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Hematological Parameters & Pulmonary Function Test among Petrol Pump Workers

Original Article

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Abstract

Long term exposure to solvents like benzene and air pollutants can lead to deleterious effects on respiratory and hematopoietic systems. The aim of this study is to assess the extent of altered pulmonary functions tests and Hematological parameters in petrol-pump workers who are exposed to petrol and diesel fumes. The study group consisted of 10 males in the age group of 20—50 year, who were working in various petrol stations as petrol attendants, 8 hours per day for more than 5 years and the control group consisted of 10 males of same age group, who were not exposed to petroleum vapors. Pulmonary functions were tested by using Spiro lab III Ver 3.2. The parameters studied were, Forced Vital Capacity (FVC), Forced Expiratory Volume in first second (FEVI), FEVI /FVC (FEVI %), and Peak Expiratory Flow (PEF) and Forced Expiratory Flow at 25-75%. Venous blood (2.5 ml) was taken from everyone in a sterile and clean EDTA container. The complete blood count (CBC) was done by using fully automated hematology analyzer (Sysmex). The results of blood tests showed forty percent had high RBC counts, hematocrit readings showed 40% with reduced values and for MCHC 40% were reduced. Platelets were significantly different in the two groups. In pulmonary functions tests there was a statistically significant decrease in FEVI, FVC, PEF and FEF25-75 in study group compared to control group with normal FEVI/FVC. 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 that their blood and pulmonary parameters are normal.

Keywords: Hematological Parameters, Pulmonary Function Test, Petrol Pump Workers, Complete Blood Count, Hematocrit Readings.

Introduction

Pollution of air causes unfavorable effects on health. Many studies have been done which show the effect of polluted environment on the respiratory tract (Nakai, Maeda, & Crest, 1987). Health problems posed by the pollutants are closely linked to nature and level of exposure to hazardous pollutants. In the same way, urban life and its vehicular density are contributing to it.

Petroleum products and their exhaust are causing significant health problem symptoms like chronic cough, breathlessness and wheezing (Uzma, Salar, Kumar, Aziz, David, & Reddy, 2008: Singhal, Khaliq, Singhal, Tandon, 2007). In high concentration they cause marked systemic pulmonary inflammatory response. Occupational exposure of such product cause impairment of functions of various parts of the body (Das, Bhargava, Kumar, Khan, Bharti, Pangtey, Rao, & Pandya, 1991).

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 (Chabra, Chabra, Rajpal, & Gupta, 2001). 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 (Aprajita, Neeraj Kant Panwar, & Sharma, 2011).

Petrol pump workers are vulnerable to developing restrictive lung disease especially those who are involved in the occupation for long duration more than 5 years (American Thoracic Society, 1987). Most of the petrol filling stations were situated near to heavy traffic; the workers were situated near to heavy traffic; the workers were more prone to exposure to CO. The air concentration of CO was maximum during the peak working hours (6AM-2PM), the workers were exposed to more CO along with other air pollutants and solvents (Levsen, 1988).

Benzene exposure has toxicity of hepatic immunological and chromosomal function and increases risk of carcinogenesis, but mechanisms yet properly not understood studies must be done (Farrell, Norris, Ryan, Porter, Jiang, & Blesso, 2015).

Benzene is a volatile compound contributing to air pollutants. The seriousness of poisoning caused by benzene depends on the amount route and length of exposure as well as age and pre-existing medical condition of exposed conditions. 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 (Marchetti, Eskenazi, Weldon, Li, Zhang, Rappaport *et al*., 2012). Moreover, exposure to benzene can cause a wide range of adverse effects on the central nervous system, hematological, hepatic, renal, and lung functions (Mandiracioglu, Akgur, Kocabiyik, & Sener, 2011).

