Effect of Chronic Exposure to Petroleum Products on some Hepato-Renal, Toxico-Inflammatory and Cardiac Biomarkers among Auto Mechanics in Mechanic Village Yenagoa, Bayelsa State, Nigeria

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Abstract

Auto-mechanics are skilled professionals that are specialists in auto mechanics, spray painting, panel beating, welding, battery recycling, brazing and repairing radiators and air conditioners. This study was aimed on the effect of chronic exposure to petroleum products on some hepato-renal, toxico-inflammatory and cardiac biomarkers among auto- mechanics in mechanic village Yenagoa Bayelsa State Nigeria. Five milliliters of blood specimen was withdrawn from ninety apparently healthy individuals between 28 and 49 years of age, who were subsequently categorized into experimental group one which consisted of 30 auto-mechanics with less than 10 years working experience, experimental group two which consisted of 30 auto-mechanics with 10-15 years working experience and control group which consisted of 30 non- auto-mechanics. The blood specimens were dispensed into lithium heparin anti-coagulated bottles respectively, spun at 1,500 revolution/minute and plasma obtained used for the quantitative measurement of aspartate aminotransferase (colorimetric), alanine aminotransferase (colorimetric), urea (urease berthelot), creatinine (Jaffe reaction), lead (atomic absorption spectrophotometry), cadmium (atomic absorption spectrophotometry), C-reactive protein (latex turbidimetry), interleukin-6 (elascience), troponin-1 (dual vial liquid immune turbidimetry) and creatinineKinase (immune-inhibition). The data obtained were analyzed using SPSS 23.0 statistical package with the results expressed as mean ± SD via the use of student "t" test which was considered significant at $p < 0.05$. No statistically significant differences were shown in the mean values of aspartate aminotransferase (7.16 ± 0.45) U/L, (p = 0.81), alanine aminotransferase (8.27 ± 0.51) U/L, (p = 0.78), urea (4.73 ± 2.22) mmol/L, (p = 0.91), creatinine (77.86 ± 4.13) µmol/L, (p = 0.89), lead (0.13 ± 0.04) $x10^{-2}$ ppm, (p = 0.81), cadmium (0.10 ± 0.03) $x10^{-2}$ ppm, (p = 0.97), C-reactive protein (2.80 ± 0.27) mg/L, (p = 0.78), interleukin-6 (9.79 ± 1.04) pg/ml, (p = 0.84), troponin-1 (1.31 ± 0.36) $\times 10^{-2}$ IU/L, (p = 0.98) and creatinineKinase-MB (4.29 ± 0.19) IU/L,(p = 0.91) in experimental group one participants as compared to that of the control group respectively while in the experimental group two participants the mean levels of plasma aspartate aminotransferase (18.12±1.20) U/L, (p=0.03) alanine aminotransferase (19.20±1.35) U/L, (p=0.03), urea

*(8.76±2.23) mmol/L, (p=0.05), creatinine (107.93±4.13) µmol/L, (p=0.04), lead (0.21 ± 0.07) x10^{-2} ppm, (p = 0.03), cadmium (0.16 ± 0.05) x10^{-2} ppm, (p = 0.04), C-reactive protein (*10.53 ± 1.43*) mg/L, (p= 0.02) and interleukin-6 (18.67*± 1.87*) pg/ng,(p=0.02) were significantly elevated compared to that of the control group: However, troponin-1 (*1.33 ± 0.39*) x10^{-2} IU/L,(p=0.93) and, creatinineKinase-MB (*4.29 ± 0.20*) IU/L, (p=0.82) were not significantly altered. In conclusion auto-mechanics with 10-15 years working experience are susceptible to the development of hepato-renal and toxico- inflammatory disorders, thus should occasionally go for the measurement of these biomarkers in a registered medical laboratory facility.*

Keywords: *Petroleum products, Biochemical markers, Auto-mechanics, Yenagoa, Bayelsa State, Nigeria*

