Some Haematological Parameters of Fuel Pump Attendants in Calabar Metropolis

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ABSTRACT

Introduction: Occupational exposure to petroleum products and fumes has been reported to have toxic effects on various organs and body system including the circulatory system. This study examined some haematological parameters of the fuel pump attendants in Calabar Metropolis.

Methods: One hundred (100) male and female participants (18-50 years) were recruited into this case control study. They consisted of 50 fuel pump attendants (28 males and 22 females) and 50 controls, all residing in Calabar metropolis. The haematological parameters were analyzed using the Sysmex XE- 2100 haematology autoanalyser. Data was analyzed using SPSS version 21.0 with Student's t-test and Pearson's correlation. P <0.05 were used considered statistically significant.

Results: Ninety percent of the fuel pump attendants were exposed for duration of 1-4 years. The packed cell volume (PCV), haemoglobin, mean cell volume (MCV) and neutrophil count of fuel pump attendants were significantly lower compared to the controls. Monocyte count was significantly higher in the fuel pump attendants than in the controls ($p<0.05$). Platelet count correlated positively with TWBC ($r=0.500$, $p=0.000$) and neutrophil count ($r=0.373$, $p=0.008$) and negatively with lymphocyte count ($r=-0.337$, $p=0.017$).

Conclusion: This finding implies that fuel has the potential to cause alterations in some haematological parameters, particularly in the red cell parameters and differential white cells, thus interfering with their normal function.

Keywords: Red cell indices, fuel pump, leucocyte count, haemoglobin

INTRODUCTION

Petrol is a mixture of volatile hydrocarbon, while diesel fuel is a distillate of petroleum which contains paraffin, alkenes and aromatics[1].Fuel (petrol and diesel) filling station attendants are exposed to a mixture of hydrocarbons in fuel and to the gases from vehicular exhaust[2]. In filling stations, the volume of fuel dispensed as well as the ambient temperature contributes significantly to the increased emission of volatile hydrocarbons. Benzene could be considered to be the most hazardous; xylene and toluene have toxicities in line with other aromatics of lower concentration compared to benzene[3]. Certain people have a greater risk of exposure to gasoline vapours; these include filling station workers, service station attendants, drivers of gasoline trucks and refinery workers. The volatile nature of petrol products makes them readily available in the atmosphere any time it is dispensed especially at the petrol filling station[4].

Many of the harmful effects seen after exposure to gasoline are due to the individual chemicals in the gasoline mixture such as benzene, lead and oxygenates. Breathing small amount of the gasoline vapour can lead to nose and throat irritation, dizziness, headache, nausea, vomiting, confusion and breathing difficulties. Some effects of skin contact with gasoline include rashes, redness and swelling. Allergic reactions (hypersensitivity) have been reported but these are rare occurrences[5].

Occupational exposure to petroleum products and fumes has been reported to have toxic effects on various organs and body system with high impact on the human respiratory system. Organs such as the heart, lung, liver, skin and kidney are affected by these toxic effects resulting in various disease and different forms of genotoxic, mutagenic, immunotoxic carcinogenic and neurotoxic manifestations [6]. With the fumes from petroleum products and lead content in fuel having a negative impact on the organs of the body, there will be an impact on the haematological parameters[7]. Haematological parameters, including red and white blood cell counts and haemoglobin concentration are widely used as clinical indicators of health and disease. These traits are tightly regulated in healthy individuals and are under genetic control. Mutations in key genes that affect haematological parameters have important phenotypic consequences.Values outside the normal ranges are diagnostic for disorders including cancer, immune disease and cardiovascular disease[7].

The adverse health effects of petrol exposure may be primarily related to impairment of the haemopoietic system with bone marrow depression[8]. The paucity of information on the possible effects of long term (6months and above) exposure of petrol fumes on the haematological parameters of pump attendants in Calabar metropolis locality is what informed this study.

MATERIALS AND METHODS

Study area

This research study was carried out within Calabar metropolis consisting of Calabar Municipal and Calabar south Local Government Areas of Cross River State, Nigeria.

Study design/Subject selection

A case control study design was used for this study. A total of one hundred (100) subjects (males and females) aged between 18-45 years were recruited for the study. This comprised of 50 fuel pump attendants and 50 control subjects. A well-structured questionnaire was administered to obtain demographic data and their informed consent to participate in the study was obtained.