Communities surrounding petroleum refineries have important health risks due to the probability of being exposed to elevated levels of benzene and other toxic chemicals (Tsai, Fox, Ransdell, Wendt, Waddell, & Donnelly, 2004). Evidence suggests that benzene-induced toxicity involves several mechanisms, for instance oxidative stress, DNA damage, disruption of the cell. Moreover, immune dysfunction has been hypothesized to synergies with benzene toxicity as benzene may interfere with cellular, humoral and in its immunity.

Major effect of long-term exposure causes anemia and eosinophilia. CBC is recognized and quick and obtainable screening for checking the heamatotoxicity of benzene However, our study is non-smokers with prolonged duration of exposure benzene for about more than 5 years. The aim of this study is to assess the extent of altered pulmonary functions tests and Hematological parameters in petrol-pump workers who are exposed to petrol and diesel fumes. In addition, the effect of the duration of the service at petrol-pumps is also studying and comparing with those of age matched healthy controls.

Methods and Materials

Study Population

The study group consisted of 10 males in the age group of 20—50 year, who were working in various petrol stations as petrol attendants, 8 hours per day for more than 5 years in Qassim region. The control group consisted of 10 males of same age group, who were not exposed to petroleum vapors. The subjects chosen in the study and the control group had no history of allergic disorders, respiratory disorders like asthma, or any systemic disease and no history of smoking, no stomach surgery, chewing tobacco, intake of alcohol and no history of previous exposure to petroleum vapor. Age, height, and weight were recorded.

Pulmonary Function Test

Pulmonary functions were tested by using Spiro lab III very 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 (FEVI), FEVI /FVC (FEVI %), and 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 8.30AM 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 pneumotachometer.

Expiration was maintained for a minimum period of 3-4 seconds, 3 to 4 trails of maximal inspiratory and expiratory efforts were made, and the highest reading was taken for statistical analysis.

Complete Blood Count (CBC) Analysis

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

Statistical Analysis

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

Results and Findings

Table l

Showing Physical Parameters of Control Subjects and Petrol Pump Workers

Study Group	Age in years (Mean ± SD)	height in Meter (Mean ± SD)	Weight in kg (Mean ± SD)	Body Mass index (Mean ± SD)
Control Group	24.8 ±4.04	1.73±0.05	74.9±6.67	25.11±1.44
Petrol Pump Workers	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

