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Assessment of some Biochemical Markers and Haematological Parameters among Panel Beaters in Yenagoa, Bayelsa State, Nigeria

***Egoro Emmanuel Tonbra, Ilegbedion Ikhide Godwin[1] Amaihunwa Kingsley Chukwuka [2], Melford Chinwebudu Miller[3]**
*&[1]Department of Medical Laboratory Science, Niger Delta University,
Wilberforce Island, Bayelsa State, Nigeria
[2] Department of Medical Laboratory Science, Delta State University,
Abraka, Delta State, Nigeria
[3] Department of Medical Technology, Cebu Doctor University, Dr P.V. Larrazabal Jr. Ave.,
North Mandaue City, Cebu, Philippines
*Corresponding author's email address: etegoro2@gmail.com
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Abstract

Panel beaters are automobile technician subspecialties whose occupational practices include repair, cutting, soldering, welding, and spray painting. This study aimed on the assessment of some biochemical makers and haematological parameters among panel beaters in Yenagoa, Bayelsa State, Nigeria. Ten milliliters of blood sample was withdrawn via venipuncture technique from each of the ninety healthy participants, age between 21-32 years with 5 ml each dispensed into lithium heparin and ethylene diamine tetra acetic acid anti-coagulated bottles respectively for the measurement of some biochemical and haematological parameters. These participants were grouped into control group made up of 30 non-panel beaters, 30 panel beaters with working experience of less than 3 years (experimental group one) and another 30 panel beaters with 3-10 years working experience (experimental group two).The biochemical markers measured were: lead (atomic absorption spectrophotometric), cadmium (atomic absorption spectrophotometric), glutathione peroxidase (ultra-violet), malondialdehyde (thiobabituric), C-reactive protein (latex turbidimetry) and interleukin-6 (ELISA) while the haematological parameters were packed cell volume (microhaematocrit), haemoglobin (cyanmethaemoglobi) total white blood cells count (improved neubauer chamber) and erythrocytes sedimentation rate (westergre). The data obtained from the measurements were analysed using SPSS 23.0 version as statistical package. The mean values of all measured biochemical parameters in the experimental group one participants revealed no significant differences ($p > 0.05$) with the exception of C-reactive protein (3.28 ± 0.45) mg/L, ($p=0.04$), and interleukin-6 (5.60 ±0.32) pg/ml ($p=0.04$) as compared to the control group C-reactive protein (2.14 ± 0.32)mg/L and interleukin-6 (3.91 ± 0.21) pg/ml ($p=0.04$) while in the experimental group 2 participants were significantly elevations in the mean values of lead (0.016 ± 0.003) ×10-2ppm, ($p=0.02$) cadmium (0.007 ± 0.002) ×10-2ppm,($p=0.03$), glutathione peroxidase (4.28 ± 0.38) µmol/L ($p=0.04$), malondialdehyde (3.98 ± 0.32) µmol/L ($p=0.03$), C-reactive protein (6.28 ± 1.78) mg/L ($p=0.01$) and interleukin-6 (7.26 ±1.34) pg/ml ($p=0.01$) as compared to the control group, lead (0.006 ± 0.001) ×10-2ppm, cadmium (0.002 ±

0.001)×10-2ppm, glutathione peroxidase (2.78 ± 0.21) µmol/L, malondialdehyde (2.91 ± 0.25) µmol/L, C-reactive protein (2.14 ± 0.32) mg/L and interleukin-6 (3.91 ± 0.21) pg/ml. The haematological parameters revealed significant decrease in the mean values of packed cell volume (34.00 ± 0.51) % (p=0.03), haemoglobin (11. 00 ± 0.04) g/dl, (p=0.03) in experimental group one participants and packed cell volume (30.00 ± 0.42) % (p=0.01), haemoglobin (9.70 ± 0.03) g/dl, (p=0.01) in experimental group two participants as compared to the control group, packed cells volume (41.00±0.84)% and haemoglobin (13.20 ± 0.07)g/dl respectively. However, the total white blood cells count (12,000 ± 1.27) cmm, (p=0.04), erythrocytes sedimentation rate (5.00 ± 0.08) mm/Hour, (p=0.03) in experimental group one participants and white blood cells count (16, 000 ± 1.31) cmm (p=0.01), erythrocytes sedimentation rate (12.00 ± 0.12) mm/Hour (p=0.01) in experimental group two were significantly elevated compared to the control group, total white blood cells count (9,000 ± 1.24) cmm, erythrocytes sedimentation rate (2.00 ± 0.12) mm/Hour respectively.. In conclusion, panel beaters with 3-10years working experience are at risk of lead, cadmium, oxidative stress, inflammatory disorders, iron deficiency anaemia and infection. It is therefore recommended that panel beaters within this category should endeavor to go for regular health check-ups so as to quickly identify any biochemical and haematological abnomalities