1. INTRODUCTION

Auto-mechanics are skilled professionals who specialize in a range of auto-related tasks, including auto mechanics, spray painting, panel beating, welding, battery recycling, brazing, and repairing radiators and air conditioners. These specialists are commonly known as automotive technicians in North America, light vehicle technicians in Britain, and motor mechanics in Australia (Boritz *et al.*, 2008). Their primary responsibility in the field of automotive repair is to swiftly and precisely diagnose the issue. Their duty may involve either replacing one or more assembled components or repairing a single component. Vehicle mechanics frequently encounter a range of pollutants including dust, aged vehicle lubricants, petroleum products (such as petrol, diesel, grease and lubricating oil), and exhaust fumes. In addition, they face the potential danger of long-term lead toxicity, which is linked to toxic effects on different body systems such as respiratory system, cardiovascular system, urinary system, immune system, renal system, neurological system as well as skin disorders (Ndubuisi, 2016; Al-jadaan and Jabbara, 2017).

Recycled engine oil contains a substantial quantity of toxic heavy metals that are produced as a result of the degradation of the vehicle's mobile parts. Furthermore, it includes benzene, a compound that is metabolized in the liver to phenol which in turn is exposed to hydroxylation to form hydroquinone and 1,4-benzenetriol by peroxidase of the bone marrow or by autoxidation (Ekpenyong and Asuquo, 2017). This benzene has been linked to heart attacks, cardiac irregularities, and other illnesses. According to Wesley *et al.* (2017), humans are at high risks of benzene poisoning as a result of frequent exposure to combustion of organic materials, cigarette smoke, pipe tobacco etc.

The liver plays a distinct role in the circulatory system, carrying out several vital functions including storing and metabolizing carbohydrates, metabolizing hormones, producing urea, synthesizing blood proteins, processing waste substances from both internal and external sources, metabolizing lipids, and producing bile (Eaten and Klaassen, 2001). The aminotransferases, namely alanine aminotransferase and aspartate aminotransferase, along with the phosphates, alkaline phosphatase and 5-neucleotidase, glutamyltransferase and lactate dehydrogenase, are the enzymes that hold the highest clinical utility in evaluating liver function (Janella and Xin, 2010).

There is a scarcity of studies regarding the impact of occupational exposure to pollutants associated with auto activities on liver biomarkers in auto workers. Regrettably, the population deemed "at risk" lack awareness on the health hazards associated with exposure to automotive emissions. The lack of workplace laws regarding exposure to environmental toxins, combined with the auto employees' disdain for workplace ethics and environmental protection legislation, is genuinely regrettable. Similarly, crucial safety precautions such as maintaining personal cleanliness, wearing face masks to reduce the inhalation of dust particles, wearing suitable workshop attire, and using barrier lotions to prevent skin irritation are completely disregarded.

According to toxicological research, the compounds that present the highest danger to humans are those with a light-chain structure, including benzene, toluene, ethyl-benzene, and xylene (together known as BTEX) (Mansour *et al.*, 2012). Due to their high vapour pressure and water solubility, they make up the volatile constituents of petrol that are slowly emitted into the atmosphere and can be found in both the gaseous phase and the water-soluble fraction. Benzene is the most prominent and harmful compound among the BTEX substances (Mansour *et al.*, 2012). Workers may be deliberately or inadvertently exposed to it by ingesting, inhalation, or skin contact. These hydrocarbons are rapidly taken in and might cause various negative impacts on one's health. The effects can vary based on several factors, including individual variations in the way the body processes and responds to the different components of petrol, the chemical and molecular properties of the petrol, and differences in the level and duration of exposure (Christopher *et al.*, 2013; Ajugwo *et al.*, 2014).

The population most susceptible to simultaneous exposure to the harmful effects of the components found in petrol are individuals employed at petrol stations and mechanic shops. This is due to the fact that each BTEX compound has an inherent capacity for causing harm (George and Adegoke, 2011). While some petroleum compounds can have negative effects, they are mainly used for therapeutic purposes, especially in rural areas, to meet medical needs. Therefore, it is crucial to carry out this study in order to ascertain the potential effects of exposure to these substances on some hepato-renal, cardio-inflammatory and toxico-oxidative stress biochemical markers among auto mechanics in mechanic village, Yenagoa, Bayelsa State, Nigeria.

