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Effects of Automobile Workshop on Haematological Parameters of Auto Mechanics and Automobile Paint Sprayers in Benue State, Nigeria



Abiodun Olaiya Paul^{1*}, Abiodun Abiola Folake²,
Sunday E. Oni³, Felix Olaniyi Sanni⁴, Zachary Gwa⁵

¹Department of National Integrated Specimen Referral Network, AXIOS International, Utako, FCT, Abuja, Nigeria

²Department of Medical Laboratory Services, General Hospital Makurdi, Nigeria.

³Department of Public Health, Rivers State University, Port Harcourt, Nigeria

⁴Department of Global Health-WABCS, Lagos State University Teaching Hospital, Ikeja, Lagos State, Nigeria,

⁵Department of Business Development, AXIOS International, Utako, FCT, Abuja, Nigeria,

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ABSTRACT

This study evaluated the effect of these chemicals on Hematological parameters among the automobile spray painters (PNs) and mechanics automobile mechanics (MCs) in Makurdi Local Government, North Central, Nigeria. This study did a preliminary survey of various chemicals used auto workshops blood samples were collected from 105 participants divided into three groups (50 control, 55 auto mechanics, and 50 Spray Painters). This study found white blood cell count, mean corpuscular hemoglobin, mean corpuscular haemoglobin concentration and neutrophils, were significantly lower in spray painters and mechanics compared than control ($p < 0.05$). Also, the values of Red blood cell, Haemoglobin, Haematocrit, Lymphocytes, and Monocytes were significantly higher in Automobile spray painters and Mechanics than in control ($p < 0.05$). No statistically significant difference was observed in the values of Packed Cell Volume, Red cell Distribution Width, Platelet Distribution Width, and Platelet-Large Cell Ratio in cases and control. However, the values of Packed Cell Volume were higher in both spray painters and Mechanics than control and the percentage Red Cell Distribution Width was higher in the Control group than for Spray painters and Mechanics. The majority of the automobile workers were in danger of the health implications of these chemicals and other products they use in their daily activities.



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INTRODUCTION

Automobile mechanics and sprayers are at a higher risk of exposure to hazardous chemicals such as polycyclic aromatic hydrocarbons and heavy metals which may cause adverse health outcomes[1]. Automobile technicians are made up of mechanics, spray painters, panel beaters and auto electricians. Just like many other occupational groups, they are exposed to many occupationally related diseases[2]. Exposure to aliphatic and aromatic hydrocarbons has been reported to be harmful to the health of humans and animals[3]. Due to the volatility of these chemicals, they can be inhaled easily or easily absorbed through the skin, the harmful effects of which may be aggravated in ambient temperature regions like Nigeria[1]. The majority of these aromatic compounds found in petrochemicals may cause adverse health outcomes if exposure to these is not controlled[4].

Certain occupations such as automobile mechanics and sprayers are prone to immediate exposure to these hazardous chemicals through either inhalation, dermal exposure, or ingestion[1]. Their occupational exposure could range from routine transportation, distribution, inhalation of vehicle exhaust fumes, accidental spills, improper handling, and use of petroleum products to leaching of petroleum hydrocarbons[5]. Automobile mechanics sometimes siphon fuel with their mouth as when trying to initialize ignition[4], and the automobile sprayer may indirectly inhale these harmful compounds (despite using masks) during the painting of a vehicle surface [1].

Exposure to heavy metals may result in bone marrow suppression and consequently lead to ineffective hematopoiesis[6]. Studies have shown that aromatic chemicals affect the hematopoietic system by inhibiting the hemoglobin synthesis and suppressing important enzymes in the pathway of heme synthesis, thereby causing a reduction in life-span of erythrocytes [1,6]. On the other hand, exposure to aromatic chemicals has been reported to bind to bone marrow DNA, leading to chromosomal disorder[2,7,8]. Thus regular exposure to the harmful compounds due to chronic inhalation may stimulate undesirable effects on the hematopoietic system in human body systems[2]. This study was therefore conducted to assess the effect of automobile workshop on the health status of automobile mechanics and automobile paint sprayers in Makurdi local government, Benue State, Nigeria.

MATERIALS AND METHODS

The factories where this study was carried out was the main location for major repairs for cars in Makurdi Local government, which consist of automobile spray painters (PNs) and automobile mechanics (MCs) among others. This facility had a staff strength of about 350 from which sampling was done, targeting the workers at high risk of occupational exposure and injuries. The total number of automobile spray painters (PNs) and mechanics automobile mechanics (MCs) was about 105. This group of workers forms the sample frame because they are more exposed to chemicals in their daily activities. The participants were divided into two groups which were the control group comprising of 50 participants and the subjects which comprised 55 mechanics and 50 automobile spray painter.

All spray painters and auto mechanics in the selected small scale auto garages in the study area, who was directly involved in mechanical or spray painting activities and willing to participate in the study were included. Those that were not directly involved in spray painting and, spray painters who were not willing to participate were excluded from the study.

