



**IMPACT OF PETROLEUM FUMES ON LIVER AND KIDNEY FUNCTIONING OF
PETROL FILLING ATTENDANTS AND GARAGE ATTENDANTS WORKING IN
SOUTH HARYANA, INDIA**

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ABSTRACT

Objective: The present study was conducted to investigate the impact of occupational exposure of petroleum fumes on liver and kidney functioning of petrol filling and garage attendants presently working in our locality i.e. South Haryana, India. **Methodology:** A total of 125 adult males (18-40 years) were divided in following five groups: were (i) control group consists of grocery shop attendants, (ii) petrol filling station attendants with occupational exposure upto 8 years, (iii) petrol filling station attendants with occupational exposure more than 8 years, (iv) garage attendants with occupational exposure upto 8 years; and (v) garage attendants with occupational exposure more than 8 years. Serum levels of cholesterol, SGOT, SGPT and creatinine were assessed to evaluate the impact of petroleum fumes on liver and kidneys functioning of the test subjects. **Results:** There was a significant elevation in SGOT and SGPT level in petroleum fumes exposed groups indicated predisposition for hepatotoxicity while a sharp elevation in blood cholesterol of all test groups indicated the potential of petroleum fumes for arteriosclerosis development. Moreover, susceptibility of nephrotoxicity was also observed, as there was sharp elevation in serum creatinine level in petroleum fumes exposed groups in comparison to control group subjects. **Conclusion:** The occupational exposure of petroleum fumes can make the attendants / workers vulnerable for hepatotoxicity, hypercholesterolemia and nephrotoxicity. So, the need of hour is to adopt some precautionary measures so as to minimize such peril of petroleum fumes exposure.

KEYWORDS: Petroleum Fumes, Petrol filling attendants, Garage attendants, Lead, Benzene, Gasoline.

1. INTRODUCTION

Petrol (or gasoline) is a volatile and inflammable petroleum-derived liquid mixture chiefly used for internal combustion of machines. It consists of hydrocarbons (aromatic, saturated and unsaturated) and on hydrocarbons (N, S, O₂, vanadium and nickel).^[1,2] Petrol is distilled from crude petroleum and vapour obtained due to its evaporation may be considered as petrol fumes. As petrol is volatile in nature, so it is readily available in the atmosphere any time it is dispensed, especially at petrol filling stations and garages. Petrol contains mixture of volatile hydrocarbons and so inhalation is the most common form of exposure.^[3] Petrol vapour can reach supra-lethal concentrations in confined or poorly ventilated areas, although such exposures are rare.^[4] These volatile hydrocarbons primarily get absorbed into blood via respiratory tract.^[5,6] leading to toxic effect on various vital body organs like kidney^[7], liver^[8], lung^[9] and brain^[10] are adversely affected by these toxic products, as reported in various animal studies. Previous studies

reported that composite fumes evaporating from kerosene, petrol and diesel contain some toxic hydrocarbons like benzene; lead and volatile nitrates which are chiefly responsible for the harmful effects of petroleum fumes. These constituents of petroleum fumes are metabolized in liver^[11] and cause a dose and time dependent increase in Cytochrome P₄₅₀ monooxygenases and reduced Glutathione-S-transferases and other related oxidative substances in the liver, kidney and lung membrane which are root cause of the damages.^[12] Among these, benzene is main contributor for ill effects of petroleum fumes on human health. Benzene is reported to induce hepatotoxicity, nephrotoxicity, hematotoxicity, carcinogenicity and pulmonary dysfunctioning.^[13, 14] Mortality rate was higher among the workers who had exposure to benzene as illustrated in some studies.^[15,16] Further, some studies claimed the nephrotoxicity of petroleum fumes in animal^[7,17] as well as in human is probably due to presence of lead and some other hydrocarbons.^[18] A recent study conducted in Ibadan state of Nigeria has concluded that the long term

inhalation of petrol fumes by petrol filling attendants is associated with adverse effect on the kidney and liver function.^[19] Moreover, the similar risk of occupational exposure to petroleum fumes is observed in auto mechanics / garage attendants of Calabar, Nigeria.^[20] Hence, on the same line, the present study was designed to observe the impact of occupational exposure to petroleum fumes on the liver and kidney functioning of petrol filling attendants as well as garage attendants of our locality i.e. South Haryana, India.

