A STUDY OF BLOOD CELL COUNT IN PETROL PUMP WORKERS

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ABSTRACT

BACKGROUND

People with high risk of exposure to petroleum products like benzene include petrol pump workers, gasoline, rubber, printing and refinery workers. Human exposure to benzene has significant deleterious health effects with the risk of developing haematological abnormalities including leukaemia, aplastic anaemia, lymphomas, etc. The present study was undertaken to know the possible deleterious effects of chronic inhalation of petrol fumes on blood cell counts.

MATERIALS AND METHODS

The present study was carried out in 30 adult male volunteers of age group 25-40 years working in petrol pump stations for more than 5 years. Control group consisted of 30 male adults of same age group who didn't have the history of exposure to petroleum products. Blood samples were collected and analysed for red blood cell [RBC], total leucocyte count [TLC], platelet count and haemoglobin [HB] concentrations. Data were represented as mean±SD [Standard deviation]. Unpaired t-test is applied to compare the changes between study and control group.

RESULTS

The study showed a statistically significant reduction in RBC count, Hb concentration, TLC count among study group when compared with control group [P <0.05]. There were no significant changes in platelet count among study and control groups.

CONCLUSION

Chronic exposure to petrol fumes has toxic effect on haematological parameters leading to bone marrow depression.

KEYWORDS

Petrol Pump Workers, Benzene, Haematotoxicity, Red Blood Cell Count, Total Leucocyte Count, Haemoglobin Concentration, Platelet Count.

HOW TO CITE THIS ARTICLE: Lavanya M, Rajanand G, Kumar ZN. A study of blood cell count in petrol pump workers. J. Evolution Med. Dent. Sci. 2016;5(89):6611-6613, DOI: 10.14260/jemds/2016/1495

BACKGROUND

Air pollutants and chemicals such as benzene, lead, carbon monoxide {CO} and other organic compounds can cause adverse health effects to the biochemical {or} physiological process of the human body.¹ All these have been found to lead deleterious effects on Respiratory, Endocrine and Haematopoietic systems.² Petrol is an integral ingredient of modern industrial world. Petroleum products consist of aliphatic and aromatic hydrocarbons as well as other organic and metallic compounds.³ Benzene is important ingredient of petrol. In India, 2-5% of benzene is added to petrol. As petrol is evaporated during refilling, petrol filling stations contain {1-25 ppm} more than any other places. Exposure occurs through breathing while refilling and via epidermal contacts.⁴ Human exposure to benzene has significant deleterious health effects with the risk of developing blood abnormalities including leukaemia, aplastic anaemia, lymphoma and

chromosomal aberrations.⁵ Exposure to benzene can cause adverse effects on central nervous system, haematological, hepatic, renal and lung functions. It has been recognised as a carcinogen.⁶

People with high risk of exposure to benzene include petrol pump workers, gasoline, rubber, printing and refinery workers. Petrol pump workers are chronically exposed to petroleum products through inhalation during vehicle refuelling as they don't use any protective equipments.⁷ The haematopoietic system is highly sensitive to most of the air pollutants which are reaching the blood very fast without being biotransformed. The solvents and air pollutants may interfere in the process of RBC synthesis and proliferation. These changes are reflected in the synthesis of haeme and life expectancy of RBC. Toxic material from air leads to significant damage to RBC causing Aplastic Anaemia.⁸

A complete blood cell count is an easy available screening method to know the effect of benzene on haematopoietic system. The present aim of the study is to evaluate the complete blood cell count, Hb concentration among petrol pump workers in and around Nandyal, so that necessary preventive measures can be taken to avoid the effect of benzene toxicity.

MATERIALS AND METHODS

This study was conducted for a period of 8 months from November 2015 to June 2016 among petrol pump workers in and around Nandyal, Andhra Pradesh. Written informed

Financial or Other, Competing Interest: None.

Submission 02-09-2016, Peer Review 11-10-2016,

Acceptance 17-10-2016, Published 05-11-2016.

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DOI: 10.14260/jemds/2016/1495

consent was obtained from each participant. Study group includes 30 male adults of age group 25-40 working in petrol pump filling stations.

Inclusion Criteria

- Healthy Non-smoker.
- History of working in petrol pump filling stations for more than 5 yrs.

Exclusion Criteria

- Any history of present or past illness {Hypertension, Diabetes}.
- Any history of smoking.
- Any acute infection.
- Individuals on medication affecting blood cell count.

Control group includes 30 healthy male adults of age group 25-40 matching socially and economically with the study group. They don't have the history of occupational exposure to petrol products. 3 mL of venous blood is collected from peripheral vein (median cubital vein) into EDTA tube and immediately sent to central lab of Santhiram Medical College, Nandyal. Samples were analysed by automated haematological analysers for RBC, TLC, Platelet count and haemoglobin concentration. Data were represented as mean $\pm$ SD [Standard deviation]. Mean value of two groups were compared by unpaired t-test and p value <0.05 was considered as statistically significant.

RESULTS

Table 1 show the changes in RBC count among study group and control group. RBC in study group was 4.29 $\pm$ 0.383 (Mean $\pm$ SD) whereas in control group it was 5.21 $\pm$ 0.336 (Mean $\pm$ SD). P-value is 0.0001. There was statically significant reduction of RBC count in petrol pump workers when compared to control.

