Assessment of Haematological Parameters Among Petrol Station Attendants and Auto Mechanics in Port Harcourt Metropolis, Rivers State

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Abstract - Rapid increase in the number of gasoline stations has contributed to air pollution. This is due to continuous discharge of volatile fractions of the product into the air and might lead to health problem in workers which are the exposed population. Auto mechanics are also constantly exposed to petroleum product by washing their hands with petrol to remove grease and washing motor engine parts. The aim of this study was to assess the hematological parameters among filling stations attendants and auto mechanics in Port Harcourt metropolis, Rivers State, Nigeria. A total of 150 subjects of age range (20—45 years) which comprises of 90 subjects that were impacted with petroleum products and 60 subjects that were not impacted with petroleum products serve as control. Using a questionnaire, personal data of each participant was collected. The questionnaire focused on age, sex and height, how long they have worked as a mechanic or filling station attendants, if they use any protective device at work, health challenge since the start of work. About 5ml of blood was collected from each subject for analysis. Haematological parameters were analyzed using auto analyzer, the various results were obtained and statistical analysis was done. Difference in mean was considered significant at $p \leq 0.05$. Analysis was performed using SPSS 20.0. From the result, there was a decrease in platelet value in auto mechanic when compared to control. In addition, there is a statistically significant decrease on platelet value in people who are exposed from four years and above. There was a decrease in WBC on subjects who are exposed. There was a statistically significant decrease in PCV on the exposed when compared to the control. It was however summarily observed from this study that petroleum products could potently cause a decrease in some haematological parameters such as PCV, WBC and platelet.

Introduction

Petroleum fuel which is also referred as gasoline is used for the internal combustion engines. It is a complex mixture of over 500 hydrocarbons that may have between 5 – 12 carbons, smaller amount of alkanes, cyclic and aromatic compounds are present.

Petroleum refining products consists of cycloakanes, straight and branched chain alkanes which becomes imminent sources of pollution in various occupational settings. Component of petroleum partitions in the environmental media according to vapour pressure, water solubility and partition coefficient. Benzene, toluene and xylene have high vapour pressures and water solubility hence, they are exist in both the vapour phase and water soluble fraction of gasoline. Aromatic compounds are absorbed more rapidly than other components of gasoline thereby having huge health implication. The major volatile aromatic hydrocarbons are benzene, toluene, ethylene benzene and xylene often referred to as BTEX (Edokpolo et al., 2014). And semi-volatile compound like polycyclic/polynuclear aromatic hydrocarbons.

Several volatile aromatic hydrocarbons are present in the atmospheric of petrol service station as a result of emission of vapours during dispensing, loading, unloading and transportation of petrol (Periago et al., 1997). During refueling, people may easily be exposed to extremely high levels of petrol vapour for a short time, although such exposure takes on more importance of gasoline sold in refueling operations and the ambient temperature can significantly increase the environment level of polycyclic aromatic compound and subsequently, the occupational risk of service station, attendants (Periago and Prado, 2004).

Petrol pump attendants and workers in petrochemical industries in developing countries like Nigeria are particularly vulnerable to the hazardous effects of such chemical compounds because of the lack of adequate regulatory and protative mechanisms (Adeniyi, 2014). During refueling at service station, the vapour saturated air is expelled through the filling channel around the nozzle, and into the breathing zone of the attendant filling the tank this exposure process is repeated as many times the attendants fills a tank in a work shift and its further exacerbated by the none usage of personal protective equipment.

Verities studies have shown that chronic exposures to gasoline toxic constituents by service station attendants may result in the occurrence of cancer and other adverse health effect (Soldators et al, 2003).

An auto mechanic is someone whose occupation is repairing and maintaining automobiles. The auto mechanics and other occupational groups are constantly exposed to some health risks. The (WHO) gave the auto mechanic the annual number of nonfatal work related diseases caused by exposure to hazards and dangerous conditions at work place (Enander et al., 2004, (Ogwike et al., 2014).