2. MATERIAL AND METHODS

2.1 Subjects: This study was carried out on healthy adult male subjects (in India, generally, males are engaged in such occupation) who complied with the following inclusion and exclusion criteria.

Inclusion criteria common to all groups

1. Age group of 20 to 40 years.
2. Subjects who have given written consent for the study.
3. Educated subjects atleast senior secondary level
4. Body Mass Index in the range of 18 to 25.

Exclusion criteria common to all groups

1. Subjects suffering from significant cardiovascular disorders.
2. Subjects with family history of malignancies.
3. Smokers, Alcohol Drinkers and subjects consuming any tabacco product.
4. Subjects with any chronic disease
5. History of any major disease / ailment during last 6 months

The selected petrol filling stations were of one company only. The garages having proper ventilation and hygienic conditions were only included in the study. Grocery Shop attendants in nearby area of these selected petrol filling stations and garages were served as control subjects for the present study. The petrol filling stations and garages following Bharat stage IV and above norms were included in the study. The working hours of all the subjects were nearly 10 am to 5pm daily. A total of 125 subjects were volunteered for participation in this study and randomly grouped as follows:

Control Group: 25 Shop attendants

Test Group, P1: 25 Petrol Filling attendants having occupational exposure less than 8 years

Test Group, P2: 25 Petrol Filling attendants having occupational exposure more than 8 years.

Test Group, G1: 25 Garage attendants having occupational exposure less than 8 years.

Test Group, G2: 25 Garage attendants having occupational exposure more than 8 years.

The criteria of 8 years experience was decided after normal distribution study of the selected test subjects.

2.2 METHODS

All tests were conducted between 10 am to 1 pm with

minimum half an hour after a light breakfast. Subjects were made to relax and comfortably seated. Venous blood sample (5 ml) was collected aseptically from a peripheral vein on arm of each subject. The each collected blood sample was processed for separation of serum after one hour of sample withdrawal. The serum was separated by centrifugation at 3000g for 5 minutes and stored in refrigerator. The seperated serum was evaluated for the levels of SGOT (Serum Glutamic-Oxaloacetic Transaminase) using IFCC method, SGPT (Serum Glutamic Pyruvic Transaminase) using IFCC method, cholesterol using CHOD – POD method and cretanine estimation using Jaffe's reaction method. These biochemical analysis were carried out using Laboratory kits reagents (Erba laboratory Ltd.) and Semiautomatic Human Chemistry Analyzer (Minitch, Logotech Ltd., Banglore).

2.3 Statistical Analysis

Unpaired 't' test was employed to compare the mean values of test groups or the control group using suitable P values. A P < 0.05 was considered to be statistically significant. The results are presented as Mean ± SEM.

3. RESULTS

The mean age of subjects in different groups were as Control: 32.5 ± 4.20, P1: 30.84 ± 5.52, P2: 34.26 ± 6.85, G1: 29.60 ± 5.74 and G2: 35.28 ± 6.82. Liver function was appraised by investigating SGOT and SGPT level. A significant (P < 0.01) rise was observed in both SGOT and SGPT enzyme levels in the samples of all test group subjects depicted in Figure I.

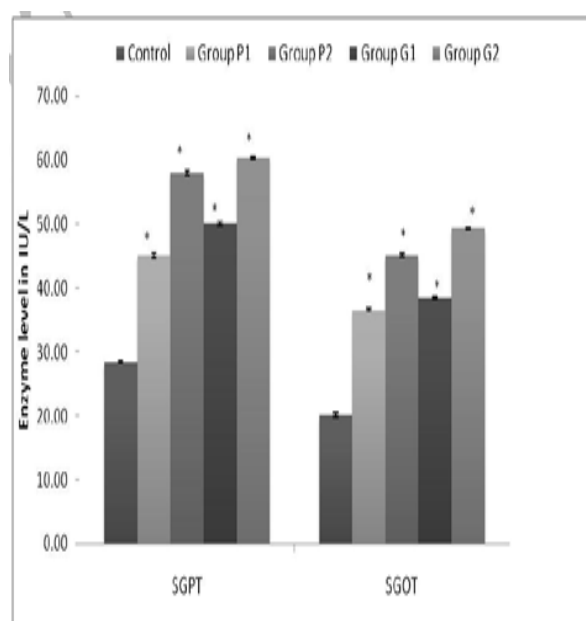


Figure I: Effect of petroleum fumes on SGOT and SGPT enzyme level; Values are shown as Mean ± SEM (n = 25); * Denotes p<0.01 as compared to control group; One way ANOVA followed by Dunnett's t-test.