Figure 1

Count of Blood Cells among Petrol Pump Workers

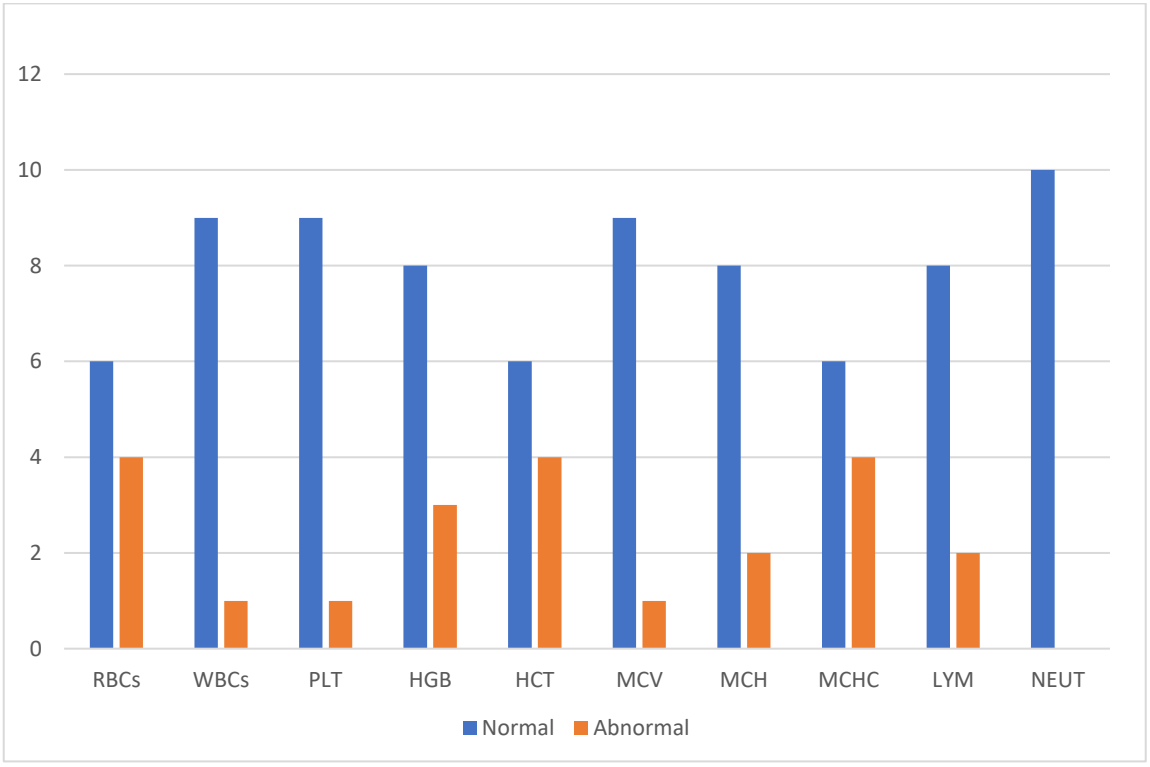
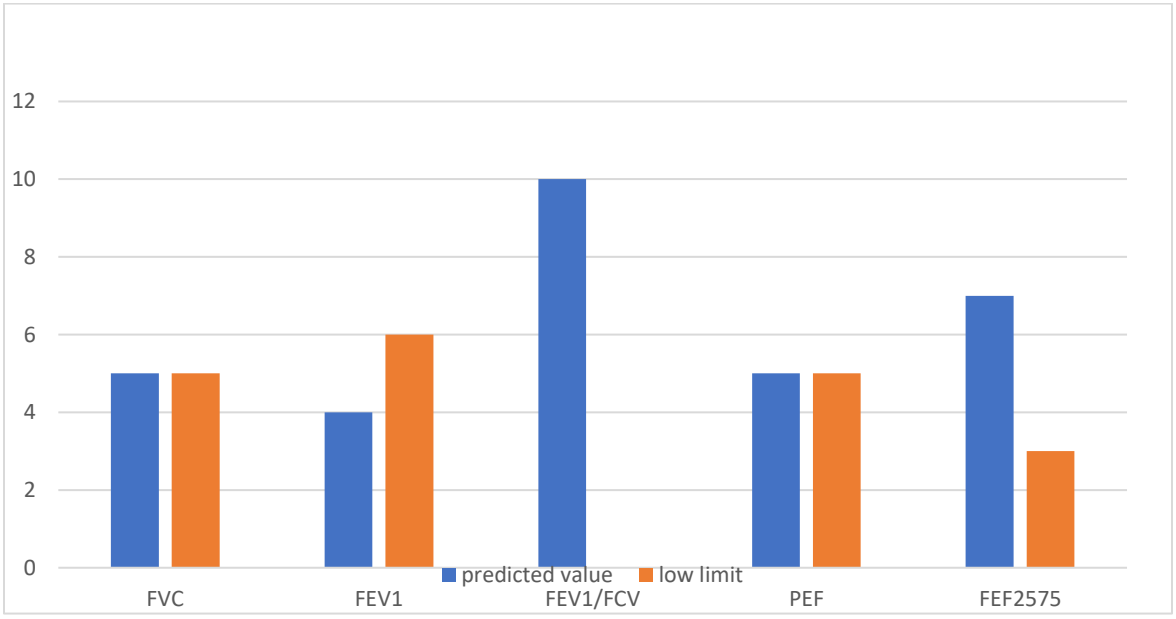


Table 3
Comparison of Pulmonary Function Parameters Between Study and Control Groups