With increasing demand of gasoline and consequent proliferation of fuel stations. Inhalation of gasoline by service station attendants is one of the exposure scenarios which may have adverse health implications on hematological parameters of which this study seek to investigate.

Materials and Methods

Systematized materials and equipments were used for this research, and they are all listed in this chapter.

The design of this study is a descriptive survey. A descriptive surveys are those studies that aim at data collection and describing it in a systematic manner, the characteristics, features and facts about a given population, Nworgu (1991).In a descriptive survey study, the researcher collects data usually from a given population and describes certain attributes or features of the sample as they are and as required by the study at that particular time without manipulating any independent variables of the study.

This research was carried out in Port Harcourt (Rivers State) and the hematological analysis was done in St Martins Specialist Medical Laboratory in Port Harcourt. The air analysis was done by Global Environmental Technology Limited and the soil analysis was done by Fugro laboratories.

Petrol attendants and automobile mechanics were used as the test group while students mostly post graduates students of University of Port Harcourt were used as the control group.

Study Population

The subjects for this study comprised of a test group and a control group.

A total of 150 subjects were used for this study which comprise 90 subjects that are impacted with petroleum products and 60 sujects that were not impacted with petroleum products which serve as control. 48 auto mechanic workers engaged in this study and 42 fuel pump attendants.

The auto mechanic workshops visited are mile 3 central auto mechanic village. Agip auto mechanic work place and Rumuokwurushi auto mechanic work place.

Petrol stations visited include:

- Mobil petrol station Garison,
- Conoil petrol station at Ikoku.
- Machison Petrol station Rumuokoro.
- Cima petrol station at Ozuoba.

The control groups are 60 students of University of Port Harcourt. The sample size of the study was calculated using Sussan et al (2015).

$$N^r = \frac{4pq}{d2}$$

N^r = Sample Size

4 = Constant

P = Attempted Number

q = (1-P) error margin

d = degree of accuracy (5-20%)

Inclusion and Exclusion Criteria

The subjects for this study have worked as a mechanic or filling station attendant for up to 2 years. Subjects between the age of 20 – 45 were used for this research. Letter was given by Physiology Department University of Port Harcourt to each of the location visisted, and their full consent were given to participate in the study; they were educated on health and safety and its importance in their working environment. The test subjects were auto mechanics and petrol station attendants.

Methods of Data Collection

Using the questionnaire, personal data of each participant was collected. The questionnaire focus mainly on age, sex, weight and height, how long they have worked as a mechanic or petrol station attendant, marital status, if they use any protective device at work, if they go for medical check up, if there is any health challenge since the start of work, if on any medication.

Air quality was trapped by a gas meter; this gas meter was used to measure the presence of CH_4 and Volatile Organic Carbon (VOCs) in air and the environment of the locations of the study. Soil samples were collected from each location to measure total recoverable hydrocarbon content (TRHC).

5mls of venous blood was taken from a peripherial vein on the arm of each subject and immediately transferred into sterile protassium EDTA anticoagulant bottles. The sample bottles were tightly covered and well labeled using the number on each questionnaire for proper identification. At the end of the day, the samples were sent for analysis. Medical waste like used cotton wool, gloves, niddles, stringes were collected apropraitely into disposable containers.

Safety and Ethnical Consideration

The research was approved by the ethics committee on human biomedical research of the University of Port Harcourt, Nigeria. Rules and guidelines governing sample collection from human for research purposes were strictly adhered to. Only individuals who were willing to participate and were clearly informed about the reason for the study were recruited. All data collected were kept in strict confidence.

Hematological Analysis

From the site of collection, these collected blood samples were taken from the arm of the subject into EDTA both to the laboratory for analysis.

In the laboratory, these blood samples are placed in blood roller mixer, the blood roller mixer mixes the blood for about 30 seconds to 1 minute. The machine was turned on and the blood parameters were displayed on the screen of the machine.

