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A STUDY OF DOSE DEPENDANT EFFECT OF CIGARETTE SMOKING ON LIPID PROFILE

Beenakumari R¹, Balachandran J²

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ABSTRACT: Cigarette smoking is the single most preventable cause of several diseases and premature deaths. Cigarette smokers have a higher risk of coronary artery disease than non-smokers. Several possible explanations have been offered for this association of which one is through its dyslipidemic effects. **AIMS:** 1. To evaluate the variation in lipid profile with respect to number (in packs) of cigarettes smoked per day. 2. To evaluate the variation in lipid profile with respect to duration (in years) of cigarette smoking. **SETTINGS AND DESIGN:** Out of 240 subjects 120 were non-smokers and 120 were smokers. All the subjects were healthy and free from any major illness **METHODS AND MATERIAL:** Subjects were asked to refrain from non-vegetarian diet for three days. Blood sample was collected after overnight fasting and analysed for lipid profile. **STATISTICAL ANALYSIS:** ANOVA test was used for analysis. **RESULTS AND CONCLUSION:** The present study shows increase in total cholesterol, triglycerides, low density lipoproteins, ratio of TC/HDL-C and LDL-C/HDL-C and decrease in high density lipoproteins, with increase in number of cigarettes (In packs) and increase in number of years of smoking. In the view of double risk for smokers (Smoking and altered lipid Profile) efforts may be made to introduce smoking cessation clinics and awareness programmes regarding ill-effects of smoking from school level itself. **KEYWORDS:** Lipid profile, Total Cholesterol, Triglycerides, Low Density Lipoproteins, High Density Lipoproteins.

INTRODUCTION: Cigarette smoking is a habit which starts usually in teenage. Cigarette smoke is a heterogeneous aerosol produced by incomplete combustion of tobacco leaf. It contains many pharmacologically active, antigenic, cytotoxic, mutagenic and carcinogenic substances.

Indians are prone for CAD due to sedentary lifestyle, hypertension, obesity, hypercholesterolemia, Insulin resistance.¹ Dramatic increase in coronary artery disease in the next twenty years was predicted by Reddy K S in 1998.² Smoking produces adverse effects on lipid profile, therefore increasing the cardiovascular disease risk. The high prevalence of an atherogenic lipid profile in smokers makes them prone to develop premature atherosclerosis.³

All the ill effects are more with more number of cigarettes and for a prolonged period. Many researchers had already shown significant change of lipid profile in smokers.⁴ The more the number of cigarettes smoked per day the greater is the risk of CAD.^{5,6}

Passive smoking also produces similar effects but to a lesser extent.

Cessation of smoking brings down the lipid abnormalities and brings down the risk of CAD.⁷ The World Health Report⁸ (2003) concludes that consumption of tobacco products are the world's leading preventable cause of death, responsible for about 5 million deaths a year mostly in poor countries and poor populations. The toll will double in 20 years unless available and effective interventions are urgently and widely adopted.

AIMS:

1. To evaluate the variation in lipid profile with respect to number of cigarettes smoked (In packs) per day.
2. To evaluate the variation in lipid profile with respect to duration of cigarette smoking (In years).

MATERIALS AND METHODS: The study was conducted in the Department of Physiology, Biochemistry and PHC Ettumanoor of Government Medical College, Kottayam after obtaining clearance from Institutional Ethical Committee. Present study includes 240 healthy male subjects between age of 20-59 years, 120 non-smokers and 120 smokers. The smokers were grouped according to the average number of cigarettes in packs (each packet containing ten cigarettes) smoked per day and number of years of smoking.

The inclusion criteria are non-smokers and smokers between age 20 and 59 years, who are otherwise healthy.

The exclusion criteria includes subjects below 20 years and above 59 years, those with H/O Hypertension, Diabetes Mellitus, Endocrine disorders, Hyper- lipidemia and those on drugs like β blockers, Diuretics, Steroids and Anticonvulsants. Details such as name, age, address, occupation, history of smoking, dietary history, history of diabetes, hypertension, hyperlipidemia and use of any drugs were enquired and noted in the performa. Informed consent was obtained from subjects.