Keywords: *Panel beaters, biochemical markers, haematological parameters, assessment, Yenagoa, Bayelsa State, Nigeria*

1. INTRODUCTION

Panel beaters or auto body mechanics are automobile technician subspecialties whose occupational practices include repair, cutting, soldering, welding and spray painting in a bid to restore damaged vehicles to their original condition, which thus expose them to lead and cadmium toxicity. These metals are known to be toxic and can accumulate in the body over time. Exposure to lead and cadmium has been linked to a number of health problems, including oxidative stress and inflammation (Omotosho *et al., 2*019). Panel beaters use different types of methods as well as tools in repairing and putting finishing touch to damaged vehicles, they operate in both the informal sector (operating along roadsides) and the formal organized sector. The informal sector is a private unincorporated enterprise operating along roadsides with no regular system of data availability. Organized panel beaters are those working in sectors with rules and requirements set by the government and the sector is governed by acts such as the Factories Act,2 labor laws, and Employee Compensation Act;3 they practice with safety precautions and have fixed working hours (D'souza *et al.,* 2013). The history of panel beating can be traced back to the early 20th century when vehicles manufacturers started producing cars using steel bodies with the first panel beaters being skilled craftsmen who indulged in the use of hand tools and techniques in the repair of vehicles that are damaged which evolved over time with the adventure of new technologies and materials

Toxicities manifest as over clinical symptoms primarily detected at high doses, thereby

underestimating the actual burden of lead toxicity (Ukaejiofo *et al.,* 2009).This occur in severe multi-systemic clinical forms: abdominal colic, joint and muscle pain, wrist and ankle drop, fine tremors, diminished visual intelligence and motor coordination, short term memory loss, irritability, encephalopathy, lethargy, delirium, convulsions, coma, fatigue, weakness, excessive tiredness, constipation, anorexia, persistent vomiting, impotence, infertility and reduced sex drive (Flora *et al.,* 2012).

This study holds significance for understanding the potential health risks faced by panel beaters as related to the status of some biochemical parameters like toxic heavy metals such as lead and cadmium, oxidative stress biomarkers such as glutathione peroxidase and malondialdehyde, inflammatory biomarkers such as C-reactive protein and interleukin-6 as well as the status of some haematological parameters such as packed cells volume, haemoglobin, total white blood cells count and erythrocytes sedimentation rate

Lead is a highly toxic metal, and it is among the metals that has severe damage effect on human health (Seema *et al.,* 2013). It is a majorly used chemical substance in variety of sectors and responsible for pollutions in both indoor and outdoor sources. It is specifically released by automobile engines that make use of gasoline containing lead tetraethyl (Mousavi *et al.,* 2013)

Cadmium is a naturally occurring heavy metal that is often exposed to in industrial settings, plant soils and via smoking. Taking into consideration its low permissible exposure level in human, over-exposure may occur even when trace amounts are present in humans, thus long term exposure to cadmium may cause significant toxicological issues (USGS, 2018).

Glutathione peroxidase is a member of the glutathione peroxidase enzyme family with the primary purpose of detoxifying peroxides in cells that may eventually decompose into extreme reactive radicals. This enzyme is of importance based on the protective coverage from free radical damage it gives to cells particularly lipd peroxidation. It catalysis the reduction of hydrogen peroxide to water and organic peroxides to a stable alcohol which in turn prevents the accumulation of hydrogen peroxide and other reactive oxygen species which can damage cellular structures and thus contribute to oxidative stress (Childs *et al.,* 2016).