2.0. MATERIALS AND METHODS

2.1. Study Area

The research was carried out in the Department of Medical Laboratory Science, which is a division of the Faculty of Basic Medical Sciences in the College of Health Sciences, Niger Delta University. The institution is situated on Wilberforce Island Amassoma which is stationed at latitude 5.20N and longitude 6.05E (Daupamowei, 2018).

2.2. Calculation of Sample Size

The sample size for this research was calculated using Taro Yamane's method with the formula $n=N / (1+N e^2)$ as earlier described by Azza and Eman, 2020

N=sample size

N=population of study

E=margin error

N = 75

e = 0.05

$n = 75 / 1 + 75 (0.05)^2$

n = 75 / 1 + 75 (0.0025)

n = 75 / 1 + 0.25

n = 60

2.3. Volunteers

Ninety (90) seemingly healthy male within the age of 28 to 49 years were selected at random and placed into three (3) groups for this research study.

2.4. Control Group

The control group consisted of thirty (30) apparently healthy male volunteers aged between 28 and 49 years who are not automobile mechanics.

2.5. Experimental Group One

This group comprised thirty (30) male automobile mechanics aged between 28 and 49 years with less than ten years of experience, who appeared to be in good health.

2.6. Experimental Group Two

This consisted of thirty (30) male volunteers aged between 28 and 49 years who are automobile mechanics with extensive professional expertise of 10-15 years.

Before and during this research study, all the chosen control and experimental subjects refrained from smoking cigarettes, using snuff, consuming drugs, consuming of excessive amount of alcohol and coffee. This was done to mitigate any potential confounding effects of these lifestyle factors on the obtained results.

2.7. Ethical Approval

The research approach closely followed the principles specified in the World Medical Association of Helsinki Declaration of 1975, as revised in 2008 after obtaining an ethical approval from the College of Health Research and Ethical Committee. Besides, the consents of the leaders of the Association of Automobile Mechanics in the Bayelsa State branch as well as that of all the recruited volunteers were obtained. The recruited volunteers were specifically informed and made aware of the purpose for which their blood samples were being collected.

2.8 Collection of Blood Specimens

The blood specimens obtained from volunteers were analyzed at the Department of Medical Laboratory Science, Niger Delta University, Amassoma. Each participant, including both the control and experimental groups, had 5 ml (five) milliliters of blood obtained using a standard venipuncture technique. The blood specimens were subsequently transferred into individual containers with lithium heparin, which acts as an anticoagulant. The contents of each bottle were well mixed to maintain homogeneity and prevent blood clotting. Subsequently, they were centrifuged at a speed of 1,500 revolutions per minute for a duration of 10 minutes using the Gulfex Medical and Scientific Macro Centrifuge Model 800D from England. The collected plasma was subsequently used to quantitatively measure the following biochemical parameters: aspartate aminotransferase, alanine aminotransferase, urea, creatinine, lead, cadmium, C-reactive protein, interleukin-6, troponin-1 and creatinineKinase-MB,

2.9. Criteria for Inclusion and Exclusion

After obtaining their consent, only auto-mechanics who appeared to be in good health and had relevant work experience were included in this study. Auto-mechanics who had any form of illness during the oral interview were not included in the study.

2.10. Statistical Analysis

The study's results were reported in terms of mean and standard deviation. The differences between the control and experimental groups of volunteers were assessed via the student 't' test. The results were considered statistically significant, as indicated by a p-value of less than 0.05.

2.11. Laboratory Analysis

2.12. Quantification of Aspartate Aminotransferase

This was performed using a colorimetric technique as earlier described by Randox Laboratories Limited and subsequently modified by Egoro *et al.,* 2021.

2.13. Quantification of Alanine Aminotransferase

This was performed using a colorimetric technique as earlier described by Randox Laboratories Limited and subsequently modified by Emmanuel, 2020.

2.14. Quantification of Urea

This was performed using a Urease-Berthelot technique as earlier described by Randox Laboratories Limited and subsequently modified by Emmanuel *et al.*, 2021.

2.15. Quantification of Creatinine

This was estimated using the Jaffe reaction method as earlier described by Randox Laboratories Limited and subsequently modified by Emmanuel *et al.*, 2021.