After mixing, the blood samples were taken on cap and aspirate. The machine is an automated hematology analyser (mindray BC 2300) the aspiration was done by placing the EDTA bottle containing the blood under tube mechanism to make sure it touched the blood and the aspirator was pressed. The machine dispensed the sample into various counting chambers compartments. Each of the chamber aspirated the respecting three solution E-Z cleaner, cell lyse and diluents. Each of the reagent mixed with the aspirated sample at the counting chamber for proper dilution of the aspirated samples. The counting is done by the machine automatically within seconds and the value of the result is displayed. The value is been printed out by pressing the printing button and the printing rollers rolled out the results accordingly. The result is been compared with the normal international value inbuilt in the machine.

AIR ANALYSIS

Air Sampling Gaseous Pollutants

Gaseous air pollutants: Volatile organic compounds (VOCs). Hydrogen suphide (H_2S) carbonmonoxide (CO). ozone (O_3) and ammonia (NH_3) were measured with a wolf pack^{TM} modular area monitor, an air quality monitoring and application equipment. It is embedded with winch computer that runs Gray Woll's Woll sense 2009 application software for displaying documenting and logging key parameters.

It has facility for but not limited to short term exposure limit (STLL) from which the gaseous pollutant concentration for the last 15 minutes can be determined the Time Weighted Average (TWA) from which the accumulated reading of the gas concentration since the monitor was turned on is divided by 8 hours and the peak reading which is the highest reading since the monitor was turned on.

Procedure for Air Quality Sampling

a) At each monitoring station, the air quality sampling equipment is positioned about 1 meter above the ground.
b) Switched on, allowed to stabilize for about 5 minutes.
c) Sampling is initiated by activating the "logging" command on the equipment. Equipment is allowed to run for about 5 minutes after which logging command is aborted.
d) Reading captured by equipment are automatically stored and can be either displayed or transferred to a computer for references.

Soil Analysis

Soil samples were collected in small quantity and was taken to laboratory for analysis. The GCFID: Gas chromatography – flame Ionization Detector (USEPA 8440) was used to analyze TRHC in a soil samples. First a known weight is passed through extraction with DCM and the extract is allowed to evaporate to 1ml. It is then packed in a vital and sent to the GC where it will pass through a column at high temperature to the FID (Flame Ionization Detector). The FID was flame to ionize analysis of interest which was detected and shown on the chromatogram.

Statistical Analysis

Data were evaluated for significant differences between control and experimental group and were assessed and determined using SPSS (Statistical Package for Social Sciences (SPSS) version 20.0. For independent T-test and one-way ANOVA followed by Sheffe, Turkey, Duncan and LSD post hoc multiple comparisons. The data were expressed as mean ± SEM at ($P \leq 0.05$).

RESULTS

Table 1: Demographic characteristics of study population.

Variables	Control	Filling Station Attendant		Auto Mechanics		Total Population	
	Female N = 32	Male N = 28	Female N = 18	Male N = 22	Male N = 50	Female N = 50	Male N = 100
Age (yrs)	30.12± 1.00	30.46± 0.99	24.44±0.99*	29.45± 1.03	29.26± 0.80	28.08± 0.82	29.64± 0.53
Weight (kg)	56.26±0.94	63.78± 1.03	57.83±1.71	63.09± 1.32	65.82± 1.29	56.82± 0.86	64.65± 0.77
Height (m)	1.56±0.011	1.62± 0.014	1.56±0.017	1.57± 0.01	1.61± 0.011	1.56± 0.0095	1.61± 0.0081
BMI (kg/m^2)	22.99±0.37	24.28± 0.44	24.19±0.88	25.64± 0.76	25.19± 0.49	23.42± 0.39	25.03± 0.32

All values are presented in mean ± SEM $p \leq 0.05$* means test values are statistically significant.

Table 2: Haematological parameters of the study population

Hematological parameters	Study group	
	Control N = 60	Exposed N = 90
WBC ($x10^9$/L)	7.40±0.46	6.33±0.34
HGB (g/dl)	12.23±0.17	11.63±0.17
RBC ($x10^{12}$/L)	4.52±0.64	4.44±0.06
PCV (%)	36.69±0.51	34.88±0.51*
MCV(FL)	83.43±0.98	83.13±0.81
MCH(Pg)	26.89±0.27	26.46±0.27
MCHC (g/dl)	32.19±0.17	31.76±0.21
PLT ($x10^9$/L)	288.83±11.56	238.24±8.89*

All values are presented in mean ± SEM. $P \leq 0.05$* means test values are statistically significant when compared to the control value.