Malondialdehye is a lipid peroxidation marker used to assess lipid peroxidation in elevated oxidation stress (Ayse *et al.,* 2009). It is formed during the breakdown of polyunsaturated fatty acids which could be formed during oxidative stress, it is a highly toxic and reactive compound. It is a biomarker that is commonly used for oxidative stress assessment. Oxidative stress occurs mainly when there is an imbalance between the production of reactive oxygen species and the ability of the body‘s anti-oxidant defense to neutralize them (Davey *et al.,* 2005)

C-reactive protein is a member of the pentraxin family of proteins that is up-regulated following infection and inflammation (Christopher *et al.,* 2016). Inflammation raises levels of C-reactive protein in blood plasma. When interleukin-6 and tumour necrosis factor stimulate the hepatocytes to produce this pentameric acute phase reactant, it becomes an inflammatory biomarker (Gilstrap and Wang, 2012). Because of its quick response and ease of testing, it is the ideal indicator of

inflammation (Chandrashekara, 2014). Whenever the body's inflammatory response is triggered by various stressors (including illness and trauma) such as C-reactive protein, the protein level rises dramatically making it an acute phase reactant (Dopika *et al.,* 2020)

Interleukin-6 is a protein that is very small, but relevant in cell signaling and plays a vital role in the immune system and inflammation. This protein is produced by variety of cells such as immune cells, endothelial cells and fibroblasts. It performs the following functions:

(i) Promotes inflammation via the stimulation and production of other pro-inflammatory cytokines
(ii) Helps in the regulation of immune response via the activation of immune cells such as T cells and platelets
(iii) It supports the production of blood cells, such as red blood cells, white blood cells and platelets
(iv) It helps by stimulating the production of acute phase proteins, which in turn helps in response to infection and inflammation (Pierrakos *et al.* 2020)

Packed cells volume otherwise known as haematocrit is the proportion of the volume of blood occupied by red blood cells, measurement of this haematological parameter is vital as it helps in the diagnosis and monitoring of various disorders that are related to blood (Adeyinka, 2019)

Haemoglobin is the protein component of red blood cells that is responsible for carrying oxygen from the lungs to the tissues in the body and in turn returns carbon dioxide from the tissues to the lungs. It contains four polypeptide chains referred to as globins as well as four haem groups with each of these heam group having an iron atom which binds to oxygen. The levels of haemoglobin are used in tracking chronic diseases progression, like cancer and kidney disease, its levels are also used in diagnosing anaemia as well as track its treatment (Saeed *et al.,* 2020)

Total white blood cells count, measures the total amount of white blood cells in the blood and is a vital part of the immune system which helps in fighting infections and diseases. An increase in the total white blood cells count may be indicative of the following:

(i) Infection which could be bacterial, viral or fungal
(ii) Inflammatory disorder such as rheumatoid arthritis, lupus or ashma
(iii) Certain type of cancer, such as leukaemia (Coresh *et al.,* 2019)

Erythrocytes sedimentation rate is the measurement of the rate at which red blood cells settle to the bottom of a test tube which contains blood sample. However, it is not specific for inflammation (Lee *et al.,* 2020)

This study which is considered extremely necessary as it will go a long way to further expose some health implications attached to this occupation as well as enlighten the public on these adverse health implications is aimed on assessment of some biochemical markers and haematological parameters among panel beaters in Yenagoa, Bayelsa State, Nigeria

2. MATERIALS AND METHODS

2.1 Experimental Scope

2.1.1 Study Area

The study was conducted in Yenagoa, a region located in of Bayelsa State. Yenagoa is geographically located within Latitude: 4° 55' 36.30" North and Longitude: 6° 16' 3.50" East. It has an area 1,698 km2 and a population of 352,285 at the 2006 census (Daupamo, 2018 and Egoro, *et al.,* 2024)

2.1.2 Ethical Approval

This research got the oral informed consent from all the participants and was carried out in compliance with the principle of Helsinki declaration of 1975 as revised in 2008 after obtaining approval from the College of Health Research and Ethics Committee (WMA, 2008)

2.1.3 Sample Size Calculation

The sample size was calculated utilising Taro Yamane's formula: $n = N / (1+N (e)^{2})$ where

n represents the sample size as described by Egoro *et al.*(2024)