2.16. Quantification of Lead

The earlier described method of solar thermo-elemental atomic absorption spectrophotometry model with model SE-71906 as modified by Egoro *et al.*, 2023 was adopted.

2.17. Quantification of Cadmium

The earlier described method of solar thermo-elemental atomic absorption spectrophotometry method with model SE-71906 as modified by Emmanuel *et al.*, 2023 was used.

2.18. Quantification of C-reactive protein (CRP)

This was estimated using the latex turbidimetry method as earlier described by Randox Laboratories Limited and subsequently modified by Emmanuel *et al.*, 2020.

2.19. Quantification of Interleukin-6

This was estimated using the earlier described elascience method with catalog number E-EL-HO.102 which was subsequently modified by Egoro *et al.*, 2023

2.20. Quantification of Troponin-1

This was quantified using the dual vial liquid immune turbidimatric method as described by Diazyme with catalog number DZ145A United States of America and subsequently modified by Emmanuel *et al.*, 2020.

2.21. Quantification of CreatinineKinase-B (CKMB)

This was estimated using the immune- inhibition method as described by Atlas Medical unit 4, William James House, Cowley Road, Cambridge, CB40WX and subsequently modified by Emmanuel *et al.*, 2020.

3. RESULTS

The outcome of the hepato-renal, toxico-inflammatory and cardiac biomarkers measured in the control and experimental group one with less than 10 years working experience are presented in Tables 1, 2 and 3 respectively.

Table 1 Hepato-renal biomarkers among auto mechanics with < 10 years working experience (experimental group one) compared with control group.

Parameters Measured	Control Group (n=30)	Experimental Group 1 (n=30)	p-value	Remarks
AST (U/L)	7.10 ± 0.42	7.16 ± 0.45	p = 0.81	NS
ALT (U/L)	8.25 ± 0.50	8.27 ± 0.51	p = 0.78	NS
Urea (mmol/L)	4.71 ± 2.20	4.73 ± 2.22	p = 0.91	NS
Creatinine (µmol/L)	77.82 ± 4.11	77.86 ± 4.13	p = 0.89	NS

Values are in mean ± standard deviation

Keys: AST = Aspartate aminotransferase, ALT = Alanine aminotransferase, NS = Not statistically significant, n = Number of volunteers

The findings indicated that the average levels of aspartate aminotransferase (7.16 ± 0.45) U/L, (p= 0.81), alanine aminotransferase (8.27 ± 0.51) U/L, (p= 0.78), urea (4.73 ± 2.22) mmol/L, (p= 0.91) and creatinine (77.86 ± 4.13) µmol/L, (p= 0.89) in experimental group one were not significantly altered compared to the average level in the control group: aspartate aminotransferase (7.10 ± 0.42) U/L, alanine aminotransferase (8.25 ± 0.50) U/L, urea (4.71 ± 2.20) mmol/L and creatinine (77.82 ± 4.11) µmol/L

Table 2 Toxico-Inflammatory biomarkers among auto mechanics with < 10 years working experience (experimental group one) compared with control group.

Parameters Measured	Control Group (n=30)	Experimental Group 1 (n=30)	p-value	Remarks
Lead ($x10^{-2}$) ppm	0.12 ± 0.03	0.13 ± 0.04	p = 0.81	NS
Cadmium ($x10^{-2}$) ppm	0.07 ± 0.01	0.10 ± 0.03	p = 0.97	NS
CRP (mg/L)	2.76 ± 0.23	2.80 ± 0.27	p = 0.78	NS
IL-6 (pg/ng)	9.71 ± 1.02	9.79 ± 1.04	p = 0.84	NS

Values are in mean ± standard deviation

KEYS: CRP = C-reactive protein, IL-6 = Interleukin-6, NS = Not statistically significant, n = Number of volunteers

The findings indicated that the average levels of lead (0.13± 0.04) $x10^{-2}$ ppm, (p=0.81), cadmium (0.10 ± 0.03) $x10^{-2}$ ppm,, (p=0.97), C-reactive protein (2.80 ± 0.27)mg/L, (p= 0.78) and interleukin-6 (9.79 ± 1.04) pg/ng,,(p=0.84) in experimental group one were not significantly altered compared to the average level in the control group lead (0.12 ± 0.03) $x10^{-2}$ ppm,, cadmium (0.07 ± 0.01) $x10^{-2}$ ppm, C-reactive protein (2.76 ± 0.23) mg/L and interleukin-6 (9.71±1.02) pg/ng

Table 3 Cardiac biomarkers among auto mechanics with < 10 years working experience (experimental group one) compared with control group.

