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Effect of petroleum products and its exhaust on heamatological parameters and pulmonary function tests in petrol pump workers in Hyderabad- An observational comparative field study.

Medicine

KEYWORDS: Benzene exposure, petrol pump workers.

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ABSTRACT

The aim of present study was to assess the extent of altered pulmonary function tests and Hematological parameters in petrol-pump workers exposed to petrol and diesel fumes. The study group consisted of 10 males in the age group of 20–50 years, working 8 hours per day for more than 5 years in various petrol stations as petrol attendants in Hyderabad region of Telangana state. The control group consisted of 10 males of matched age group, not exposed to petroleum vapors. Complete blood count analysis comprising Hb concentration, RBCs counts, values of MCV and MCHC, Total WBC with differential counts, platelets and Pulmonary functions parameters comprising Forced Vital Capacity (FVC), Forced Expiratory Volume in first second (FEV_1), FEV_1 /FVC, Peak Expiratory Flow Rate (PEFR) and Forced Expiratory Flow at 25-75% were investigated and analyzed comparatively between the exposed and unexposed subjects using unpaired t test to evaluate any statistically significant differences. FVC, FEV_1, PEFR, FEF_{25-75} among the pulmonary function tests and platelet and neutrophils in hematology analysis were found significantly lower to the unexposed group. It may thus be concluded that the petroleum products and its fumes have equivocal affects on hematology parameters but certain and deleteriously restrictive affects on pulmonary function tests thereby making them vulnerable to a variety of restrictive lung disorders.

Introduction : Pollution of air causes unfavorable affects on health. Many studies have been done which show the effects of polluted environment on the respiratory tract [1,2]. Health problems posed by the pollutants are closely linked to the nature and level of exposure to hazardous pollutants and the urban life and its vehicular density are contributing to it. Petroleum products and its exhaust cause significant health problems catalyzing symptoms like chronic cough, breathlessness and wheezing. [3,4] In high concentration, they cause marked systemic pulmonary inflammatory response. Occupational exposure of such products causes multiple organ system dysfunctions in the body[5]. Benzene is one of the most broadly used chemicals in the synthesis of various polymers, resins and synthetic fibers. Furthermore, benzene is a common component of gasoline[2]. Petrol pump workers (filling attendants) are continuously exposed to the organic and inorganic substances present in the petrol. Their average daily exposure exceeds about 10h/day. Duration of exposure may vary depending on their occupation tenure[6]. Petrol pump workers are vulnerable to develop restrictive lung diseases, especially those who are involved in the occupation for duration of more than 5 years[7]. Most of the petrol filling stations are usually situated near to the heavy traffic, exposing the workers to air pollutants and solvents including CO. The ambient air concentration of CO remains maximum during the peak working hours (6AM – 2PM) [8]. Benzene exposure produces toxicity in hepatic, immunological and chromosomal functions and increases risk of carcinogenesis; however, mechanism is not yet properly understood and warrants further studies to be done[9].

Benzene is a volatile compound contributing to air pollutants. The seriousness of poisoning caused by benzene depends on the route, amount and length of exposure as well as age and pre existing medical conditions of exposed persons. Human exposure to benzene has significant deleterious health effects and might be associated with the risk of blood abnormalities, including aplastic anemia, leukemia, lymphoma, pancytopenia and chromosomal aberrations[10]. Moreover, exposure to benzene can cause a wide range of adverse effects on the central nervous system, hematological, hepatic, renal, and lung functions[11]. Communities surrounding petroleum refineries have profound health risks due to the probability of being exposed to elevated levels of benzene and other toxic chemicals[16]. Evidence suggests that benzene-induced toxicity involves several mechanisms, for instance oxidative stress, DNA damage, disruption of the cell etc. Moreover, immune dysfunction has been hypothesized to synergize with benzene toxicity as benzene may interfere with cellular, humoral and innate immunity. Major effect of long term exposure causes anemia and eosinophilia. CBC is recognized as quick and easily obtainable tool for screening the heamatotoxicity of benzene The aim of this study is to assess the extent of altered pulmonary functions tests and Hematological parameters in petrol-pump workers exposed to petrol and diesel fumes at least for 8 hours per day engaged for more than 5 years in comparison to the age matched healthy controls**.**

Material and Methods:

Study Population: The study group consisted of 10 males in the age group of 20–50 years, working for 8 hours per day for more than 5 years in various petrol stations as petrol attendants, in Hyderabad region of Telangana state. The control group consisted of age matched 10 males, not exposed to petroleum vapors. The participants of study group were selected randomly from petrol pumps of Hyderabad region while the healthy age matched participants of control group were randomly selected from the surrounding houses. The written voluntary consent was taken from all the participants before enrolling them into the study. Ethical clearance was taken from the institutional ethical committee.