N represents the total population,

e denotes the margin of error, set at 0.05

When N equals 32

$n = 70 (1+70 (0.05)^2)$

$n = 70 (1+70 (0.0025)$

$n = 70 (1+0.175)$

$n = 70 / 1.175$

$n = 60$

2.1.4 Sample Collection and Processing

Ten milliliter of blood was withdrawn via venipuncture technique from 90 apparently healthy individuals within the age range of 21-32 years, with 30 of them being panel beaters with less than 3 years working experience, another 30 being panel beaters with 3-10 years working experience, and the remaining 30 non panel beaters, thus served as control group. 5ml each of the blood was dispensed into lithium heparin anti-coagulated bottles and ethylene diaminetetraacetic acid anticoagulated bottles respectively The blood in the lithium heparin anti-coagulated bottles were spun at 2500 revolution/minute with the aid of a macro-centrifuge and the obtained plasma used for the measurement of the following biochemical markers: lead, cadmium, glutathione peroxidase,

malondialdehyde, C-reactive protein and interleukin-6 while the other blood sample in the ethylene diaminetetraacetic acid anticoagulated bottles were used for the measurement of the following haematological parameters: packed cells volume, haemoglobin, total white blood cells count and erythrocytes sedimentation rate

2.1.5 Study Population

The study population consisted of ninety apparently healthy participants, who were grouped as shown:

2.1.5.1 Control Group

This group consisted of thirty apparently healthy participants, aged between 21-32 years, who are not panel beaters.

2.1.5.2 Experimental Group One

This group consisted of thirty apparently healthy participants aged between 21 - 32 years, who are panel beaters for less than 3 years.

2.1.5.3 Experimental Group Two

This group consisted of thirty apparently healthy participants aged between 21 - 32 years, who are panel beaters for 3-10 years.

2.1.5.4 Inclusion Criteria

All the apparently healthy participants used for this study were not having any health issues.

2.1.5.5 Exclusion Criteria

Participants that are drugs, cigarette smoking and snuffing addicts as well those suffering from one illness or the other were excluded from this study.

2.2. Measurement of Biochemical Parameters

2.2.1 Measurement of plasma lead

This measurement was carried out in accordance with Solaar Thermo Elemental Atomic Absorption Spectrophotometry Model SE-71906 as described by Egoro *et al.* (2024).

2.2.2 Measurement of plasma cadmium

This measurement was carried out in accordance with Solaar Thermo Elemental Atomic Absorption Spectrophotometry Model SE-71906 as described by Egoro *et al.* (2024).

2.2.3. Measurement of Plasma Glutathione Peroxidase

The ultraviolet (U.V.) method described by Bio-diagnostic, 29 Tahreer Street, Dokki, Giza, Egypt as modified by Egoro *et al.* (2024) was adopted.

2.2.4. Measurement of Plasma Malondialdehyde (MDA)

The Thiobabituric acid method described by Bio-diagnostic, 29 Tahreer Street, Dokki, Giza, Egypt as modified by Egoro *et al.* (2024) was adopted.

2.2.5. Measurement of Plasma C - Reactive Protein Level

This was measured in accordance with the latex turbidimetry method as described by Emmanuel *et al.* (2020) using reagents manufactured by Spinreact Diagnostic manual, Spain.

2.2.6. Measurement of Plasma Interleukin-6 Level

This was measured in accordance with the ELISA method with catalogue number E-EL-HO. 102 and further modified by Egoro *et al.* (2023) was adopted

2.3. Laboratory Analysis of Haematological Parameters

2.3.1. Measurement of Packed Cell Volume

Microhaematocrit method as described by the International Council for Standardization in Haematology (ICSH) 1980 was used

2.3.2. Measurement of Haemoglobin Level

Haemoglobin cyanmethaemoglobin method as described by Van Kampen and Zijistra 1961 was adopted

2.3.3. Measurement of Total White Blood Cell Count

This measurement was carried out in accordance with the improved Neubauer chamber tube method as described in Textbook of Medical Laboratory Technology by Baker *et al.* (1998)

2.3.4. Measurement of Erythrocyte Sedimentation Rate

Westergren method as described by Westergren in 1921 was utilized

Statistical Analysis

The data from this research work were presented as mean and standard deviation, analysed using the SPSS version 23.0, while differences between the control and experimental groups were evaluated using the Student's t-test. A p-value of $p < 0.05$ was deemed statistically significant.

3. RESULTS

The measured biochemical parameters in the control group were compared to those in the experimental group one (< 3 years). The results are presented in Table 1.