Parameters Measured	Control Group (n=30)	Experimental Group 1 (n=30)	p-value	Remarks
Troponin-1 ($x10^{-2}$) IU/L	1.29 ± 0.35	1.31 ± 0.36	p = 0.98	NS
CKMB (IU/L)	4.26 ± 0.17	4.29 ± 0.19	p= 0.91	NS

Values are in mean ± standard deviation

KEYS: CKMB = CreatinineKinase, NS = Not statistically significant, n = Number of volunteers

The findings indicated that the average levels of troponin (1.31 ± 0.36) $x10 - 2$ IU/L , p = 0.98 and creatinineKinase-MB (4.29 ± 0.19) IU/L, p= 0.91 in experimental group one were not significantly altered compared to the average level in the control group: troponin (1.29 ± 0.35) $x10^{-2}$ IU/L and CKMB (4.26± 0.17) IU/L

The outcome of the hepato-renal, toxico-inflammatory and cardiac biomarkers measured in the control and experimental group two with 10 - 15 years working experience are presented in Tables 4, 5 and 6 respectively.

Table 4 Hepato-renal biomarkers among auto mechanics with 10-15 years working experience (Experimental group two) compared with control group

Parameters Measured	Control group (n=30)	experimental group 2 (n=30)	p-value	Remarks
AST (U/L)	7.10±0.42	18.12±1.20	p = 0.03	S
ALT (U/L)	8.25±0.50	19.20±1.35	p = 0.03	S

Urea (mmol/L)	4.71±2.20	8.76±2.23	p = 0.05	S
Creatinine (µmol/L)	77.82±4.11	107.93±4.13	p = 0.04	S

Values are in mean ± standard deviation

KEYS: AST = Aspartate aminotransferase, ALT = Alanine aminotransferase, S = Statistically significant, n = Number of volunteers

The findings indicated that the average levels of aspartate aminotransferase (18.12±1.20) U/L, (p=0.03) alanine aminotransferase (19.20±1.35) U/L, (p=0.03), urea (8.76±2.23) mmol/L, (p=0.05) and creatinine (107.93±4.13) µmol/L, (p=0.04) in experimental group two were significantly elevated compared to the average level in the control group: aspartate aminotransferase (7.10±0.42), U/L alanine aminotransferase (8.25±0.50) U/L, urea (4.71±2.20) mmol/L and creatinine (77.82±4.11) µmol/L.

Table 5 Toxico-inflammatory biomarkers among auto mechanics with 10-15 years working experience (Experimental group two) compared with control group

Parameters Measured	Control Group (n=30)	Experimental Group 2 (n=30)	p-value	Remarks
Lead ($x10^{-2}$) ppm	0.12 ± 0.03	0.21 ± 0.07	p = 0.03	S
Cadmium ($x10^{-2}$) ppm	0.07 ± 0.01	0.16 ± 0.05	p = 0.04	S
CRP (mg/L)	2.76 ± 0.23	10.53 ± 1.43	p= 0.02	S
IL-6 (pg/ng)	9.70 ± 1.02	18.67 ± 1.87	p= 0.02	S

Values are in mean ± standard deviation

KEYS: CKMB = CreatinineKinase-MB, CRP = C-reactive protein, IL-6 = Interleukin-6, S = Statistically significant, n = Number of volunteers.