The subjects included in the study and the control groups had no history of smoking, stomach surgery, chewing tobacco, intake of alcohol, previous exposure to petroleum vapor, allergic disorders, respiratory disorders like asthma or any systemic disease. For matching purposes among the participants, age, height, and weight were recorded.

Parameters of assessment:

Complete Blood Count (CBC) Analysis:

2.5 ml of blood was taken from each individual in a sterile and clean EDTA container. The complete blood count (CBC) was done using a fully automated haematology analyzer (Sysmex).

Counts of Red blood cells, White blood cells, Neutrophils, Lymphocyte, Platelet and values of Hemoglobin, Hematocrit, Mean corpuscular volume, Mean corpuscular hemoglobin and Mean

corpuscular hemoglobin concentration were estimated in both the groups and analyzed statistically using unpaired t test.

Pulmonary Function Test:

Pulmonary functions were tested during work shift using Spirolab III ver 3.2 (a self-calibrating computerized spirometer that fulfils the criteria for standardized lung function tests). The parameters studied were Forced Vital Capacity (FVC), Forced Expiratory Volume in first second (FEV_1), FEV_1 /FVC, Peak Expiratory Flow Rate (PEFR) and Forced Expiratory Flow at 25-75%. The subjects were familiarized with the setup and detailed instructions were given. All the tests were carried out at the same time of the day, between 8.30 AM to 9.30 AM to avoid possible diurnal variations. Tests were performed using the acceptability standards outlined by the American Thoracic Society (ATS) with subjects in a standing position and wearing nose clips. The subjects were asked to breathe forcefully following deep inspiration into the mouthpiece attached to the pneumatachometer; expiration was maintained for a minimum period of 3–4 seconds; 3 to 4 trials of maximal inspiratory and expiratory efforts were made and the highest reading was taken for statistical analysis.

Statistical Analysis:

All the Data were analyzed by Excel Version 2015; continuous data were presented as mean ± Standard Deviation. The mean value of two groups was compared by unpaired t test. A p value < 0.05 was considered statistically significant.

Results:

Participant groups	Age in years (Mean ± SD)	Height in Meter (Mean ±SD)	Weight in kg (Mean ±SD)	Body Mass index (Mean ±SD)
Control	34.8 ±4.04	1.73±0.05	74.9±6.67	25.11±1.44
Petrol pump worker	36.1±7.88	1.73±0.04	73.4±5.5	24.74±2.30

Table 2. Comparison of complete blood count tests between exposed and unexposed groups

Parameters (units)	Exposed group (N = 10) (Mean± SD)	Unexposed group (N = 10) (Mean±SD)	p value
Red blood cells ($mm^3 \times 10^6$)	5.66±0.72	5.22±0.42	0.17
White blood cells ($mm^3 \times 10^3$)	9.7±1.83	8.97±0.91	0.26
Platelet ($mm^3 \times 10^3$)	218.1± 52.24	263.1±50.68	0.05*
Hemoglobin (g/dL)	15.76± 2.33	15.7±0.98	0.94
Hematocrit (%)	46.12± 6.08	45.43±2.96	0.79
Mean corpuscular volume (fL)	81.77± 6.74	84.23±1.91	0.28
Mean corpuscular hemoglobin(pg)	28.49±3.50	29.98±1.45	0.28
Mean corpuscular hemoglobin concentration (%)	34.1± 1.92	33.16±0.87	0.06
Lymphocyte (%)	29.38±5.75	32.18±4.46	0.10
Neutrophils (%)	62.87±6.74	57.02±6.68	0.04*

*Significant

Figure 1: Count of blood cells among petrol pump workers

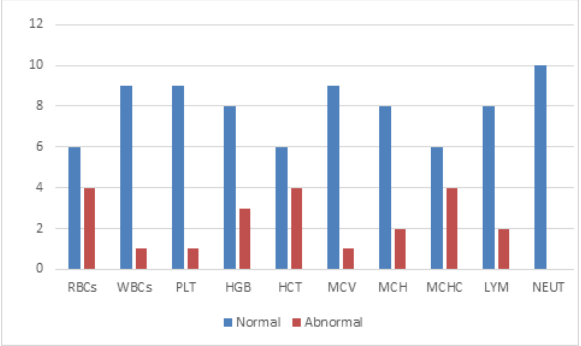

Table-3: Comparison of pulmonary function parameters between study and control groups