Table 3: Values of Haematological parameters of study population with respect to occupation

Parameters	Occupation of Subjects		
	Control N = 60	Auto mechanics N = 50	Filling station attendants N = 40
WBC ($x10^9$/L)	7.40±0.46	5.91±0.44*	6.86±0.53
HGB (g/dl)	12.44±0.24	11.62±0.17*	11.96±0.22
RBC ($x10^{12}$/L)	4.54±0.09	4.44±0.06	4.50±0.08
PLT ($x10^9$/L)	288.8±11.56	228.0±12.06*	250±13.00
MCV(FL)	84.39±1.11	83.12±0.81	82.22±1.71
MCH(Pg)	27.26±0.37	26.40±0.27	26.42±0.38
MCHC (gldl)	32.31± 0.23	31.76±0.21	31.03±0.26

All values are presented in mean ± SEM. $P \leq 0.05$ * means test value are appreciable statistically when compared to control value.

Table 4: Haematological parameters of study population with respect to duration of exposure

Parameters	Duration of Exposure (yrs)			
	0 Years N = 60	1 – 3 yrs N = 36	4 – 6yrs N = 43	7 yrs and above N = 11
WBC ($x10^9$/L)	7.40±0.46	6.81±0.61	6.22±0.74	5.96±0.46*
HGB (g/dl)	12.43±0.67	12.36±0.22	12.01±0.26	11.62±0.17*
RBC ($x10^{12}$/L)	4.62±0.08	4.54±0.20	4.44±0.06	4.40±0.10
PLT ($x10^9$/L)	288.8±11.56	251.76±10.53	232.32±14.11*	204.6±38.06*
MCV(FL)	86.41±1.86	83.18±2.04	83.12±0.817	82.86±1.03*
MCH(Pg)	27.28±0.73	26.78±0.39	26.88±0.43	26.39±0.27
MCHC (gldl)	32.67±0.27	31.76±0.25	31.76±0.21*	31.63±0.40*

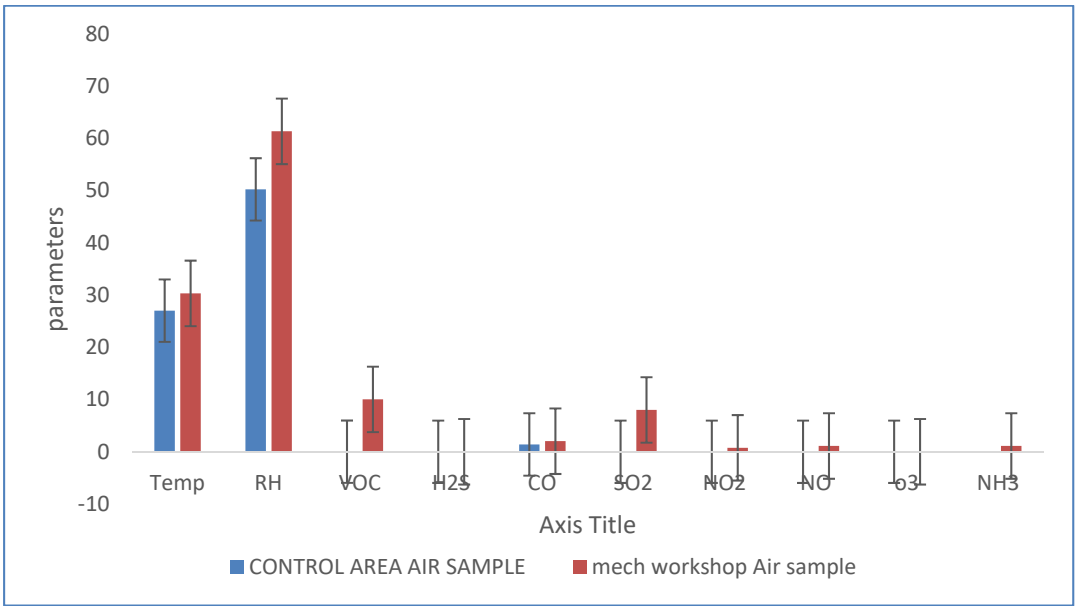

Figure 1. Composition of sample of air at control and test group (mechanic) locations.