Method of Sample Collection and analysis

Samples were collected from workers during their routine work hours across their shops. About 3–4 mL venous blood from the antecubital vein of each participant was taken with the use of a 5-10mL disposable plastic syringe and immediately transferred to a sterile vacutainer which contains either K/ potassium–EDTA anticoagulant containers for analysis. All samples were analyzed immediately to avoid false positive results. With the aid of digital Sysmex customized automated hematology analyzer (KX-21), analysis of selected parameters was performed using whole blood approximately 50 (fifty) microlitres. Sysmex machine was also used to measure Red Blood Cells (RBCs) in $1 \times 10^6/\mu\text{L}$, the White Blood Cells (WBCs) in $\times 10^6/\mu\text{L}$, Platelet Counts (PCs, in $\times 10^6/\mu\text{L}$), Hemoglobin (Hb, in g/dL), Packed Cell Volume (PCV, in %), and Mean Corpuscle Volume (MCV, in ft) and urine was collected in sterile containers and analyzed immediately.

Data Analysis

Data analysis was done using the IBM-Statistical package for Social Science (IBM-SPSS) version 21. Inferential statistics of Chi-square was used to test for significant associations

between socio-demographic variables and the practices of the automobile spray painters (PNs) and auto Mechanics (MCs). Statistical level of significance was set at P-value <0.05.

Ethical considerations: An approval to conduct the study was obtained from the Hospital Management Board, the State Ministry of Health (SMoH) of Benue State in Nigeria.

RESULTS

A total of One Hundred and five (105) participants and 50 Control samples were taken. Table 1 shows that the values of TWBC were significantly lower in spray painters ($5.12 \times 10^3/\mu\text{L}$) and mechanics ($5.35 \times 10^3/\mu\text{L}$) compared to control ($6.70 \times 10^3/\mu\text{L}$).

Similarly, the values of MCH, MHCH, and Neut are significantly lower in Spray painters and Mechanics than control ($p < 0.05$). On the other way round, the values of RBC, Hgb, HCT, LYM, and MXD are significantly higher in Automobile spray painters and Mechanics than control ($p < 0.05$). Also, the values of these parameters are higher in Mechanics than in Spray Painters. Although the values MCV are higher for Mechanics and Spray painters, these higher values are not significantly higher in both groups than in control ($p > 0.05$).

The total LYM value was not significantly higher in spray painters ($2.34 \times 10^3 \mu\text{L}$) than in control ($2.23 \times 10^3 \mu\text{L}$) but significantly higher in Mechanics than control $2.53 \times 10^3 \mu\text{L}$ ($p < 0.05$). The value of total LYM was insignificantly higher in Mechanics than Spray Painters. The value of total MXD was significantly higher in control $0.75 \times 10^3 \mu\text{L}$ than Mechanics, $0.66 \times 10^3 \mu\text{L}$ ($p < 0.05$) but insignificantly higher than the value seen in spray painters, $0.72 \times 10^3 \mu\text{L}$ ($p > 0.05$). Also, there was no significant difference in the values of total MXD for both spray printers and mechanics were ($p > 0.05$) (Table 2).

No statistically significant differences observed in the values of MPV, RDW, PDW and P-LCR in the treatment groups compared to the control group. However, the values of MPV were higher in both spray painters (10.53fL) and Mechanics (10.45fL) than in control (10.25fL). Percentage RDW was higher in the Control group, 13.97% than the 13.80% and 13.93% recorded for Spray painters and Mechanics. Similar to MPV, the control group also showed lower values of PDW (12.68fL) and P-LCR (28.19%) than Spray painters (PDW; 13.33fL, P-LCR; 28.93%) and Mechanics with 13.09fL PDW and 28.23% P-LCR respectively (Table 3).

Table 1: Distribution of haematological parameters in subjects and control

Parameter	Control	Spray Printers	Mechanics
TWBC (x10³/μL)	6.70 ± 0.11	5.12* ± 0.84	5.35* ± 1.68
RBC (x10⁶/μL)	4.31 ± 0.01	4.91* ± 0.35	5.00* ± 0.28
Hgb (g/dL)	12.23 ± 0.17	13.60* ± 0.84	13.80* ± 0.69
HCT (%)	35.57 ± 0.30	41.09* ± 2.61	41.82* ± 1.78
MCV (fL)	82.68 ± 0.22	83.85 ± 3.56	83.77 ± 2.81
MCH (pg)	28.34 ± 0.13	27.78* ± 1.61	27.66* ± 1.31
MCHC (g/dL)	34.22 ± 0.20	33.12* ± 0.84	33.02* ± 0.93
Plts (x10³/μL)	201.38 ± 3.07	192.32 ± 65.51	192.36 ± 67.87
LYM (%)	29.97 ± 0.07	45.94* ± 7.28	47.97* ± 9.11
MXD (%)	10.50 ± 0.04	14.27* ± 4.62	12.57* ± 4.62
Neut (%)	59.61 ± 0.04	39.72* ± 6.38	39.46* ± 8.32

*The mean is significant with control at the 0.05 level, TWBC = Total White Blood Cell count, RBC = Red blood cell count, Hgb = Haemoglobin, HCT = Haematocrit/Packed Cell Volume, MCV = Mean corpuscular volume, MCH = Mean corpuscular hemoglobin, MCHC = Mean corpuscular haemoglobin concentration, Plts = Platelets, LYM = Lymphocytes, MXD = Monocytes, Neut = Neutrophils.