The subjects were asked to refrain from non-vegetarian diet for three days. Blood sample (5ml) was collected after an overnight fasting, using disposable syringe and needle under aseptic precautions. Samples were kept unshaken for half an hour, serum was separated by centrifuging at 3000 rpm for 5 minutes. Serum TC was done using kit AGAPPE diagnostics, TG using Enzyme calorimetric test and HDL-C using Phosphotungstic Acid method. Concentrations were measured colorimetrically.

LDL-C was calculated using Friede wald's formula.

LDL cholesterol = Total cholesterol – (VLDL Cholesterol + HDL Cholesterol), where

VLDL cholesterol= Triglyceride/5

Ratio of TC/HDL-C and LDL-C/HDL-C was also calculated.

Statistical analysis was done using ANOVA test. The calculated F value is compared with that given in F table and level of significance was determined.

RESULTS: Table 1a shows Comparison of mean total cholesterol based on number of cigarettes (in packs) smoked per day. There is statistically significant increase in mean total cholesterol with increase in number of cigarettes smoked per day.

Table 1 b shows comparison of mean total cholesterol based on duration of smoking. There is increase in mean cholesterol with increase in number of years of smoking and is statistically significant.

Table 2a shows Comparison of mean TG based on number of cigarettes (in packs) smoked per day. There is statistically significant increase in mean triglyceride with increase in number of cigarettes smoked per day.

Table 2 b shows comparison of mean TG based on duration of smoking. There is increase in mean triglyceride with increase in number of years of smoking and is statistically significant.

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Table 3a shows comparison of mean LDL cholesterol based on number of cigarettes (In packs) smoked per day. There is statistically significant increase in mean low density lipoprotein cholesterol with increase in number of cigarettes smoked per day.

Table 3b shows comparison of mean LDL Cholesterol based on duration of smoking. There is increase in mean low density lipoprotein cholesterol with increase in number of years of smoking and is statistically significant.

Table 4a shows comparison of mean HDL cholesterol based on number of cigarettes (In packs) smoked per day. There is statistically significant decrease in mean HDL cholesterol with increase in number of cigarettes smoked per day.

Table 4 b shows comparison of mean HDL Cholesterol based on duration of smoking. There is decrease in mean HDL cholesterol with increase in number of years of smoking and is statistically significant.

Table 5a shows comparison of mean TC/ HDL-C based on number of cigarettes (In packs) smoked per day. There is statistically significant increase in mean ratio of total cholesterol to high density lipoproteins with increase in number of cigarettes smoked per day.

Table 5 b shows comparison of mean TC/HDL-C based on duration of smoking. There is increase in mean ratio of total cholesterol to high density lipoproteins with increase in number of years of smoking and is statistically significant.

Table 6a shows comparison of mean LDL-C/HDL-C based on number of cigarettes (In packs) smoked per day. There is statistically significant increase in ratio of mean low density lipoprotein to high density lipoprotein cholesterol with increase in number of cigarettes smoked per day.

Table 6 b shows comparison of mean LDL-C/HDL-C based on duration of smoking. There is increase in mean ratio of low density lipoprotein to high density lipoprotein cholesterol with increase in number of years of smoking and is statistically significant.

DISCUSSION AND CONCLUSION: Smoking was not accepted as a bonafide hazard in the development of heart disease till Framingham study established smoking as an important risk factor of coronary artery disease. This factor could be modified to bring down occurrence of coronary artery disease.^{9,10} Risk of coronary artery disease and ischemic stroke increased by smoking.¹¹ There is a strong link between cigarette smoking and high rates of cardio vascular morbidity and mortality.^{12,13} The risk was found to be fifteen times more in smokers.¹⁴ In India smoking has also been correlated with increased mortality from pulmonary tuberculosis¹⁵.

