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Variations of Plasma Fibrinogen, Lipid Profile and Haematological Parameters in Smokers

Medical Science

KEYWORDS : Cigarette smoking, Plasma Fibrinogen, Lipid profile, Cardiovascular disease.

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ABSTRACT

Introduction –Cigarette smoking is one of the major health hazards, an essential public health problem worldwide contributing significantly to cardiovascular morbidity and preventable mortality.

Aim: The present study was undertaken to determine the effect of smoking on the levels of Plasma Fibrinogen (PF), Lipid profile and haematological parameters.

Materials and methods: This study was carried out on 80 male subjects of which 40 were apparently healthy male smokers and 40 were apparently healthy non-smokers. Plasma Fibrinogen, Total cholesterol(TC), Triglycerides(TG), Low Density Lipoprotein(LDL) , High Density Lipoprotein(HDL), White Blood Cells(WBC) ,Packed Cell Volume(PCV) and Erythrocyte Sedimentation Rate(ESR) were analysed in both the groups by standard biochemical methods.

Results: PF was significantly increased in smokers with a mean value of 298mg/dl , while it was within normal limits in the control group (235mgs/dl). Concentration of cholesterol, triglycerides and LDL were found to be increased in smokers with a mean value of 259mg/dl, 174mg/dl and 189mg/dl respectively while it was within normal limits in the control group (Mean concentration of Cholesterol : 184mgs/dl, Triglycerides : 133mgs/dl and Low Density Lipoproteins: 120mgs/dl). Mean concentration of HDL, WBC count and PCV were not significantly altered between smokers (HDL : 34.7mg/dl, WBC count : 8183/cu.mm and PCV : 37.9%) and non-smokers (HDL : 37.25 mg/dl, WBC count : 7892/cu.mm and PCV : 33.25%) while mean ESR showed a high significant increase in smokers (21.3 mm) compared with the control group (6.35mm).

Conclusion : In healthy individuals cigarette smoke induces an inflammatory reaction with increased production of interleukins and tumour necrosis factor which in turn regulates the synthesis of fibrinogen. Similarly lipid parameters associated with atherogenesis are increased.

INTRODUCTION

Cigarette Smoking causes serious health problems ranging from lung cancer to diseases of blood vessels. Cigarette smoke impacts all phases of atherosclerosis from endothelial dysfunction to acute thrombotic events. Both active and passive smoking precipitates cardiovascular dysfunction. Recent epidemiological studies have proved that cigarette smoke increases the incidence of myocardial infarction and coronary artery disease (CAD)1,2

Though in passive smokers smoke exposure is about one hundredth that of active cigarette smoking, it is associated with a 30% increase in the risk of CAD compared with active smokers who are at 80% risk of developing the complications (3,4).

Cigarette smoke contains over 4000 known components of which only few are isolated and studied (5) such as nicotine, carbon monoxide (CO), free radicals and other gaseous products (6). Initially it was believed that CO triggered the cardiovascular changes (5) but now various studies have suggested that it was unlikely(7). Nicotine at the level found in smoke has a very minor role in initiation and probagation of atherosclerosis (8,9). Experimental models have proved that polycyclic aromatic hydrocarbons found in cigarette smoke have an important role in atherogenesis(10). An important etiological factor in the initiation of atherosclerosis in smokers is increased oxidative stress with the loss of protective effect of nitric oxide (11,12).

Fibrinogen is an acute phase reactant involved in both atherogenesis and thrombosis. PF is a coronary risk indicator as it reflects the inflammatory condition of the vascular wall. Low PF results in increased risk of bleeding while high concentration of PF alters the blood rheology and increases the blood viscosity, which is the cause of thromboembolic manifestations.

MATERIALS AND METHODS

The biochemical work was carried out on 40 apparently healthy male subjects with normal blood pressure within the age group of 30-45 years forming the control group. 40 apparently healthy male subjects with normal blood pressure who had a habit of cigarette smoking formed the smokers group. These smokers had a history of smoking 10 cigarettes or more per day for a minimum period of 10 years. Subjects were either employees or attenders of the patients visiting Government General Hospital, Chennai. Ethical committee clearance was obtained and blood samples were taken from these individuals for biochemical analysis.

ESTIMATION OF PF

Citrated blood sample was collected, plasma was separated and stored at -70°C and PF levels were measured by Kit method using Thromboscreen Fibrinogen assay kit from Pacific Hemostasis, North Carolina, USA.

Principle – Assay based on the method described by Clauss (13)

Serum Total Cholesterol-CHOD-POD (Cholesterol oxidase peroxidase) method .

Serum Triglycerides-GPO (Glycerol phosphate oxidase) method .

Serum HDL cholesterol –Precipitation method .

Plasma Glucose-GOD-POD(Glucose oxidase –peroxidase) method.

Serum LDL cholesterol using Friedwald formula.

PCV was estimated using Wintrobes method and ESR by Westergren method.