Table 2: Distribution of total haematological parameters in subjects and control

Total parameter	Control	Spray Printers	Mechanics
Total LYM x10³μL	2.23 ± 0.44	2.34 ± 0.52	2.53* ± 0.61
Total MXDx10³μL	0.75 ± 0.07	0.72 ± 0.22	0.66* ± 0.21
Total Neut. x10³μL	3.91 ± 0.01	2.07* ± 0.57	2.15* ± 0.86

*The mean is significantly different from control at the 0.05 level, LYM = Lymphocytes, MXD=Monocytes, basophils, and Eosinophils, Neut = Neutrophil volume.

Table 3: Distribution of MPV, RDW, PDW and P-LCR in the major group in comparison with the control group

Parameter	Control	Spray Printers	Mechanics
MPV (fL)	10.25 ± 1.19	10.53 ± 0.78	10.45 ± 0.86
RDW (%)	13.97 ± 0.88	13.80 ± 0.95	13.93 ± 0.85
PDW (fL)	12.68 ± 0.96	13.33 ± 1.66	13.09 ± 1.83
P-LCR (%)	28.19 ± 5.78	28.93 ± 5.81	28.23 ± 6.37

*The mean is significant with control at the 0.05 level, PCV = Packed Cell Volume, RDW = Red cell Distribution Width, PDW = Platelet Distribution Width, P-LCR = Platelet-Large Cell Ratio.

DISCUSSION

This study evaluated the effect of these chemicals on hematological parameters among the automobile spray painters (PNs) and automobile mechanics (MCs) in Makurdi Local Government, North Central, Nigeria. The important hematological parameters varied significantly in Automobile spray painters and Mechanics than in the control group which is considered normal ($P < 0.05$). This may be attributed to chemical inhalation by the treatment groups and thereby need urgent intervention.

One of the major effects of exposure to organic solvents is the alterations in blood parameters. This study found TWBC, MCH, MHCH, and Neut, were significantly lower in spray painters and mechanics compared than control ($p < 0.05$). However, no significant difference was seen in platelet counts between subjects and control. According to Kyrian, in unhealthy situations, the level of WBC is altered and their concentration in the blood reduces[9].

In a similar study conducted in Port Harcourt, Nigeria, Adu and his team found lower TWBC in Mechanics and Spray Painters but higher MCH and MHCH in cases[1]. In another study conducted in Pakistan by Karmal and Malik, they reported slightly increased platelet counts and TWBC counts among spray painters and mechanics exposed to occupational chemicals and attributed the increase to an indicator of anemia[10].

It has also been reported that WBCs and other blood parameters undergo changes under abnormal conditions with increased values due to some diseases acute infections and leukemia[10]. However, Karmal and Malik involved smokers in their subjects; that might be the reason a slightly higher TWBC count they reported. In our study, our opinion in agreement with[9] is that the decrease in these parameters may be due to some inflammatory conditions because of the function of WBCs to provide a primary defense.

We are also of the opinion that these inflammations might be as a result of regular exposure of mechanics and spray painters to organic solvents during the discharge of their statutory duty. However, since workers are often exposed to organic solvent mixtures in paints, it is hard to attribute the alterations seen in the blood parameters to any particular substance[9].

We also found that the values of RBC, Hgb, HCT, LYM, and MXD were significantly higher in Automobile spray painters and Mechanics than in control ($p < 0.05$). The total LYM value was not significantly higher in spray painters than in control, but significantly higher in Mechanics than control. The value of total MXD was significantly higher in control than in Mechanics ($p < 0.05$) but not significantly higher than the value seen in spray painters ($p > 0.05$). These findings contradict the report of Kyrian in Port Harcourt in Nigeria, where the values of RBC, hemoglobin concentration and HCT of paint industry workers were significantly decreased ($p < 0.05$)[9], but similar to the report of Gedion *et al.* [11].

No statistically significant differences observed in the values of MPV, RDW, PDW and P-LCR in the treatment groups compared to the control group. However, the values of MPV were higher in both spray painters and Mechanics than in control. Percentage RDW was higher in the Control group than for Spray painters and Mechanics. Control group also showed lower values of PDW and P-LCR than in Spray painters and Mechanics. This finding contradicts the reports of the study of Adu and his team in which the values of MPV and RDW were significantly higher in Mechanics and Spray Painters [1]. It has been reported in other studies that heavy metals in aromatic compounds may result in ineffective erythropoiesis as a consequence of its suppressive activity on the bone marrow[1,6].

CONCLUSION

In this study, our findings revealed that the exposure of the Mechanics and Spray Painters to organic solvents and other petrochemicals negatively affect the bone marrows due to the alteration of their hematological parameters. We conclude that the majority of the automobile

workers were in danger of the health implications of these chemicals and other products they use in their daily activities.

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