Research Article

Study of red blood cell count, hemoglobin concentration, and platelets in petrol pump workers of Surat city

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Abstract

Background: Petrol pump workers are exposed to many air pollutants and chemicals such as benzene, lead, other heavy metals, carbon monoxide (CO), and their metabolites in the work premises of petrol pump, which has carcinogenic and hematotoxic effects. **Aims and Objective:** This study was conducted to find the effect of benzene and other air pollutants on red blood cell (RBC) counts, hemoglobin (Hb) concentration, and platelets in petrol pump workers of Surat city. **Materials and Methods:** Thirty (30) healthy male petrol pump workers aged 20–50 years, working for $\geqslant$1 year ($\geqslant$8 h/day) who volunteered for the study were taken as the study group. Thirty (30) healthy male non-petrol pump workers aged 20–50 years matching socioeconomically with the study group were taken as control group. Morning (8–10 AM) blood samples were collected under aseptic precautions from all the participants. Blood samples were analyzed by 3-part automated cell counter ABX MICROS 60 in the hematology lab of the Department of Physiology, GMC, Surat. Data were presented as mean ± SD and compared using unpaired t-test. *P* value <0.05 was considered as statistically significant. **Results:** RBC counts were significantly higher in the study group (4.91 + 0.6) than in the control group (4.51 ± 0.5). Concentration of Hb was significantly higher in study group (13.58 ± 1.3) than in the control group (12.71 ± 0.8). Platelet count was lower in study group (263.99 ± 84.3) than in the control group (278.3 ± 60.0). **Conclusions:** We found increased RBC count and Hb concentration, which may be due to adverse effect of CO, which causes tissue hypoxia and stimulation of RBC formation. Platelet counts were lower due to bone marrow depression caused by benzene.

KEY WORDS: Red Blood Cell; Air-Pollutants; Petrol Pump Workers; Hematotoxicity

Introduction

Air pollutants and chemicals such as benzene, lead, other heavy metals, and carbon monoxide (CO) and their metabolites with known adverse effects can cause adverse health effects by interacting with molecules crucial to the biochemical or physiological processes of the human body.[1] Benzene is a volatile organic compound added in petrol to increase octane rating and reduce knocking. In India, 2%–5% benzene(C_6H_6) is added to petrol, which evaporates inside the fuel tank of the vehicle and escape into the atmosphere during refilling. Petrol filling station contains 1–25 ppm more benzene than any other place.[2] Exposure mainly occurs through breathing and via epidermal contact. The hematopoietic system is highly sensitive to most of the air pollutants reaching the blood very fast without being biotransformed. The solvents and air pollutants may interfere in the process of red blood cell (RBC) proliferation, which causes adverse effects on heme synthesis and the life expectancy of RBCs. Chronic exposure leads to increased risk of developing leukemia, lymphoma, aplastic anemia, pancytopenia, and chromosomal aberrations.[1]

Petrol pump workers are at a higher risk of developing toxicity from benzene, lead, other heavy metals, and CO as they do not use

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any personal protective equipments. Hence proper biomonitoring of petrol pump workers and installation of vapor recovery system are important measures for preventing and protecting them from occupational hazards of higher benzene in their working atmosphere.

Several studies have shown abnormalities related to Pulmonary Function Testing (PFT), thyroid function, and blood parameters. A complete blood count has been recognized as an easy and readily available screening tool for assessing the hematotoxicity of benzene.[2] Hence, this study has been undertaken to find the effects of benzene and air-pollutants on RBC count, Hb concentration, and platelet count in male petrol pump workers of Surat city and to educate and motivate them to use personal protective measures for prevention of benzene toxicity.

Materials and Methods

The study was approved by the Institutional Ethical Committee of Government Medical College of Surat. Written informed consent was obtained from each participant and petrol pump owners prior to the study.

Thirty (30) apparently healthy non-smoker males aged 20–50 years, working in different petrol pumps of Surat city for 8 hours/day for >1 year who volunteered for the study were selected as study group by purposive sampling. Thirty (30) healthy male non-smokers matching socially and economically with the study group and not exposed to benzene or other air pollutants were selected as control group. Here, we excluded subjects with any present and past illness, acute infection (typhoid, malaria, pharyngitis, etc.), any systemic disease or allergies (hypertension, diabetes mellitus, rheumatoid arthritis, etc.), and using medications affecting blood counts. Relevant data regarding participant's age, height, weight, and so on were collected and a brief physical and general examination was carried out. A volume of 3 mL of venous blood samples were collected in the morning between 8 and 10 AM in Vacuette EDTA tubes from median cubital vein under aseptic precautions. All blood samples were delivered to the lab within 6 h after collection. Samples were analyzed by 3-part automated cell counter ABX MICROS 60 at the Department of Physiology, GMC, Surat. Data were presented as mean ± SD. The mean values of two groups were compared by unpaired t-test and *P* values <0.05 was considered as statistically significant at 95% Cl. All statistical analyses were done by OpenEpi software.

Results

Table 1 shows the demographic distribution among study group and control group. Data collected were statistically nonsignificant ($P < 0.05$).