Table 1: Mean ± SD values of measured biochemical parameters in control group as compared with that of experimental group one (< 3 years)

Parameters	Control group (n= 30)	Experimental group (n= 30)	p-value	Remark
Lead×10^{-2} (ppm)	0.006±0.001	0.011±0.001	0.92	NS
Cadmium×10^{-2} (ppm)	0.002±0.001	0.004±0.001	0.97	NS
GPx(µmol/L)	2.78±0.21	2.80±0.23	0.84	NS
MDA (µmol/L)	2.91±0.25	2.93±0.27	0.78	NS
CRP (mg/L)	2.14±0.32	3.28±0.45	0.04	S
IL-6	3.91±0.21	5.60±0.32	0.04	S

KEYS:

GPx = Glutathione peroxidase, MDA = Malondialdehyde, CRP = C-reactive protein, IL-6=Interleukin-6, S=Statistically significant, NS = Not statistically significant, n=Number of participants

The results indicated that the mean values of all the measured biochemical parameters were not significantly altered ($p>0.05$) as compared with the control group with the exception of C-reactive protein ($p=0.04$) and interleukin-6 ($p=0.04$) which were significantly elevated when compared with the control group

The measured biochemical parameters in the control group were compared to those in the experimental group two (3-10 years). The results are presented in Table 2.

Table 2: Mean ± SD values of measured biochemical parameters in control group as compared with that of experimental group two (3-10 years)

Parameters	Control group (n= 30)	Experimental group (n= 30)	p-value	Remark
Lead×10^{-2} (ppm)	0.006±0.001	0.016±0.003	0.02	S

Cadmium×10^{-2} (ppm)	0.002±0.001	0.007±0.002	0.03	S
GPx(µmol/L)	2.78±0.21	4.28±0.38	0.04	S
MDA (µmol/L)	2.91±0.25	3.98±0.32	0.03	S
CRP (mg/L)	2.14±0.32	6.28±1.78	0.01	S
IL-6	3.91±0.21	7.26±1.34	0.01	S

KEYS:

GPx = Glutathione peroxidase, MDA – Malondialdehyde, CRP = C-reactive protein, S = Statistically significant, n=Number of participants

The results indicated that the mean values of all the measured biochemical parameters were significantly elevated: lead (p=0.02), cadmium (p=0.03), glutathione peroxidase (p=0.04), malondialdehyde (p=0.03), C-reactive protein (p=0.01) and interleukin-6 (p=0.01) as compared with the control group.

The haematological parameters measured in the control group were analysed in relation to those in the experimental group one (less than 3 years). The findings are detailed in Table 3.

TABLE 3: Mean levels of the measured haematological parameters in the control group compared to those in the experimental group one participants.

Parameters	Control group (n=30)	Experimental group one (n=30)	p-value	Remarks
PCV (%)	41.00 ± 0.84	34.00 ±0.51	0.03	S
Hb (g/L)	13.20 ± 0.07	11.00±0.04	0.03	S
Total WBC (cmm)	9,000±1.24	12,000±1.27	0.04	S
ESR (mm/Hour)	2.00±0.21	5.00±0.08	0.03	S

KEYS:

PCV = Packed cells volume

Hb = Haemoglobin

Total WBC= Total white blood cells count

ESR= Erythrocytes sedimentation rate

n=Number of volunteers

S= Statistically significant

The information shown in this Table revealed that the mean values of all assessed haematological parameters in participants from experimental group one, with less than three years panel beating experience exhibited statistical significant decrease in the mean values of packed cells volume (p =0.03) and haemoglobin (p =0.03) in comparison to the control group, while the mean values of total white blood cells (p =0.04) and erythrocytes sedimentation rate (p = 0.03) were significantly elevated in relation to the control group.

The measured haematological parameters in the control group were compared to those in the experimental group two (3-10 years). The results are presented in Table 4

TABLE 4: Mean levels of the measured haematological parameters in the control group compared to those in the experimental group two participants.