There is a dose dependant relation of increasing total cholesterol, triglycerides, low density lipoproteins and a decreasing high density lipoproteins with smoking.¹⁶ No significant change was found with LDL-C by¹⁷ Seidel. Increase in total Cholesterol and LDL-C increase were considered to be important risk factors for CAD.¹⁸ Serum HDL-C levels were found to be low in smokers irrespective of the number of cigarettes smoked by Rosenson¹⁹ and this is an independent risk prediction factor of CAD.²⁰

The ratio of TC/HDL-C was found to be (> 3.5) and ratio of LDL-C/HDLC (>4.5) was found to be higher in smokers,²¹ and the increase is more with more dose of smoking. Higher the value of the ratios, higher is the risk of CAD.²²

Our findings of high levels of total cholesterol, triglycerides, low density lipoprotein & low levels of high density lipoproteins with increased number of cigarettes smoked per day and increased years of smoking are in accordance with several studies.^{23,24,25,26}

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Myocardial infarction rates are directly related to amount and duration of cigarettes smoking.²⁷ The rate of reinfarction and mortality due to coronary artery disease also has a direct relationship with dose.²⁸ Cessation of smoking brings down the cardiovascular risk by several years.²⁹ No other intervention for cardiovascular disease is likely to be as cost effective as smoking cessation and is included in the nondrug regime of Hypertension protocol.³⁰

Thus from the present study it is inferred that higher the number of cigarettes smoked per day or longer the duration of smoking, higher is its influence on lipid profile values towards atherogenic side. It implies that more the number of cigarettes smoked per day or more the number of years of smoking, more will be the risk of coronary artery disease.

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	Non smokers	Smokers Number of cigarettes smoked per day				Total
		<1 pack	1 pack	2 packs	>2 packs	
No. of persons	120	21	36	40	23	240
Mean TC	183.49	2218.94	213.95	223.07	232.31	202.44
Std. Deviation	31.99	38.16	36.64	37.57	30.82	39.08
F Value						19.54
Significance						.0001**

Table 1a: Comparison of mean Total Cholesterol based on number of cigarettes (in packs) smoked per day

	Non smokers	Smokers Duration of smoking in years					Total
		1 -5	6-10	11-15	16-20	>20	
No. of persons	120	17	19	23	20	41	240
Mean TC	183.49	181.38	195.33	221.70	235.78	242.83	202.43
Std. Devn	31.99	18.78	25.33	42.83	27.72	23.22	39.08
F Value							32.37
Significance							.0001**

Table 1 b: Comparison of mean Total Cholesterol based on duration of smoking

	Non smokers	Smokers Number of cigarettes smoked per day				Total
		<1 pack	1 pack	2 packs	>2 packs	
No. of persons	120	21	36	40	23	240
Mean TG	149.06	165.29	162.40	176.09	168.28	158.92
Std. Deviation	38.09	43.21	37.78	26.75	54.84	39.92
F Value						4.47
Significance						.002*

Table 2a: Comparison of mean Triglycerides based on number of cigarettes (in packs) smoked per day

	Non smokers	Smokers Duration of smoking in years					Total
		1 -5	6-10	11-15	16-20	>20	
No. of persons	120	17	19	23	20	41	240
Mean TG	149.06	138.22	150.06	172.38	178.44	183.41	158.92
Std. Deviation	38.09	25.51	35.95	36.90	32.60	41.14	39.93
F Value							8.2
Significance							.0001**

Table 2 b: Comparison of mean Triglycerides based on duration of smoking

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	Non smokers	Smokers Number of cigarettes smoked per day				Total
		<1 pack	1 pack	2 packs	>2 packs	
No. of persons	120	21	36	40	23	240
Mean LDL-C	108.92	145.14	142.49	150.74	163.66	129.34
Std. Devn	29	37.11	41.82	38.17	27.51	39.33
F Value						23.91
Significance						.0001**

Table 3 a: Comparison of mean Low density lipoprotein levels based on number of cigarettes (in packs) smoked per day