The findings indicated that the average levels of lead (0.21 ± 0.07) $x10^{-2}$ ppm, (p=0.03), cadmium (0.16 ± 0.05) $x10^{-2}$ ppm,, (p=0.04), C-reactive protein (10.53 ± 1.43) mg/L, (p= 0.02) and interleukin-6 (18.67± 1.87) pg/ng, (p=0.02) in experimental group two were significantly elevated compared to the respective average level in the control group: plasma lead (0.12 ± 0.03) $x10^{-2}$ ppm,, cadmium (0.07 ± 0.01) $x10^{-2}$ ppm,,, C-reactive protein (2.76 ± 0.23) mg/L and interleukin-6 (9.70 ± 1.02) pg/ng

Table 6 Cardiac biomarkers among auto mechanics with 10-15 years working experience (experimental group two) compared with control group.

Parameters Measured	Control Group (n=30)	Experimental Group 2 (n=30)	p-value	Remarks
Troponin-1 ($x10^{-2}$) IU/L	1.31 ± 0.36	1.33 ± 0.39	p = 0.93	NS
CKMB (IU/L)	4.29 ± 0.19	4.29 ± 0.20	p= 0.82	NS

Values are in mean ± standard deviation

KEYS: CKMB = CreatinineKinase-MB, NS = Not statistically significant, n = Number of volunteers.

The findings indicated that the average levels of troponin-1(1.33± 0.39) $x10^{-2}$ IU/L, (p=0.93) and creatinineKinase (4.29±0.20) IU/L, (p=0.82) in experimental group two were not significantly altered compared to the average level in the control group: troponin-1 (1.31± 0.36) $x10^{-2}$ IU/L and, creatinineKinase (4.29± 0.19) IU/L

4. DISCUSSION

Petroleum products, such as petrol, diesel, grease, lubricating oil, and others, are complex blends of various hydrocarbons and related chemicals, some of which have substantial risks and carcinogenic qualities. This study conducted a comparison of the mean levels of hepato-renal (such as aspartate aminotransferase, alanine aminotransferase, urea and creatinine) toxico-inflammatory (such as lead, cadmium, C-reactive protein and interleukin-6) and cardiac (such as troponin-1 and creatinineKinase) biomarkers between two distinct groups of auto mechanics with less than 10 years of work experience (Tables 1-3) and another with 10-15 years of work experience (Tables 4-6) respectively with that of the control group which comprised of non-auto mechanics.

The results, as shown in Table 1 demonstrated that the mean values of the measured hepato-renal biomarkers aspartate aminotransferase (p=0.81), alanine aminotransferase (p=0.78), urea (p=0.91) and creatinine (p=0.89) revealed no significant differences between the experimental group, which consisted of auto mechanics with less than ten years of experience, and the control group. This finding which is suggestive that this category of auto-mechanics are not prone to hepato-renal disorder is in agreement with the past work of Mohammed and Samar, 2021 who reported a no significant mean value of (19.40 ± 0.99) U/L and (27.93 ± 1.53) U/L for aspartate aminotransferase and alanine aminotransferase respectively (hepatic biomarkers), but contrary to the findings of Akram *et al.*, 2017 and Ola-el-Kheir, 2016 who reported elevated mean values of

(25.50 ± 7.00) mg/dl and (19.58 ± 3.90) mg/g for urea and creatinine respectively (renal biomarkers).

As shown in Table 2, the mean values of the toxico-inflammatory biomarkers among auto-mechanics with less than 10 years working experience revealed no significant differences lead (p= 0.81), cadmium (p=0.97), C-reactive protein (p=0.78) and interleukin-6 (p=0.84) between the experimental group, which consisted of auto mechanics with less than ten years of experience, and the control group. This finding which is indicative that these auto-mechanics are not prone to lead and cadmium poisoning as well as not at the risk of inflammatory disorder as a result of this period of exposure and subsequent inhalation of these toxic substances in the petroleum products is in conformity with the previous work of Serekara *et al.*, 2016 who in their research reported insignificant difference in the mean value of lead (p=0.24), but contrary to the previous works of Ben-Chioma and Nwachukwu, 2018 who reported a significant elevated mean value of cadmium (p=0.03) and that of Abdrabouh *et al.*, 2017 who reported an elevated significant mean values of (5.87 ± 1.51) mg/L and (12.21 ± 2.80) pg/ng for C-reactive protein and interleukin 6 respectively

Table 3 revealed that the mean values of the measured cardiac biomarkers such as troponin-1 (p = 0.98) and creatinineKinase-MB (p=0.91) in the auto-mechanics with less than 10 years working experience manifested no significant differences when compared to the non-auto-mechanics which served as control group. This study's findings suggest that auto mechanics in the study area are not prone to cardiac disorder due to exposure to petroleum components below 10 years.