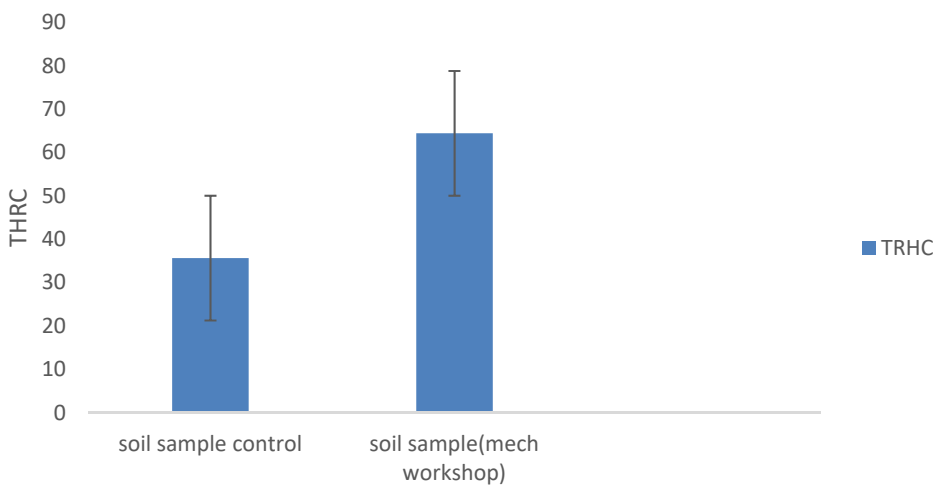

Figure 2. Soil quality analysis of TRHC of control and test group mechanic locations TRHC – Total Recoverable Hydrocarbon

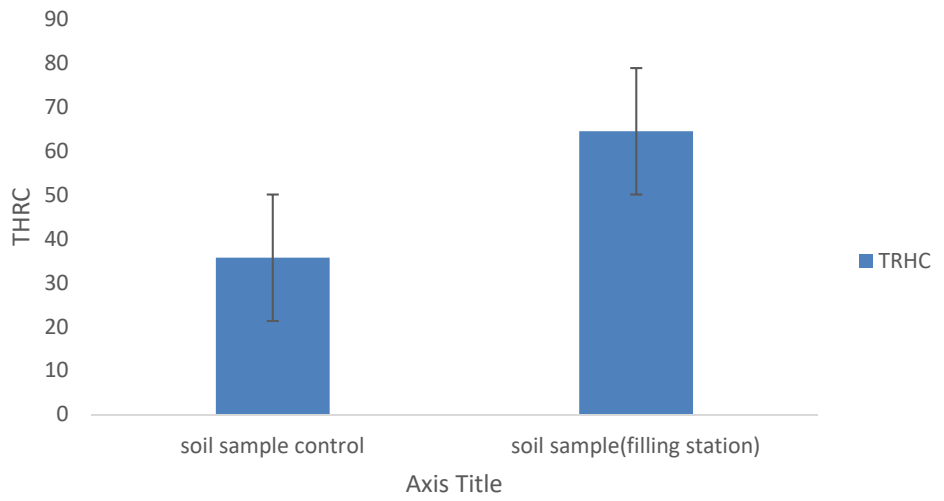

Figure 3. Soil quality analysis of TRHC of control and test group (filling stations) locations TRHC – Total Recoverable Hydrocarbon