Parameter	Study Group (N=30) Mean $\pm$ SD	Control Group (N=30) Mean $\pm$ SD	P-Value
Red Blood Cell Count	4.29 $\pm$ 0.383	5.21 $\pm$ 0.336	0.0001 Statistically Significant
Table 1. Red Blood Cell Count (Millions/mm³) in Study and Control Group			

Table 2 demonstrates the changes in haemoglobin concentration. Hb concentration in study group was 13.06 $\pm$ 0.634 (Mean $\pm$ SD) whereas in control group it was 15.36 $\pm$ 0.730 (Mean $\pm$ SD). P value is 0.0001. There was statistically significant reduction of Hb concentration in study group when compared to control group.

Parameter	Study Group (N=30) Mean $\pm$ SD	Control Group (N=30) Mean $\pm$ SD	P-Value
Hb Concentration	13.06 $\pm$ 0.634	15.36 $\pm$ 0.730	0.0001 Statistically Significant
Table 2. Haemoglobin Concentration (g/dL) in Study and Control Group			

Table 3 depicts the changes in total leucocyte count among study group and control group. Total leucocyte count in study group was 8466.6 $\pm$ 1908.4 (Mean $\pm$ SD) whereas in control group was 7180.8 $\pm$ 1393.4. P value is 0.0042. There was significant reduction of total leucocyte count in study group when compared to control group.

Parameter	Study Group (N=30) Mean $\pm$ SD	Control Group (N=30) Mean $\pm$ SD	P-Value
Total Leucocyte Count	8466.6 $\pm$ 1908.4	7180.8 $\pm$ 1393.4	0.0042 Statistically Significant
Table 3. Total Leucocyte Count (Thousands/mm³) in Study and Control Group			

Table 4 shows the comparison of platelet count among study and control groups. Platelet count in study group was 2.76 $\pm$ 0.68. P value is 0.4827. There was no significant change in platelet count among petrol pump workers and control group.

Parameter	Study Group (N=30) Mean $\pm$ SD	Control Group (N=30) Mean $\pm$ SD	P-Value
Platelet Count	2.76 $\pm$ 0.68	2.65 $\pm$ 0.50	0.4827 Not significant
Table 4. Platelet Count (lakhs/mm³) in Study and Control Group			

DISCUSSION

The present study was conducted among petrol pump workers as they are more likely to get affected by the toxic effects of benzene than other counterparts. Chronic inhalation of petrol fumes may cause toxic effect on haematological, respiratory and neurological systems.⁴ Benzene is reported to produce haematological changes ranging from pancytopenia to total bone marrow aplasia through its myelotoxic action.⁹ The study group showed that there was significant reduction in RBC count, total leucocyte count and Hb concentration. Decrease in Hb concentration could be due to decrease in RBC (or) impaired biosynthesis of haeme in bone marrow. Decreased Hb and RBC could also be attributed to insufficiency of protein synthesis that mainly induces decrease of essential amino acid synthesis incorporated in Hb production.¹⁰ Toxic constituents of crude oil such as benzene are reported to be activated in bone marrow and cytotoxic effects are mediated through disturbance in DNA function. The resultant bone marrow depression is characterised by inadequate production of RBC and other formed elements.¹¹

Our findings are in accordance with the study conducted by Qing Lan et al group who showed that exposure to solvents like benzene decreases the RBC count and haemoglobin levels causing anaemia among workers exposed to benzene.¹² Another study performed in Baghdad city by Ali, A. Sahb et al on petrol pump workers showed that there is significant reduction in haemoglobin and RBC levels.³ T. Tunsaringkarn et al conducted a study in 2013 and reported that exposure to benzene causes bone marrow depression presenting as a drop in haemoglobin, haematocrit and eosinophil count.¹³ Our findings are inconsistent with results from the study done in Texas city in 2014, which reported that Hb and haematocrit

levels are elevated in benzene exposed subjects.¹⁴ A study conducted by Mohammed Aleemuddin et al in 2015 among petrol workers also revealed that there is significant reduction in Hb concentration and RBC count.¹⁵

The current study showed that the mean values of total leucocyte count were significantly decreased in study group when compared with control group. The results were statistically significant, P value being less than 0.05. Our study was in accordance with the study conducted by Madhura Yogesh et al in 2015 on petrol pump workers. Reduction in total leucocyte count may be due to the cytotoxic effect of compounds present in petrol, solvents are causing toxicity to progenitor cells of WBC instead of circulating cells.⁷ Similar results were found with the study conducted by Qing et al group in 2004.¹²

Our findings are inconsistent with study conducted by Nazia Uzma et al in 2008 among petrol filling workers.¹ A study conducted by Mohammed Aleemuddin et al in 2015 also revealed that there was significant reduction in TLC among petrol pump workers when compared with control group.³ Another study conducted by Deepankar Singh et al showed that there was significant reduction in eosinophil count with increasing exposure to petroleum fumes.⁴

Concerning platelet count, the present study concluded that platelet count was within the normal range. There was no significant difference in platelet count among petrol pump workers and control group. These findings are consistent with the results from the study done by Abozer Y elderly et al in 2015.⁶ In contrast, the findings are inconsistent with the study conducted by Mistry et al group in 2016 where there was significant reduction in platelet count among petrol pump workers when compared to control group.¹⁶

CONCLUSION

The present study concludes that long term exposure to petrol fumes has deleterious effects on human haematopoietic system leading to bone marrow depression. We observed a significant reduction in RBC count, Hb concentration and total leucocyte count. Platelet counts were within the normal range. Workers at fuel stations should be subjected to periodic investigations and should be protected from exposure to benzene by wearing specialised gowns, effective masks and goggles. Further studies are necessary to evaluate the possible effects of petroleum products on petrol pump workers.

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