RBC count, Hb concentration, and platelet count in the study and control groups are shown in Table 2.

Table 3 shows hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC) in the study and control groups.

Table 1: Demographic distribution among study group and control group. Data collected were statistically nonsignificant ($P < 0.05$)

Traits	Study group (*n* = 30)	Control group (*n* = 30)	*P* value
Age (year)	33.48 ± 7.6	35.58 ± 9.8	0.35
Height (cm)	166.02 ± 2.4	166.38 ± 3.4	0.63
Weight (kg)	60.12 ± 6.5	61.35 ± 5.4	0.42

Table 2: Red blood cell (RBC) count, hemoglobin (Hb) concentration, and platelet count in study and control groups

	Study group (*n* = 30)	Control group (*n* = 30)	*P* value
RBC counts (10^6/mm^3)	4.91 ± 0.6	4.51 ± 0.5	0.006
Hb concentration (g/dL)	13.58 ± 1.3	12.71 ± 0.8	0.003
Platelet counts (10^3/mm^3)	263.99 ± 84.3	278.30 ± 60.0	0.45

Discussion

This study was conducted on petrol pump workers because most of the petrol filling stations were situated near to the heavy traffic; the workers were more prone to exposure to CO. The ambient air concentration of CO was maximum during the peak working hours (6 AM–2 PM), the workers were exposed to more amount of CO along with other air pollutants and solvents.[1] This study was important as prolonged exposure to benzene and air pollutants may cause known hematological and neurological toxic effects and cancers.[2]

RBC counts, Hb concentration, and platelet count were measured in the study and control groups. Study shows significant increase in RBC counts and Hb concentration along with a decrease in platelet count, which is nonsignificant. Platelet counts were lower due to bone marrow depression caused by benzene. We also found significant increase in HCT and significant decrease in MCHC. Along with benzene exposure, petrol pump workers are also exposed to air pollutants such as CO. Exposure to CO is causing tissue hypoxia and a stimulation of RBC formation. The CO emitted mainly by

Table 3: Hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) in study and control groups

	Study group (*n* = 30)	Control group (*n* = 30)	*P* value
HCT (%)	42.75 ± 4.3	39.1 ± 2.8	0.0002
MCV (mm^3)	87.63 ± 7.6	89.13 ± 6.1	0.4
MCH (pg)	27.87 ± 2.9	29.01 ± 2.1	0.09
MCHC (g/dL)	31.76 ± 1.0	32.70 ± 0.4	0.00002

internal combustion engines of motor vehicles readily enters the blood through the respiratory system and binds over 200 times more firmly to Hb than oxygen, forming carboxyhemoglobin seriously interfering with the oxygen transport capability of blood, which ultimately leads to hypoxic hypoxia. Tissue hypoxia is the most potent stimulus for erythropoiesis, so it leads to the stimulation of erythropoietin—a factor that stimulates erythropoiesis—which ultimately leads to the production of more number of RBC and Hb in the circulating blood.[1]

A number of studies have been conducted in the past to find out the effect of benzene on humans. In 2008, the study conducted by Uzma et al. found significant increase in RBC count and Hb concentration in benzene-exposed workers.[1] This observations were consistent with our results. In contrast, studies conducted by Ray et al. (2007) had shown decrease in RBC counts and Hb concentration along with significant increase in MCV.[3] Rothman et al. (1996), Ward et al. (1940–1975), Qu et al. (2002), and Khuder et al. (1999) found significant decrease in RBC count.[4–7] While studies conducted by Collins et al. (1991, 1997) and Tsai et al. (2004) did not find any difference between benzene-exposed workers and reference group.[8–10]

This study has several limitations. It was based on a relatively small number of participants, so it is unclear whether the results can be applied to other populations. Our analyses are based on single measurement of blood test markers, which may not reflect these relationships over time. Although we excluded smoking, medications, and other systemic disease affecting blood counts, there are many confounding factors such as diet (veg–nonveg), which may affect blood counts. We have taken samples from different areas of Surat city; hence we tried to exclude other environmental confounding factors. All blood tests were done in ABX MICROS 60, which is a standardized, sensitive instrument. Further prospective studies with larger sample size and prospective cohort studies are needed to assess the role of air pollutants and chemicals on blood counts in petrol pump workers.

Despite these limitations, our study demonstrated that certain hematological disfunctioning effects are constantly observed in the occupationally exposed petrol pump workers. The data suggest that background benzene and air pollutants could account for hematological disfunctioning. The effects of chronic benzene poisoning in exposed workers can be detected by monitoring blood counts at regular intervals. In order to prevent these among petrol filling workers, we suggest that medical observation, including prior to employment, and periodic medical checkup should be performed. Control strategies should be adopted to reduce benzene concentration in the ambient air. Petrol pump workers must be provided with effective masks to avoid inhalation of noxious substances.

Conclusions

We found increased RBC count and Hb concentration, which may be due to adverse effect of CO, which causes tissue hypoxia and a stimulation of RBC formation. Platelet counts were lower due to bone marrow depression caused by benzene.

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