Original Article
Toxicology International, *Jan-April 2017 / Vol-24 / Issue-1, 54-57*
ISSN (Print) : 0971-6580
ISSN (Online) : 0976-5131
DOI: 10.22506/ti/2017/v24/i1/146722

Hematotoxic Effect of Petroleum Fumes on Petrol Filling Attendants and Garage Attendants in South Haryana, India

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Abstract

The present study was conducted to investigate the impact of occupational exposure of petroleum fumes on hematological profile of petrol filling and garage attendants presently working in our locality i.e. South Haryana, India. A total of 125 adult males (18-40 years) were divided in five groups i.e. control group having grocery shop attendants, petrol filling station attendants with occupational exposure upto and more than 8 years and garage attendants with occupational exposure upto and more than 8 years. Complete blood profile (CBC) was assessed to evaluate the impact of petroleum fumes on hematological profile. A significant fall in red blood cells (RBC), hemoglobin and hematocrit count and significant abnormal rise in mid-sized (MID) cells was observed in all test groups having exposure to petroleum fumes in proportionate to their exposure period. In conclusion, occupational exposure to petroleum fumes may cause anemia and leukemia which worsen with prolonged exposure.

Keywords: Petroleum, Fumes, Attendants, Garage Lead, Benzene, Gasoline

Received: 22-07-2016 **Revised:** 13-11-2016 **Accepted:** 05-12-2016

Introduction

Petrol (or gasoline) is a commonly employed volatile and inflammable petroleum-derived liquid mixture chiefly used for internal combustion of machines. It consists of various hydrocarbons (aromatic, saturated and unsaturated) and on hydrocarbons (N, S, O_2, vanadium and nickel) (1, 2). Petrol is distilled from crude petroleum and the vapours 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. As petrol contains mixture of volatile hydrocarbons, so inhalation is the most common form of exposure (3). These volatile hydrocarbons mainly get absorbed into blood via respiratory tract (4, 5) leading to toxic effect on various vital body organs like kidneys (6), liver (7), lungs (8) and brain (9) 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. Among these, benzene is main contributor for ill effects of petroleum fumes on human health. Benzene is reported to induce hematotoxicity through bone marrow depression (10). Mortality rate was higher among the workers who were exposed to benzene as illustrated in earlier studies (11, 12). Further, the inhalation of petroleum fumes in animals is reported

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to induce hematotoxicity and the major constituent responsible for toxicity was Benzene (13). A recent study conducted in Nigeria has concluded that the chronic inhalation of petrol fumes by petrol filling attendants as well as garage mechanics caused bone marrow depression and so hematotoxicity in exposed groups (14, 15). Hence, on the same line, the present study was designed to observe the impact of occupational exposure to petroleum fumes on the hematological profile of petrol filling attendants as well as garage attendants of our locality i.e. South Haryana, India.

Material and methods

Subjects

The study was conducted on total 125 subjects who 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.

This study was carried out on healthy adult male subjects (in India, in general, males are engaged in such occupation) who complied with pre-decided inclusion and exclusion criteria. Inclusion criteria included age group of 20 to 40 years, subjects who have given written consent, educated subjects at least senior secondary level and Body Mass Index (BMI) in the range of 18 to 25 while exclusion criteria included subjects suffering from significant cardiovascular disorders, subjects with family history of malignancies, smokers, alcohol drinkers and subjects consuming any tabacoo product and subjects with any chronic disease and history of any major disease / aliment during last 6 months. The selected petrol filling stations were of one company only whilst the selected garages which had proper ventilation and hygienic conditions were included in the study. Shop attendants in nearby area of these selected petrol filling stations and garages were served as control subjects for the present study. The selected petrol filling stations and garages were also following Bharat stage IV and above norms. The working hours of all the subjects were nearly 10 am to 5pm daily. The criteria of 8 years experience was decided after normal distribution study of the selected test subjects.

Methods

All tests were conducted between 10 am and 1 pm 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 and was transferred to sterile K_2EDTA (Di-potassium Ethylene Diamine Tetraacetate) bottles for estimation of total WBC (White Blood Cells), Mid sized cells (MID), Lymphocytes (LYM), Granulocytes(GRE) and RBC (Red Blood Cells) count; Haemoglobin (Hb), Hematocrit (HCT), Mean Corupusular Volume (MCV), Mean Corupuscular Haemoglobin (MCH),Mean Corupuscular Haemoglobin Concentration (MCHC), Thrombocytes Count (PLT) and Mean Platelet Volume (MPV) using CBC Auto Hematology Analyzer (Minitech, Logotech Ltd. Banglore).

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 statisiticaly significant. The results are presented as Mean ± SEM.

Results

A significant (P<0.001) rise in mid sized cells (MID) level was observed in all groups viz. P1, P2, G1 and G2 when compared to the level observed in control group (Figure 1).

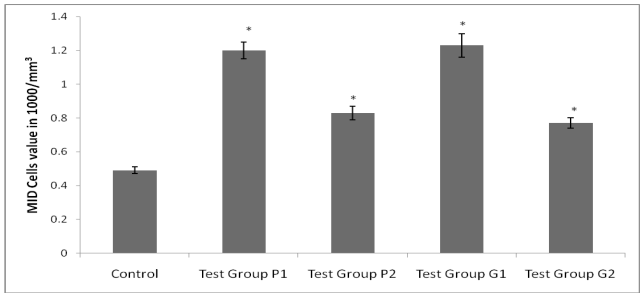


Figure 1. Effect of petroleum fumes on MID Cells values in 1000/mm^3; Values are Mean ± SEM (n = 25); * Denotes p<0.01 as compared to control group; One way ANOVA followed by Dunnett's t-test.