	Non smokers	Smokers Duration of smoking in years					Total
		1 -5	6-10	11-15	16-20	>20	
No. of persons	120	17	19	23	20	41	240
MeanLDL-C	108.92	111.75	121.99	147.79	164.34	172.39	129.34
Std. Devn	29.05	20.55	23.12	41.59	37.43	24.26	39.33
F Value							37.59
Significance							.0001**

Table 3 b: Comparison of mean Low density lipoprotein levels based on duration of smoking

	Non smokers	Smokers Number of cigarettes smoked per day				Total
		<1 pack	1 pack	2 packs	>2 packs	
No. of persons	120	21	36	40	23	240
Mean HDL-C	44.81	42.09	41.60	37.68	35.01	41.96
Std. Devn	6.45	6.33	4.01	5.31	5.69	6.77
F Value						20.44
Significance						.0001**

Table 4a: Comparison of mean High density lipoproteins levels based on number of cigarettes (in packs) smoked per day

	Non smokers	Smokers Duration of smoking in years					Total
		1 -5	6-10	11-15	16-20	>20	
No. of persons	120	17	19	23	20	41	240
Mean HDL-C	44.81	43.73	43.25	39.48	40.15	34.58	41.96
Std. Devn	6.45	3.48	3.11	5.27	4.31	5.39	6.77
F Value							22.02
Significance							.0001**

Table 4 b: Comparison of mean High density lipoprotein levels based on duration of smoking

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	Non smokers	Smokers Number of cigarettes smoked per day				Total
		<1 pack	1 pack	2 packs	>2 packs	
No. of persons	120	21	36	40	23	240
Mean TC/HDL-C	4.22	5.38	5.21	6.08	6.81	5.00
Std. Devn	1.13	1.50	1.12	1.53	1.42	1.55
F Value						30.99
Significance						.0001**

Table 5a: Comparison of mean TC/HDL-C based on number of cigarettes (in packs) smoked per day

	Non smokers	Smokers Duration of smoking in years					Total
		1 -5	6-10	11-15	16-20	>20	
No. of persons	120	17	19	23	20	41	240
Mean TC/HDL-C	4.22	4.16	4.53	5.69	5.93	7.19	5.03
Std. Devn	1.130	0.41	0.55	1.24	0.88	1.18	1.54
F Value							54.77
Significance							.0001**

Table 5 b: Comparison of mean TC/HDL-C based on duration of smoking

	Non smokers	Smokers Number of cigarettes smoked per day				Total
		<1 pack	1 pack	2 packs	>2 packs	
No. of persons	120	21	36	40	23	240
Mean LDL-C/HDL-C	2.53	3.59	3.49	4.15	4.82	3.26
Std. Devn	0.92	1.26	1.20	1.45	1.19	1.37
F Value						30.79
Significance						.0001**

Table 6 a: Comparison of mean LDL-C/HDL-C based on number of cigarettes (in packs) smoked per day

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	Non smokers	Smokers Duration of smoking in years					Total
		1 -5	6-10	11-15	16-20	>20	
No. of persons	120	17	19	23	20	41	240
Mean LDL-C/HDL-C	2.53	2.56	2.83	3.82	4.15	5.11	3.26
Std. Devn	0.92	0.44	0.52	1.20	1.09	1.10	1.37
F Value							52.90
Significance							.0001**

Table 6 b: Comparison of mean LDL-C/HDL-C based on duration of smoking

** -Highly significant * -Significant

TC-Total Cholesterol, TG-Tri Glycerides,

LDL-Low Density Lipoproteins, HDL-High Density Lipoproteins

AUTHORS:

1. Beenakumari R.
2. Balachandran J.

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Physiology, Sree Gokulam Medical College and Research Foundation, Venjaramodu, Trivandrum.
2. Associate Professor, Department of Pulmonary Medicine, Travancore Medical College, Kollam.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Beenakumari R,
MRA-5,
Bappuji Gardens Lane 1,
Kulathoor House,
Mannanthala, P. O,
Trivandrum-15.
E-mail: dr.beenakumari@yahoo.co.in

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