The ratio of SGOT to SGPT (SGOT/SGPT) was calculated as the index of hepatic tissue damage (Table

I). This ratio was declining proportionally with exposure time from test group P1 to P2 and from group G1 to G2.

Table I: Comparison of SGOT/SGPT ratio observed in the samples of control and petrol fumes exposed groups.

GROUP	SGOT (U/L)	SGPT (U/L)	SGOT/SGPT
Control group	27.41 ± 0.15	28.43 ± 0.11	0.964
Test group P1	36.65 ± 0.26	45.18 ± 0.35*	0.8112*
Test group P2	45.19 ± 0.36	58.04 ± 0.15*	0.778*
Test group G1	38.53 ± 0.25	50.06 ± 0.36*	0.769*
Test group G2	49.36 ± 0.09	60.44 ± 0.16*	0.816*

Values are shown as Mean ± SEM (n = 25); * Denotes p<0.01 as compared to control group; One way ANOVA followed by Dunnett's t-test.

Serum cholesterol level was also significantly (P < 0.01) higher in all of subjects who were exposed occupationally to petroleum fumes. But, the elevation was lesser in case of garage attendants than that of petrol filling attendants as shown in figure II.

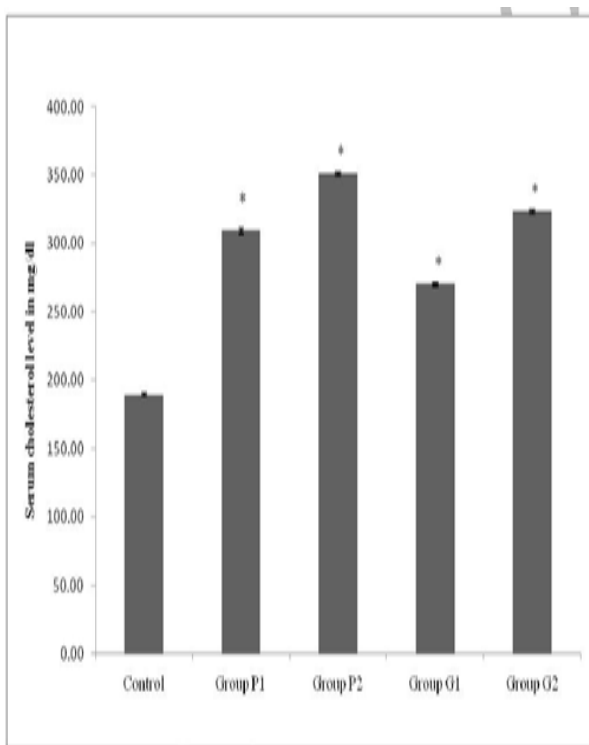


Figure II: Effect of petroleum fumes on serum cholesterol level; Values are shown as Mean ± SEM (n = 25); * Denotes p<0.01 as compared to control group; One way ANOVA followed by Dunnett's t-test.

Similarly, serum creatinine was also on abnormal rise (P < 0.01) in all of test group subjects and highest level was observed in Test group G2 where the subjects were garage attendants having more than 8 years exposure of petroleum fumes as depicted in figure III.