The results from the second experimental group, which consisted of auto mechanics who had 10-15 years of experience, are shown in Tables 4-6 respectively.

These results as seeing in Table 4 revealed significantly elevated mean levels of the hepatic biomarkers: aspartate aminotransferase (p=0.03) and alanine aminotransferase (p=0.03) as compared to that of the control group. This finding which is contrary to that of Mohammed and Samar, 2021 who in their previous research reported insignificant mean value of (19.40 ± 0.99) U/I for aspartate aminotransferase compared to the control group (18.17 ± 0.83) U/I and (27.93 ± 1.53) U/I for alanine aminotransferase compared to the control group (28.27 ± 1.68) U/I may be due to the long term exposure and subsequent inhalation of some toxic substances in the petroleum product which would have caused damage to the liver, thus leading to the leakage of these enzymes from this organ to the plasma. In furtherance to this finding, it is suggestive that auto-mechanics in this category may be at the risk of hepatic disorder. Besides, it was revealed that there were significant elevations in the mean values of urea: (p= 0.05) and creatinine (p=0.04) compared to that of the control group as seeing in Table 4. These finding which are in agreement with the respective past works of Akram *et al.*, 2017 and Ola-El-Kheir, 2016 who reported an elevated mean value of p=0.07 for urea and p=0.01 for creatinine are indicative that auto-mechanics within this category are prone to renal dysfunction. The elevated mean values of urea and creatinine levels may be associated with the exposure to and subsequent inhalation of petroleum products which may have compromised and damaged the nephrons structural integrity

Table 5 revealed significant elevations of the mean values of the measured toxico – inflammatory biomarkers such as lead (p= 0.03), cadmium (p=0.03), C-reactive protein (p= 0.02) and interleukin-6 (p=0.02) in this category of auto mechanics as compared to the control group. This finding which has thrown more light that this category of auto mechanics are at the risk of heavy metals such as lead and cadmium poisoning as well as inflammatory disorder is in agreement with the past works of Ben-Chioma and Nwachukwu, 2018 who reported a mean value of p=0.0001 and p=0.03 for lead and cadmium respectively and Abdrabouh *et al.*, 2017 who reported mean values of (5.87 ± 1.51) mg/L and (12.21 ± 2.80) for C-reactive protein and interleukin-6 respectively. The inflammatory disorder would have been triggered by a cascade of reactions, thus leading to systemic inflammation with the resultant elevations of the C-reactive protein and interleukin-6 biomarkers.

As revealed in Table 6, the mean values of the measured cardiac biomarkers such as troponin-1 (p=0.93) and creatinineKinase (p=0.82) were not significantly altered in this category of auto-mechanics as compared with the control group. This finding is suggestive that exposure and inhalation of petroleum products for as long as 10-15 years have no adverse effect on the structural integrity of the heart.

CONCLUSION

The results of this study suggest that auto mechanics who have been exposed to petroleum products for less than 10 years have a low probability of developing hepato-renal, toxico-inflammatory and cardiac problems. Nevertheless, those who have been exposed to petroleum products for a duration of 10-15 years are susceptible to the development of hepato-renal and toxico - inflammatory disorders.

Competing Interest

None

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Recommendations

In order to minimize the inhalation effect of petroleum products on auto mechanics, it is recommended that:

(i) Auto mechanics adhere to safety standards, including the use of nose and mouth masks

(ii) This group of professional should also imbibe the culture of regular washing of their hands during and after the day's work

(iii) Auto mechanics, who heavily rely on petroleum products, should regularly undergo biochemical tests for aspartate aminotransferase, alanine aminotransferase, urea, creatinine, lead,

cadmium, C-reactive protein, interleukin-6, troponin-1 and creatinineKinase in a certified medical laboratory. The purpose of these tests is to identify and address any abnormal levels of these biomarkers, with the goal of restoring them to normal.

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