PFT	Exposed group (N=10) (mean ± SD)	Un-Exposed group (N=10) (mean ± SD)	P Value
FVC	3.39±0.50	4.09±0.30	0.005*
FEV1	2.92±0.66	4.6±0.42	0.028
FEV1/FVC	84.59±7.31	82.57±5.22	0.54
PEF	5.51±2.35	8.46±0.26	0.002*
FEF25-75	3.41±0.86	4.05±0.48	0.058*

Figure 2
Pulmonary Lung Functions Test Among Petrol Pump Worker



Discussion

This study was conducted on workers of fuel station in Qassim Region to assess their hematological and pulmonary functions. Many similar studies have been conducted in different countries for the same purpose. effects of benzene need prolonged 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 hematotoxin agents. The present results revealed that seven patients (70%) of the participants were normal for Hb concentration, and only one patient (10%) had decreased values and only two patients (20%) showed increased Hb concentration. HCT in the current study results showed that most participants four patients (40%) were below the normal reference while in six patients 60% of them 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 (D'Andrea & Reddy, 2015). Another study done Sulaymaniyah City in Iraq, showed an increase in Hb concentration among fuel workers when compared with the control subjects (Mohammed, 2014). Concerning RBC counts, the

present study showed six patients (60%) of the participants were within the normal range, while four patients (40%) showed increased RBCs count (See Figure 1). These findings are consistent with the previous study from Iraq, reporting that counts of RBCs, PLTS, and WBCs were within normal ranges and had no significant differences with those of controls (Mohammed, 2014).

The present study showed that one patient (10%) of the fuel stations workers were below the normal range and the rest nine patients (90%) within the normal MCV values, while two patients (20%) of the participants found below the normal range of MCH, eight patients (80%) within the normal range, as set out in figure 1. The status of MCHC showed most patients (60%) were within the normal range and the remaining 4 patients (40%) higher than the normal value (See figure 1). These findings not in agreement with the study done in Iraq stated that, MCH and MCHC were within the normal ranges, while our study agrees with the value of MCV both in studies in normal value (Mohammed, 2014). 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 (Qu, Shore, Li, Jin, Chen, Cohen, Melikian, & Eastmond, 2002; Collins, Belinda, Paul, Nair, Rashmi, Braun, 1997; Tsai, Fox, Ransdell, Wendt, Waddell, & Donnell, 2004).

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. in Levsen (1988) showed that solvents are causing toxicity to progenitor cells of WBCs and platelets instead of 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 are very much susceptible to the solvents especially benzene. In the present study, there was no significant difference in WBC counts compared to the control group. This may show that our sample is too small to represent the effect of petroleum on WBC count in comparison to previous studies. However, the platelets number shows remarkable decrease in the petroleum stations workers. In the present study most of the lung functions parameters decreased significantly in petrol pump workers as compared to controls. Although FEVI and FVC both decreased in petrol pump workers their ratio did not differ between the two groups. This finding indicates the restrictive nature of pulmonary involvement in the study group. In the present study expiratory and inspiratory flow rates, i.e. PEFR, FEF25-75, also decreased.

Conclusion

This study concluded that there are variations in hematological parameters among fuel stations workers, particularly in platelets, and restrictive effects of the lung with involvement of small airways, especially in those who are involved in the occupation for long duration (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 that their blood and pulmonary parameters are normal.

Declarations

Ethical Approval and Consent to Participate: This study strictly adhered to the Declaration of Helsinki and relevant national and institutional ethical guidelines. Informed consent was obtained. All procedures performed in this study were by the ethical standards of the Helsinki Declaration.

Consent for Publication: Here, we, the authors, give our consent for publication.

Availability of Data and Materials: Data will be provided upon written request from the corresponding author.

Competing Interest: The writers of this article affirm that they are free from any conflicts of interest, whether financial or otherwise, that may have affected their independence in completing this work.

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