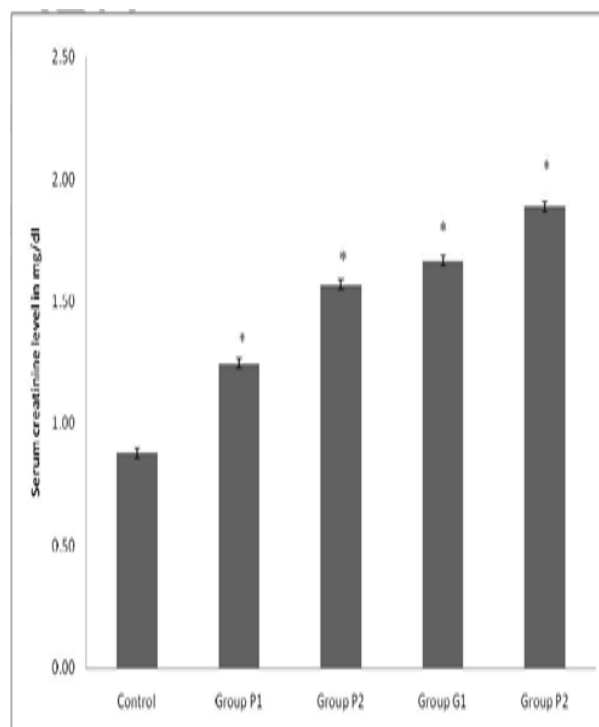


Figure III: Effect of petroleum fumes on serum creatinine level; Values are Mean ± SEM (n = 25); * Denotes p<0.01 as compared to control group; One way ANOVA followed by Dunnett's t-test.

4. DISCUSSION

In present study, we have observed that the occupational exposure of petroleum fumes in all test groups resulted in significant rise in SGOT & SGPT enzyme level, elevation in serum creatinine level and significant increase in serum cholesterol level.

SGPT level has been reported to increase as a result of liver injury in patients with severe hepatotoxicity^[21] as SGPT enzymes might have leaked from damaged cells due to increased permeability of the hepatocellular membrane or due to necrosis, indicating organ dysfunction.^[22] A significant elevation was seen in SGPT level in all test groups indicating toxic influence of petroleum fumes on liver cells. The activity of SGOT was also significantly higher in subjects exposed

occupationally to petroleum fumes in comparison to level observed in control group subjects. This damage is attributed to reactive free radical species generated from the metabolism of aromatic and aliphatic hydrocarbons present in petroleum fumes.^[23,24] The ratio of SGPT/SGOT is also an important index for measurement of hepatotoxicity. The decrease in the ratios in subjects of test groups indicated the liver damaging effect of petroleum fumes as seen in earlier animal studies.^[8] The observed hepatotoxicity of petroleum fumes in the line of the earlier study conducted in petrol attendants of Ibadan, Nigeria.^[25]

The significant abnormal rise in serum cholesterol in all test groups indicates the negative influence of petroleum fumes on lipid metabolism. The lipid metabolism is affected as a result of liver damage and disturbance of the cell membrane integrity which releases some membrane lipids into circulation. On the other hand, petroleum fumes reduce the capacity of tissues to regulate lipid metabolism. So, there is likelihood that inhalation of petroleum fumes leads to atherosclerosis as observed in earlier animal studies also.^[26, 27] Increase in cholesterol level was lesser in garage workers than in petrol filling attendants which might be due to the reason that heavy physical works in garage workers may compensate elevation in serum cholesterol level.

Serum creatinine level was abnormally elevated in all of the test group subjects. The nephrotoxicity observed in this study suggests the presence of some nephrotoxic chemical substances in petroleum fumes as reported earlier in a study on rats.^[7] The presence of lead in automobile exhaust was declared as risk for nephrotoxicity among traffic policemen^[18] while another study reported lead as a component of gasoline is responsible for nephrotoxicity observed to be associated with exposure to leaded gasoline.^[17] However, the specific chemical constituent(s) and mechanism(s) responsible for nephrotoxic effect proposed in this study is not yet clear, but it is believed that the reactive metabolites of the hydrocarbons and other constituents of the fumes might have interacted with the renal tissues to cause derangements in glomerular function.

Therefore, there is need to adopt some control strategies to reduce the petroleum fumes emission in air include evaporation controls, the use of catalytic converters and reducing benzene and lead concentration in fuel. Frequent health check-up of petrol filling attendants and garage attendants should be followed as routine. As ambient air quality guidelines in India are not available, the need of the hour is to set guidelines for safety in occupational handling of petroleum fumes for a better environment. Precautionary measures like masks may be advised to reduce the incidences of all such health hazards due to inhalation. In addition, some improvement in daily diet like vitamin (A, C and E) supplements may overact the hazards of occupational exposure to petroleum fumes as observed in the case of

rats.^[28/29]

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