PFT	Exposed group (N = 10) (Mean ± SD)	Unexposed group (N = 10) (Mean ± SD)	p Value
FVC	3.39±0.50	4.09±0.30	0.005*
FEV_1	2.92±0.66	3.6±0.42	0.028*
FEV_1/FVC	84.59±7.31	82.57±5.22	0.54
PEFR	5.51±2.35	8.46±0.26	0.002*
FEF_{25-75}	3.41±0.86	4.05±0.48	0.058*

*Significant

Discussion :

This study was conducted in workers of fuel stations in Hyderabad to assess their hematological parameters and pulmonary functions in comparison to the age matched healthy individuals from the surrounding location. Many similar studies have been conducted in different countries for the same purpose. Effects of benzene need prolonged exposure time to be apparent in those workers. In contrast, exposure to low concentrations of benzene in some studies has been associated with changes in blood parameters. The exact reason(s) of these inconsistencies are not known. However, differences in cumulative exposure concentrations, length of exposure, occupational and non-occupational exposure to other hematotoxic agents may play an important role in varied outcome.

The present results revealed that seven patients (70%) of the participants in study group were found having normal Hb concentration while one patient (10%) had decreased value and only two patients (20%) showed increased Hb concentration (figure 1). Hematocrit (HCT) was below normal reference range in 4 participants (40%) while in six others (60%), the HCT was within the normal value (figure 1). These findings are inconsistent with results from one study done in Texas City in 2014, which reported that hemoglobin and hematocrit levels were elevated in benzene exposed subjects compared with the unexposed subjects[12]. Another study, done in Sulaimaniya City in Iraq, showed an increase in Hb concentration among fuel workers when compared with the control subjects[13].

The RBCs counts were within the normal range in six participants (60%), while four participants (40%) showed increased RBCs count (Figure 1). These findings are consistent with the previous study done in Iraq reporting that counts of RBCs, PLTs, and WBCs were within normal ranges and had no significant differences with those of controls[13].

MCV value in one participant (10%) was below the normal range and within normal MCV values in other nine patients (90%). The value of MCH in two (20%) participants was found below the normal range; while, eight patients (80%) were within the normal range, as set out in figure 1. The MCHC values were within the normal range in 6 participants (60%) and higher in the other 4 participants (40%). (figure 1). The findings in this study regarding MCH and MCHC are not in agreement with the findings of a study done in Iraq which revealed that MCH and MCHC were within the normal ranges; however, value of MCV is in agreement with the Iraq study as it was found within normal reference range[13]

Occupational exposure decreased WBCs and Platelets in petrochemical workers exposed to <10ppm benzene. Collins et al and Tsai et al did not detect decreased blood cell counts on routine monitoring of workers exposed to low level of benzene[14-16].The present study indicates that total WBC, differential counts and platelets were decreased in workers with longer periods of exposure. The studies conducted by Qing Lan et al[8] showed that solvents cause toxicity to progenitor cells of WBCs and platelets instead of the circulating cells. This may be the reason why there is a decrease in the WBCs and platelet count. T means that CFU (colony forming unit – myeloid and lymphoid) of the workers with longer period of exposure

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are very much susceptible to the solvents especially benzene.

In the present study, neutrophils and platelet counts were decreased significantly in comparison to the control group. However, other hematology parameters to assess the benzene and petroleum fumes toxicity were not significantly different from those of control group. This may be due to very small sample size to represent the effect of petroleum on various hematology parameters in comparison to previous studies.

In this study, most of the pulmonary function parameters were decreased significantly in petrol pump workers as compared to the controls. Although FEV_1 and FVC were decreased in petrol pump workers but their ratio did not differ significantly between the two groups. PEFR and FEF_{25-75} were also decreased significantly. These finding indicate the restrictive nature of pulmonary involvement in the study group.

Conclusion:

This study concluded that there are variations in haematological parameters, significantly in platelets and neutrophils and in most of the lung function parameters among fuel station workers involved in the occupation for more than 5 years. Workers at fuel stations should be subjected to periodic blood tests and protected from exposure to benzene by wearing protective devices such as masks and goggles to ensure their blood and pulmonary parameters remain within normal limits.

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