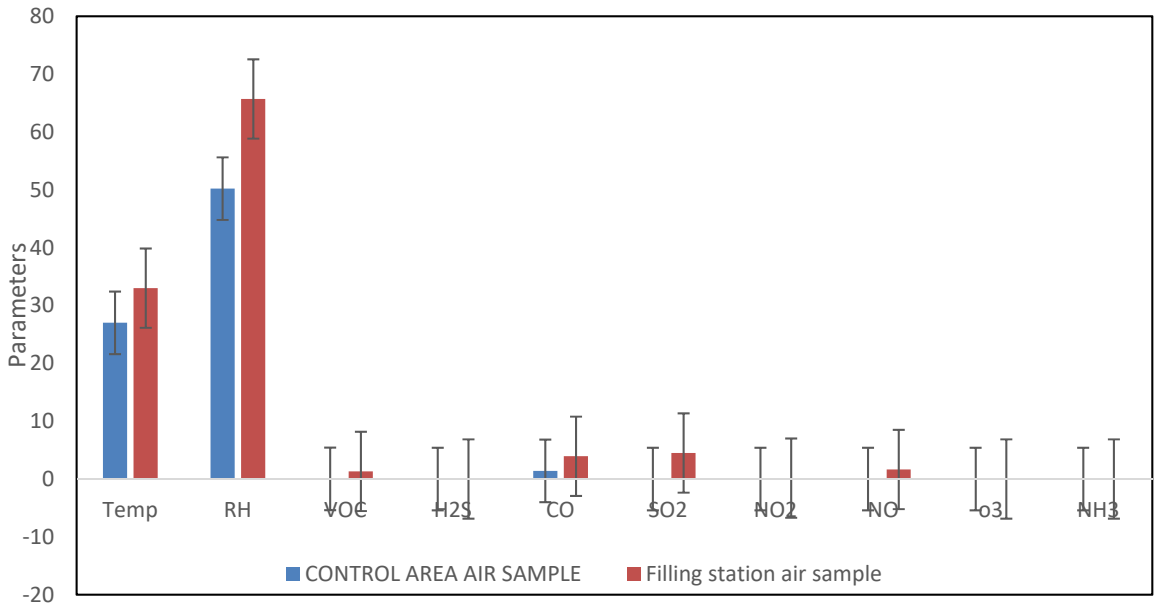

Figure 4. Composition of sample of air at control and test group (filling stations) locations.

Discussion

From this study, it was observed that there was a decrease in platelet, the main function of platelet is blood clotting and a decrease can cause a reduction in blood clouting time. There was a decrease in platelet value in auto mechanic when the exposed was compared with the control. In a study by Marieb (1995) it was revealed that toxic elements in petroleum products change blood chemistry and therefore interfere with the production of platelets in animal. MCHC is low on people who are exposed and also platelet is low on people who are exposed from 4 years and above. The decrease in MCHC could be as a result of the effect of benzene and xylene as stated by D'Azevedo et al., (1996). Benzene causes pancytopenia and might result to bone marrow aplasia, while xylene has been found to cause leucopenia. These issues could lead to impaired migration of phagocytic cells, lower resistance to viruses, bacteria and foreign bodies by Marieb (1995). Toxic components of crude oil like benzene and lead are stated to be triggered in the bone marrow and the cytotoxic effect studied are carried out through disruption in DNA other exposure to benzene is reported to have hazardous effect on human health (Smith, 1996).

There was a decrease in haemoglobin level when exposed were compared to the control. The value of that of the auto mechanic is statistically significant compared to the control. This is in agreement with Okoro et al., 2006. There is a decrease in the WBC in the auto mechanic and petrol pump attendants when compared to the control. This could be due to the constant exposure of VOC's and harmful chemicals found in petroleum products example. Benzene, toluene etc. An investigation on the effect of toluene on some blood parameters by E. Akbass (2004). It was revealed that toluene reduces the white blood cell count and also reduce its life span. White blood cell function mainly in defence against foreign bodies and this is attain through leucocytosis and antibody production (Marieb, 1995). WBC was reduced showing that the immunity of the mechanics and petrol pump attendants is being compromised by the constant exposure of these petroleum products. (Synder, 2000).

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