Inclusion criteria

Fuel pump attendants (exposed for one year and above) and controls who gave their consent were enrolled for the study.

Exclusion criteria

Fuel pump attendants (below one year of exposure) and controls who did not give their consent and those with blood related diseases were excluded from the study.

Ethical Approval

Ethical approval was obtained from the ethical committee of Cross-River State Ministry of Health, Calabar.

Sample collection

Using aseptic technique, 4mls of blood was collected via venepuncture into a dipotassium ethylene diamine tetra acetic acid (EDTA K_2) container to a final concentration of 2mg/ml. The container was properly mixed, properly labelled and carefully placed in a rack and stored inside a cooler with ice-pack placed at the bottom of the cooler and cotton wool placed in between the ice pack and the rack containing the blood sample to avoid lyses. The anti-coagulated blood sample was used to determine the haematocrit value, haemoglobin concentration, red blood cell count, red cell indices, total white blood cell count, differential white blood cell count and platelet count.

Laboratory analyses

The haemoglobin concentration, haematocrit value, red blood cell count, red cell indices, total white blood cell count, differential white blood cell count and platelet count were analysed using System automated haematology analyser, Sysmex XE- 2100 [9]. Red blood cell morphology was manually evaluated by a well- trained and certified Laboratory Scientist.

Statistical analysis

Results were presented in tables as mean ± standard deviation (SD). The Statistical Package for Social Sciences (SPSS) version 21.0 was used in the statistics analysis. Student's t-test and Pearson's correlation were used to analyse the data. A P-value less than 0.05 was considered statistically significant.

RESULTS

The demographic data obtained from the study showed that majority of the participants (74-80%) were between the ages of 18-28 years with more males (22) than females (15). Fifty four (54%) of the fuel pump attendants had no residual knowledge of the effects of petroleum products on human health (Table 1). A comparison of the haematological parameters of the fuel pump attendants and controls showed that packed cell volume (PCV), Haemoglobin (Hb) concentration, mean cell volume (MCV) and Neutrophil count were significantly lower ($p<0.05$) in the fuel pump attendants when compared to the control subjects. The monocyte count was significantly higher ($p<0.05$) in the fuel pump attendants compared to the control subjects. Other parameters were comparable (Table 2).Figure 1 shows the distribution of fuel pump attendants based on duration of exposure. Out of the 50 subjects, 90% were exposed for duration of 1 – 4years, 4% were exposed for 5 – 8years while 6% were exposed for duration of 8years and above. Figure 2 shows a significant positive correlation ($r = 0.500$, $p=0.000$) between platelet count and TWBC in the fuel pump attendants. Figure 3 shows a significant positive correlation ($r = 0.373$, $p=0.008$) between platelet count and neutrophil count in the fuel pump attendants. However, figure 4 shows a significant negative correlation ($r = 0.337$, $p=0.017$) between platelet count and lymphocyte count.

Table 1: Demographic data of fuel pump attendants and controls

Demographics	Fuel pump attendants N (%)	Controls N (%)	P-value
Age range (years)			
[illegible]	37(74.0)	40(80.0)	0.764
29 – 39	10(20.0)	8(16.0)	
40 – 50	3(6.0)	2(4.0)	
Gender			
Male	28(56.0)	30(60.0)	0.685
Female	22(44.0)	20(40.0)	
Previous knowledge on the effect of petroleum on health			
Yes	23(46.0)	0(0.00)	
No	27(54.0)	0(0.00)	NS
Smoking history			
Yes	0(0.0)	0(0.0)	NS
No	50(100.0)	50(100.0)	
Drug history			
Yes	2(4.0)	0(0.0)	0.153
No	48(96.0)	50(100.0)	

Table 2: Some haematological parameters of fuel pump attendants and controls

Parameter/Group	Fuel pump attendants n = 50	Control subjects n = 50	
Age (years)		25.14±9.01	0.151
RBC count (×10^{12}/l)	4.82±0.87	5.03±0.47	0.132
PCV (l/l)	0.41±0.10	0.45±0.05	0.000*
Haemoglobin conc.(g/dl)	12.97±2.55	15.40±1.82	0.000*
MCV(fl)	81.48±7.67	84.02±4.06	0.041*
MCHC(g/dl)	34.21±5.54	33.99±1.02	0.779
MCH (pg)	27.78±4.49	28.85±1.31	0.109
TWBC (×10^{9}/l)	6.57±4.66	5.47±1.19	0.109
Lymphocyte (%)	42.96±9.61	42.98±7.91	0.992
Monocyte (%)	11.04±3.86	5.88±2.49	0.000*
Basophil (%)	0.00±0.00	0.00±0.00	NS
Eosinophil (%)	3.42±1.20	3.18±1.02	0.450
Neutrophil (%)	41.68±3.56	47.96±7.65	0.001*
Platelet count (×10^{9}/l)	192.16±73.88	216.76±51.94	0.057