Parameters	Control group (n=30)	Experimental group two (n=30)	p-value	Remarks
PCV (%)	41.00±0.84	30.00±0.42	0.01	S
Hb (g/L)	13.20 ± 0.07	9.70±0.03	0.01	S
Total WBC (cmm)	9,000±1.24	16,000±1.31	0.01	S
ESR (mm/Hour)	2.00±0.12	12.00±0.12	0.01	S

KEYS:

PCV = Packed cells volume

Hb = Haemoglobin

Total WBC= Total white blood cells count

ESR=Erythrocytes sedimentation rate

n=Number of volunteers

S= Statistically significant

The information shown in this Table revealed that the mean values of all assessed haematological parameters in participants from experimental group two, with 3-10 years working experience as panel beaters exhibited statistical significant decrease for packed cells volume ($p = 0.01$) and haemoglobin ($p = 0.01$) as compared to the control group while that of total white blood cells count ($p = 0.01$) and erythrocytes sedimentation rate ($p = 0.01$) revealed statistical significant elevations in relation to the control group.

4. DISCUSSION

This study examined the occupational effect of panel beating on the following biochemical parameters: lead, cadmium, glutathione peroxidase, malondialdehyde, C-reactive protein, interleukin-6 and haematological parameters such as packed cells volume, haemoglobin, total white blood cells count and erythrocytes sedimentation rate among panel beaters with less than 3 years working experience experimental group one and between 3-10 years working experience, experimental group two in mechanic village, Yenagoa, Bayelsa State, Nigeria

In this study lead and cadmium were measured in order to assess heavy metal toxicity in these categories of panel beaters.

The mean value of lead in experimental group one participants with less than 3 years working experience as panel beaters ($p=0.92$) as shown in Table 1,revealed no significant alteration when compared with the control group. This finding which is in agreement with the past work of Nwagbara *et al.* (2018) is suggestive that panel beaters with less than 3 years working experience are not prone to lead toxicity. However, as shown in Table 2, the mean value of lead in experimental group two participants ($p=0.02$) revealed significant elevation as compared to the control group. This finding which indicates that panel beaters with 3-10 years working experience are at the risk of lead toxicity is in agreement with the previous work of Ibeto *et al* (2020). This toxicity may be attributed to the chronic occupational exposure to lead generated from metals that are used during the course of work and its subsequent inhalation, thus leading to its accumulation in their system.

As shown in Table 1 (experimental group 1) participants, the mean value of cadmium ($p=0.97$) was not significantly altered as compared to that of the control group. This finding which is in non-alignment with the previous work of Nwagbara *et al.* (2018) is indicative that this group of panel

beaters are not prone cadmium toxicity. However, in Table 2 (experimental group 2) participants, the mean value of cadmium (p=0.03) revealed significant elevation when compared to the control group. This finding is in consistence with the earlier work of Ibeto *et al.* (2020). This is indicative that these panel beaters are at the risk of cadmium toxicity due to the chronic exposure to cadmium during the course of work

In this study glutathione peroxidase and malondialdehyde were measured in order to assess oxidative stress.

As revealed in Table 1 (experimental group 1) participants, the mean value of glutathione peroxidase was not altered significantly (p=0.84) as compared to that of the control group. This finding which indicates that panel beaters within this range of working experience are not prone to oxidative stress is in non-alignment with the earlier work of Adeyeye *et al.* (2019). As shown in Table 2, the mean values of glutathione peroxidase in experimental group 2 participants, indicated significant elevation of glutathione peroxidase (p=0.04). This finding which is in agreement with the past work of Adeyeye *et al.* (2019) may be linked to the first line defense action of this anti-oxidant in a bid to inhibit the overproduction of reactive oxygen species following the chronic exposure (3-10) years to toxic heavy metals and other harmful compounds during the course of work

The mean value of malondialdehyde (p=0.78) as shown in experimental group one participants (Table 1) revealed no significant alteration when compared to that of the control group. This finding which indicates no oxidative stress among these participants is in disagreement with the past work of Olaniyi *et al.* (2017). However, in experimental group two participants as shown in Table 2, the mean value of malondialdehyde (p=0.03) was significantly elevated compared to the control group. This finding which is presumed to be associated with oxidative stress in these participants is in alignment with the earlier work of Olaniyi *et al.* (2017). This may be attributed to an increased production of free radicals as a result of the chronic exposure and subsequent inhalation of toxic heavy metals such as lead and cadmium by these participants during the course of work.