To find out the influence of cigarette smoking, the mean values obtained for the biochemical parameters for smokers were compared with that of the control group. The statistical significance of the variation in the level of the parameters is arrived at from the p value which is obtained from student's t test. (Table I)

RESULTS

Scrutinizing the results obtained in the above condition taken

up for study, the reference range for the main parameter namely PF is 235.3±5.606 mg/dl. This range is found to fall well within the levels found in standard text books (14) and that of the kit methodology adopted for the study (13). The reference range of other parameters obtained in the study is found to be valid and acceptable.

The mean PF concentration in smokers was 298 ±14.53 mgs/dl compared to the control value of 235 ± 5.61mgs/dl. The difference between mean PF of smokers and non-smokers was statistically significant (P <0.01). The mean concentration of Total Cholesterol, Triglycerides and LDL were 259±32.01, 174±10.71 and 189±34.19 respectively in smokers against 184.33±24.96, 133.35±20.01 and 120.45 ±23.36 respectively in control group. The difference between the mean concentration of the above parameters between the two groups was found to be statistically highly significant (p<0.001). HDL concentration, WBC and PCV values were not significantly altered between smokers (HDL : 34.7mg/dl, WBC count : 8183/cu.mm and PCV : 37.9%) and non-smokers (HDL : 37.25 mg/dl, WBC count : 7892/cu.mm and PCV : 33.25%) while mean ESR showed a highly significant increase in smokers (21.3 mm) compared with the control group (6.35mm).

DISCUSSION

Smoking increases the concentration of PF in healthy individuals, which suggests that smoking induces an inflammatory reaction of the pulmonary bronchi and alveolae (15) which may result in a general acute phase reaction with increased PF. Increased PF level in smokers may promote a hypercoagulable state and this explains the association of smoking with high incidence of cardiovascular disease, hypertension, stroke and clotting disorders.

Human and animal experiments have proved that both active and passive smoking are associated with decrease in vasodilation of the endothelium secondary to non availability of nitric oxide (16).Thus decreased availability of nitric oxide has both primary and secondary effects on the initiation and progression of atherosclerosis and on subsequent thrombotic events.

Cigarette smoking increases the peripheral blood leucocyte count , inflammatory markers like C reactive protein, interleukin and tumour necrosis factor and alters the cell to cell interaction(17). Platelet count is elevated in smokers indicating that they have a role in the pathogenesis of arteriosclerosis(18).

Authors have concluded from their work that association of smoking with PF is dose dependent, depending on the number of cigarettes smoked and duration of smoking (19). Genetic predisposition is found to influence smokers in development of atherosclerosis, the intersubject variability in the atherosclerotic process in smokers may be partially mediated by genetic variants (20).

Abstaining from smoking for a period of only 2 weeks induces a significant reduction in the rate of synthesis of fibrinogen in the liver . The changes in lipid parameters in smokers may be due to the following reasons .

(i) Nicotine stimulates secretion of catecholamines resulting in increased lipolysis and increased hepatic free fatty acids and triglycerides along with Very Low Density Lipoproteins (VLDL) in the blood stream.

(ii) A decrease in oestrogen levels in smokers leads to decreased HDL concentration.

(iii) Hyperinsulinaemic environment in smokers leads to increased cholesterol, LDL, VLDL, and TG due to decreased activity of lipoprotein lipase

CONCLUSION

Regular monitoring of PF and lipid parameters in smokers is advisable as changes can be detected at an early stage and preventive measures like cessation of smoking can be advised to them. In people who are at high risk of coronary heart disease, PF and serum lipid profile should be periodically monitored.

The rapid reduction in risk of cardiac events after cessation of smoking implies that policies that prevent and reduce smoking will have immense benefits for reducing cardiovascular complications.

Table I

COMPARISON OF LEVELS OF PLASMA FIBRINOGEN AND OTHER BIOCHEMICAL PARAMETERS IN CONTROL AND SMOKERS

		Plasma Fibrinogen (mg/dl)	Plasma Prothrombin Time (sec)	Serum Triglycerides (mg/dl)	Serum Cholesterol (mg/dl)	Serum HDL (mg/dl)	Serum LDL (mg/dl)	WBC (cu mm/blood)	PCV (%)	ESR (mm)
Control	Mean	235.25	13.225	133.35	184.325	37.25	120.45	7892	33.25	6.35
	+/- SD	5.606	1.143	20.077	24.955	4.929	23.355	947	4.16	5.4
Smokers	Mean	298.0	12.7	174.0	259.0	34.7	189.4	8183	37.9	21.3
	+/- SD	14.53	1.160	10.708	32.01	5.12	34.19	1627	5.916	13
P Value		<0.01	>0.05	<0.001	<0.001	>0.05	<0.001	>0.05	>0.05	<0.001
Significance		S	NS	HS	HS	NS	HS	NS	NS	HS
NS – Not Significant, HS – Highly Significant, S - Significant										

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