Values are expressed as mean ± SD, where: * = Significant at $p < 0.05$, RBC = Red Blood Cells, PCV = Packed Cell Volume, MCV = Mean Cell Volume, MCHC = Mean Cell Haemoglobin Concentration, MCH = Mean Cell Haemoglobin, TWBC = Total White Blood Cell, NS = No Statistics.

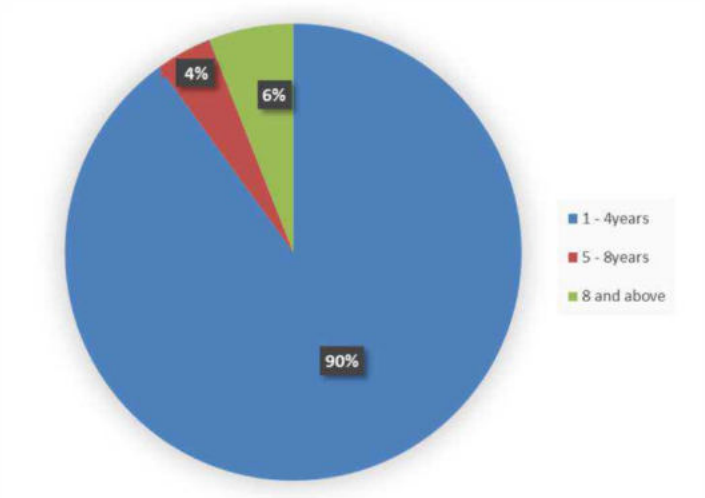

Fig.1: Distribution of fuel pump attendants based on duration of exposure

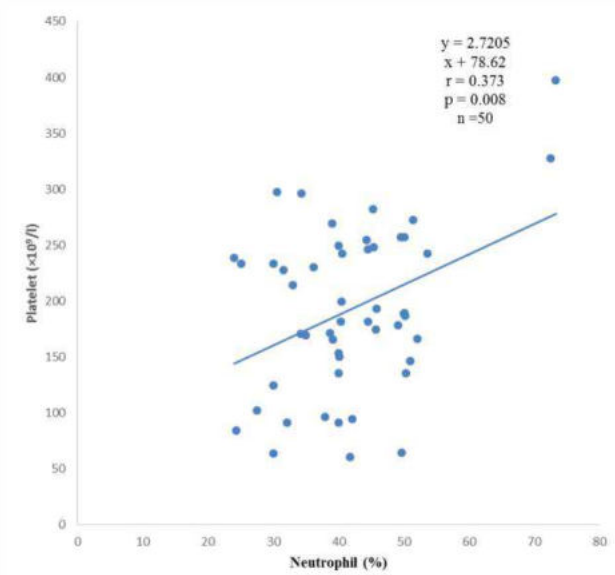

Fig. 3: Correlation plot of Platelet count against neutrophil count in fuel pump attendants.

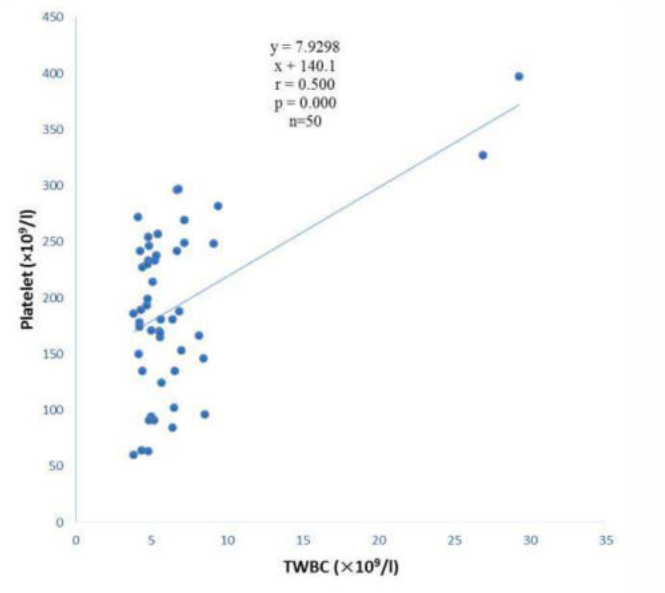

Fig. 2: Correlation plot of Platelet count against TWBC in fuel pump attendants.