In this study C-reactive protein and interleukin-6 were specifically measured so as to assess inflammatory disorder among these categories of panel beaters

As shown in Table 1, the mean values of C-reactive protein (p=0.04) and interleukin-6 (p=0.04) in the experimental group one participants revealed significant elevations as compared to that of the control group. This finding which depicts that panel beaters with working experience of less than 3 years are at the risk of inflammatory disorder is in agreement with the earlier work of Ezeh *et al.* (2019)

In Table 2, the mean values of C-reactive protein (p=0.01) and interleukin-6 (p=0.01) as shown in the experimental group two participants, revealed significant elevation when compared with the control group. This finding is in agreement with the past work of Ezeh *et al.* (2019). The findings in both Tables 1 and 2 are indicative that panel beaters within < 3 years and between 3-10 years

working experiences are prone to inflammatory disorder which may be attributed to an inflammatory response of the lungs following chronic inhalation of toxic heavy metals such as lead, cadmium and other harmful chemical substances such as particulate matter during the course of repairing damaged vehicles, thus influencing the release of interleukin 6 as well as inflammatory cytokines that are capable of triggering the increase synthesis of C-reactive protein which serves as a pointer to inflammatory disorder

Packed cells volume was assessed in this study in a bid to find out the adverse effect of panel beating as an occupation on this haematological parameter

The mean values of packed cells volume in experimental group one participants (p=0.03) as shown in Table 3 and that of experimental group two participants (p=0.01) as shown in Table 4 revealed significant decrease. This finding agrees with the past work of Ogundipe *et al.* (2018)

The mean values of haemoglobin in experimental group one participants (p=0.03) as shown in Table 3 and that of experimental group 2 (p=0.01) as shown in Table 4 revealed significant decrease. This finding which agrees with the previous work of Adeyeye *et al.* (2020) may be due to the chronic exposure and inhalation of lead during the course of work by these panel beaters which is suggestive to inhibit porphobilinogen synthase and ferrochelatase, thus preventing the formation of both porphobilinogen and the incorporation of iron into protoporphyrin IX which prevents haem synthesis

As shown in Tables 3 (experimental group one) and Table 4 (experimental group two) participants, the mean values of total white blood cells count (p=0.04) in experimental group one and (p=0.01) in experimental group two, revealed significant elevations as compared to the control group. This finding which is indicative of infection in these categories of panel beaters is in agreement with the past works of Nwagbara *et al.* (2015) and Ezeh *et al.* (2019)

The mean values of erythrocytes sedimentation rate in experimental group one participants (p=0.03) and experimental group two participants (p=0.01) as shown in Tables 3 and 4 respectively, revealed significant elevations in comparison with the control group. This finding which is as a result of chronic exposure to toxic heavy metals such as lead and cadmium supports the previous work of Nduka *et al.* (2019) and is indicative of inflammatory disorder in this category of panel beaters

CONCLUSION

This study revealed significant elevations in the mean values of lead, cadmium, glutathione peroxidase, malondialdehyde, C-reactive protein, interleukin-6, total white blood cells count and erythrocytes sedimentation rate in panel beaters with 3-10 years working experience while a significant decrease of mean values were revealed in packed cells volume and haemoglobin

From these findings, it is concluded that panel beaters with 3-10 years working experience are at the risk of lead and cadmium toxicity, oxidative stress disorder, inflammatory disorder, infection and iron deficiency anaemia

Based on these findings, it is recommended that

i) Panel beaters should endeavor to wear protective clothing like overalls, safety shoes, gloves and eye glass in the course of repairing damaged vehicles
ii) Panel beaters should be acquainted with the use of respiratory protectors such as mask or respirators when working with chemicals or dust
iii) Panel beaters should ensure good ventilation in the workshop so as to prevent inhalation of fumes and dust
iv) Panel beaters should always handle chemicals with care as well as adhere strictly to manufacturers' instructions when working
v) Panel beaters should ensure regular health check- ups so as to identify health problems earlier
vi) Panel beaters should ensure regular blood tests such as lead, cadmium, glutathione peroxidase, malondialdehyde, C-reactive protein, interleukin-6, packed cells volume, haemoglobin, total white blood cells count, erythrocytes sedimentation rate etc to monitor their health system

Conflict of Interest: None

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Contribution to Knowledge

This study has given an insight on some adverse health implications associated with panel beating, thus would be highly beneficial to panel beaters as well as the public at large.

Recommendation for Future Study

It is recommended that microbiological investigations such as urine microscopy, culture and sensitivity as well as blood culture tests be carried out in panel beaters within this category so as to further confirm infection

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