of 10-15 year. It was observed that the LDL value increased with increase duration of smoking. There was statistically significant that increase in the level of LDL in with increase duration of smoking (P value <0.00001).

### DISCUSSION

Cigarette smokers have a higher risk of coronary artery disease than nonsmokers. Several possible explanations have made for this association, including altered blood coagulation, impaired integrity of the arterial wall, and changes in blood lipid and lipoprotein concentrations.

In our study it revealed that TC, TG, and LDL were statistically significantly higher and HDL is significantly lower in smokers as compared to nonsmokers.

By combining the results of individual studies in the present analysis we have shown conclusively that smoking is associated with significantly higher serum concentrations of total cholesterol, triglycerides, low density lipoprotein cholesterol and lower serum concentrations of high density lipoprotein cholesterol and that this association is dose and duration dependent. In support of these clinical observations Brischetto et al" proposed a mechanism to explain the link between smoking and some of the observed changes in serum lipid and lipoprotein concentrations:

(a) Nicotine stimulates the release of adrenaline by the adrenal cortex, leading to the increased serum concentrations of free fatty acid observed in smokers".

(b) Free fatty acid is a well known stimulant of hepatic secretion of very low density lipoprotein and hence triglycerides.

(c) High density lipoprotein concentrations vary inversely with very low density lipoprotein concentrations in serum. Complementary to this mechanism is the finding that free fatty acid also stimulates hepatic synthesis and secretion of cholesterol<sup>10</sup>.

#### Lipid profile in smoker and non-smoker

Authors		Mean TC		Mean TG		Mean HDL		Mean LDL	
		NS	S	NS	S	NS	S	NS	S
Neki NS et al.	NS=50 S=50	164.1	181.0	129.1	173.0	46.65	43.8	87.0	103.7
Odedeji OA et al	NS=50 S=20	4.06	5.26	1.25	1.22	1.15	1.45	2.37	3.27
Makoto et al	NS=38 S=75	198.8	202.4	103.4	150.9	57.0	55.6	12.1	166.6
Aneela et al	NS=31 S=30	140.1	175.6	101.84	129.76	45.82	31.56	73.93	118.11
Present study	NS=100 S=100	98.20	181.04	60.60	130.06	51.87	37.53	54.81	102.74

In our study the mean serum total cholesterol, triglycerides, LDL, HDL levels were higher in smoker than nonsmoker and this difference was statistically significant (p value< 0.005).The mean HDL levels were higher in nonsmokers than smokers and this difference was statistically significant (p value<0.005). Studies conducted on the mean serum total cholesterol, triglycerides, LDL, HDL levels by NS Neki et al, OA Odedeji et al, Mokoto et al, Aneela et al are corroborating with our study.

There is inverse relationship between smoking and serum HDL level. Also this inverse relationship is dose (on number of cigarettes smoked per day) dependent as in the present study.

Serum HDL was lowest among heavy smokers group followed by moderate and mild smokers in present study, Study conducted on the mean serum HDL level by Imamura et al are corroborating with our study, which was statistically significant (p<0.05).

Serum TC, TG, LDL value was highest among heavy smokers group followed by moderate and mild smokers in present study, Study conducted on the mean serum total cholesterol, triglycerides, LDL levels by Imamura et al are corroborating with our study, which was statistically significant ( $p < 0.05$ ).

### **CONCLUSION**

The present study provides a detailed profile of the plasma lipid levels according to cigarette smoking status (smoker and non-smoker) and dosage [number of cigarette(s) smoked per day] in the southern part of Rajasthan. The study was carried out in 100 healthy smokers and 100 healthy nonsmokers selected from volunteers from general public, patient attendants and hospital staff of R.N.T. Medical College and Hospital Udaipur Rajasthan.

The mean value of total cholesterol, triglyceride, LDL levels was higher in smokers when compared to nonsmokers and in smoker highest in heavy smokers, less in moderate smokers and least in mild smokers. The difference of these values with non-smokers was statistically significant.

The mean value of HDL was lower in smokers when compared to that of nonsmokers and the difference of these values compared to nonsmoker group are statistically significant. The serum HDL level was lowest in heavy smoker group, higher in moderate smoker group and highest in mild smoker group. The difference of these values are statistically significant.

The duration and doses (cigarettes smoked/day) of smoking affect the lipid profile and the effect on TC, TG, LDL increases with increase in duration and HDL decreases with increase in duration and this are statistically significant.

### **LIMITATION**

1. Taking a large sample would have helped to conclude the study more effectively.
2. Taking female patients in sample would have helped to conclude the study more effectively.
3. Follow up of patients was not done in our study which could have added additional information regarding the dynamic change of serum lipid level parameters.

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