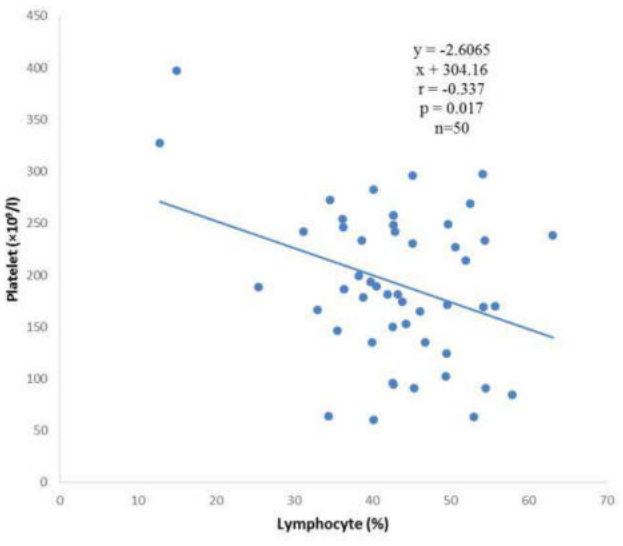

Fig. 4: Correlation plot of Platelet count against lymphocyte count in fuel pump attendants.

DISCUSSION

It was observed in this study that a high percentage of fuel pump attendants were young single adults within the age range of 18-25 years. This agrees with the findings of Rocha et al [10]. It was also observed that the males were slightly more in number than the females, 56% and 44% respectively. This is in contrast to a similar study in Elele, Nigeria[11], They reported 49% for the males and 51% for the females. A greater percentage of the fuel pump attendants had a working duration of 1-4 years. This may be because the job is seen as temporary until they get a better job offer or offered admission into the higher institution. It was also observed that 54% of the fuel pump attendants were not aware of the effects of petrol on their health due to lack of proper education and orientation.

In this study, it was observed that the packed cell volume, haemoglobin concentration, mean cell volume and neutrophil count of the fuel pump attendant were significantly reduced compared to the controls. This may be an indication of anaemia and impairment of the bone marrow haemopoetic function as a result of the effect of exposure to benzene via inhalation. Benzene is a volatile organic compound found in petroleum products including diesel and gasoline fuel [12]. This observation is in agreement with the work of Ovuru and Ekweozor[13]. The morphology of the red cells of the fuel pump attendants appeared as microcytic hypochromic cells and they were also crenated. This is suggestive of anaemia. White blood cells function primarily in body defense against foreign bodies and this is often achieved through leukocytosis and antibody production. The result showed a significant decrease in the neutrophil counts which is in contrast to the findings of Ita and Udofia[14]. This suggests leucopaenia and bone marrow toxicity which can be due to the myelotoxic action of benzene to the white blood cells.

There was a significant increase in the monocyte count of fuel pump attendants. Monocytes are involved in first line of defense and as immune regulatory cells. This significant increase may be due to the body's response to the hazardous petrol fumes which may be perceived by the body as an infectious substance. This finding is in agreement with the findings of Emelike et al.[15]

The study showed a positive correlation between the platelets and the total white cells count as well as between platelet count and neutrophil count of the fuel pump attendants. This may be due to the resultant effect of the fuel fumes on the respiratory tree with resultant inflammation and allergic reactions thus leading to harmful effect on the lungs and respiratory system. This is in agreement with the findings of Tell et al.[16]. The study also showed a negative correlation between the platelet count and the lymphocyte count of the fuel pump attendants. This occurs when platelet releases PGH2 (a type of prostaglandin) to activate strong platelet activation, utilized by lymphocytes to form PGI2 (prostacyclin) which inhibits the platelet activation and prevent the formation of platelet plugs. This is in agreement with the findings of Wuet al.[17] It occurs in cases of respiratory tree inflammation due to the inhalation of petrol fumes.

CONCLUSION

The findings from this study have shown that exposure to fuel has adverse effect on some haematological parameters particularly in the red cell parameters and differential white cells, thus interfering with their normal blood function.

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