Simultaneously; number of RBC, Hb, HCT contents were significantly (P<0.01 for P1 group, P<0.001 for P2, G1 and G2 groups) lower in case of all test groups in comparision to control group (Figure 2).

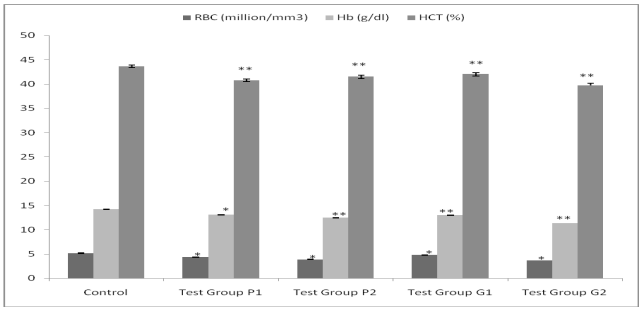


Figure 2. Effect of petroleum fumes on RBC Count (million/mm^3), haemoglobin (Hb in g/dl) and Hematocrit (HCT in %) level; Values are Mean ± SEM (n = 25); * Denotes p<0.01 as compared to control group; ** denotes p<0.01 as compared to control group; One way ANOVA followed by Dunnett's t-test.

No significant variation was observed in case of other hematological parameters (Table I).

Discussion

Benzene and lead are major component of petroleum product, disturb normal DNA functioning and are cytotoxic in nature which result in bone marrow depression, characterized by inadequate RBC production (16). The mean values of Hb, HCT and RBC significantly decreased in proportion of occupational exposure time; showing the adverse influence of petroleum fumes on bone marrow and so on RBC life cycle. These findings are in line of earlier studies carried in animals as well as in human beings (15, 17-19). The tendency to cause anemia was highest in case of group G2 which might be due to a prolonged exposure as well as cutaneous absorption of gasoline in case of garage attendants.

MID cells i.e. mid-range cells, may include less frequently occurring cells correlating to monocytes, eosinophils, basophils, blasts and other precursor white cells. The normal count of MID cells is upto 1100/mm^3. In our study, the level of MID cells was significantly higher than normal level as well as level observed in control group in all petroleum fumes exposed groups. Increased level of MID cells in petroleum fumes exposed group might be due to predisposition of the individuals to various infections because of benzene induced immune-suppression (20).

Looking into the occupational hazards of petroleum fumes, control strategies must be adopted to improve the quality of the petroleum by means of evaporation controls, employing catalytic converters and reducing benzene and lead concentration in the petroleum. Frequent health check-up of attendants should be part of their routine. As ambient air quality guidelines in India are not available, the need of the hour is to set guidelines to have safe and healthier occupation of persons dealing with petroleum products. Precautionary measures like masks may be advised to reduce the inhalational exposure in the workers. In addition, some modification in diet of the attendants like vitamin (A, C and E) supplements may prove helpful to overact the peril of occupational exposure to petroleum fumes as observed in laboratory study on rats (21) (22).

Conclusion

From this study, it can be concluded that chronic exposure to petroleum fumes may play crucial role in the

Table 1. Effect of petroleum fumes on hematological parameters observed in the samples of control and petrol fumes exposed groups

Parameter	Control	Test Group P1	Test Group P2	Test Group G1	Test Group G2
Total WBC (1000/mm^3)	5.33 ± 0.07	5.55 ± 0.078	5.44 ± 0.08	5.43 ± 0.06	5.47 ± 0.09
LYM (1000/mm^3)	2.89 ± 0.08	2.78 ± 0.09	2.75 ± 0.09	3.15 ± 0.11	3.2 ± 0.11
GRE (1000/mm^3)	5.5 ± 0.08	5.35 ±0.08	5.42 ± 0.08	5.36 ± 0.07	5.73 ± 0.1
MCV (µm^3)	83.19 ± 0.3	82.99 ± 0.3	82.11 ± 0.35	81.89 ± 0.35	82.85 ± 0.33
MCH (pg)	28.78 ± 0.09	27.34 ± 0.22	26.97 ± 0.21	27.7 ± 0.27	27.24 ± 0.21
MCHC (g/dl)	30.95 ± 0.82	30.91 ± 0.21	30.89 ± 0.59	31.22 ± 0.18	30.87 ± 0.59
PLT (1000/mm^3)	260.5 ± 2.37	263.5 ± 2.3	260.0 ± 1.9	259 ± 2.0	259.5 ± 1.9
MPV (µm^3)	9.67 ± 0.02	9.65 ± 0.02	9.65 ± 0.01	9.69 ± 0.02	9.68 ± 0.01

development of anemia as well as leukemia in petrol filling attendants and garage attendants. Such impairments in these attendants may endanger their health. So there is call for to take some effective and substantial measures by concerned authorities to preclude all these unsolicited impacts of petroleum fumes so as to have a safe and healthy living of petrol filling attendants and garage attendants.

Conflict of Interest

None Declared

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