

Blood Lead Level and Renal Function in Roadside Traders at Major Junctions Along Akure-Owo Road, Ondo State, Nigeria.ODEYINKA OLUFUNSHO ODEWUSI¹, BODE MUDA OKUNADE², ALABI GBOLAHAN OLAJIDE³

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ABSTRACT

This study looked at the impact of car exhaust pollution on people working in an area with high vehicular activities. Blood lead level one of the constituents of exhaust fume was evaluated. Similarly, renal effect of the toxic gas fumes was assessed by the determination of plasma creatinine. A total of one hundred and twenty samples were collected. Ninety (90) samples were collected from roadside dwellers at major junctions on the highway between Owo and Akure, southwestern Nigeria. The remaining thirty were collected from subjects who had no business dwelling at a roadside as a daily routine, these served as control. Estimations of blood lead content and plasma creatinine levels were carried out on each of these samples, using atomic absorption spectrophotometry and the modified jaffe reaction methods respectively. The plasma levels of lead and creatinine were significantly higher among the car exhaust fume exposed groups than less exposed control groups by the virtue of the location of the business areas. $P < 0.05$. It appears that dwelling at the roadside as a routine exposes these subjects under examination to lead contamination, and that the inhaling of vehicle exhaust fumes was the most probable cause. The study suggests that prolonged exposure to exhaust may have potential toxic effect on renal function.

Keywords: Lead; Creatinine; Renal function; exhaust fumes**INTRODUCTION**

Lead is a highly poisonous metal; it affects almost every organ and system in the body, the main target for lead toxicity being the nervous system (1). Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people (2). In pregnant women, high levels of exposure to lead may cause miscarriage, while Chronic, high-level exposure has been known to reduce fertility (2). A high lead level has been reported in pregnant women with pre eclampsia (3). Lead poisoning typically results from ingestion of food or water contaminated with lead; but may also occur after accidental ingestion of

contaminated soil, dust, or lead-based paint (4). Lead is rapidly absorbed into the bloodstream and is believed to have adverse effects on the central nervous system, the cardiovascular system, kidneys, and the immune system (5). Lead(II) acetate (also known as sugar of lead) was used in the Roman Empire as a sweetener for wine, and some consider this an explanation that chronic lead poisoning contributed to the empire's gradual decline (6). In humans, lead inhibits porphobilinogen synthase and ferrochelatase, thereby preventing both porphobilinogen formation and the incorporation of iron into protoporphyrin IX. This causes ineffective heme synthesis and

subsequent microcytic anemia (7). A small amount of ingested lead was reported to be store in bones (1%), and the rest will be excreted by an adult through urine and feces within a few weeks of exposure (4). Exposure to lead and lead chemicals can occur through inhalation, ingestion and dermal contact (1). Creatinine on the other hand is a product of nitrogen metabolism. It is released into body fluids at a constant rate and its plasma level is a balance between production and excretion. Its clearance can be measured as an indicator of glomerular filtration rate (8).

MATERIALS AND METHODS.

Study Area

The Owo - Akure expressway is a federal highway about 45kilometres long linking the towns of Akure and Owo .it also a portion of the long stretch of road that links Ile-ife at Ipetu-modu to Benin at Oluku junction. There are seven major junctions on this highway namely Ikare junction, Rufus Giwa Polytechnic (RUGIPO) main gate, Emure junction, Uso junction, Ogbesse junction and, Ado junction at Akure. To limit the speed of vehicles at these junctions, government have built bumps to safeguard the lives of the citizenry and also to provide the necessity of slowing down for security checks by law enforcement agents. Though these bumps are serving the intended purpose, they have also provided the opportunity for roadside hawkers to trade their wares, since the time spent slowing down to climb these bumps by vehicles, most of the time, brings about the latitude the traders and their would-be customers would need to strike a deal. Since commerce is the root of civic virtue, many other artisans and traders have moved towards these junctions to look for their daily bread, to the extent that these junctions have gradually become populated. One of the problems insinuated by the investigators in

the present research are those likely to be caused by vehicle exhaust fumes, This research work was therefore designed to estimate the blood lead content and plasma creatinine concentration of roadside traders at the various junctions

Source of samples:

A total of 120 blood samples were collected. Ninety (90) blood samples were collected from both male and female roadside traders at major junctions along Akure Owo Expressway. The remaining thirty (30) was collected from the members of staff and students of Achievers University, owo. The criteria of the selection of subjects were that no one should be a smoker or have a history of smoking, whether active or passive. All subjects included in the present study were thus normal healthy subjects. The study was conducted at Department of Medical Laboratory Science, College of Medicine and Health sciences, Afe Babalola University, Ado ekiti, Ekiti state, Nigeria. This study was approved by the Ethical Committee in accordance with the declaration of Helsinki

Blood collection

Six milliliters (6 cm³) of each blood sample was collected by venous puncture of the cubital fossa using 22G needle and syringes. 1ml of the blood collected was immediately dispensed into lithium heparin bottles and refrigerated until needed for the estimation of blood lead. The remaining 5mls of whole blood was dispensed into lithium-heparinized bottles, mixed and centrifuged at 2000 r.p.m for 10 minutes. The supernatant plasma was then removed using automatic pipettes and placed into a plain bottle. The plasma samples were then refrigerated at 4°C until the samples were analyzed within 24hours.

Estimation of parameters

Lead estimation was carried out using Atomic absorption spectrophotometry (9), while plasma creatinine level was estimated using the modified jaffe reaction (10).

Statistical analysis was done using SPSS. The students't test was the tool of choice. Significance was tested at $P < 0.05$.

RESULTS

TABLE 1: Level of plasma lead and creatinine exposed to Car exhaust Fumes in some areas of Ondo State

Location	Sample size	Lead ($\mu\text{g/dL}$)	Creatinine $\mu\text{mol/L}$
Ikare junction	36	1.2321 \pm 0.2144*	94 \pm 17*
isuada	18	1.0070 \pm 0.0806*	88 \pm 21*
polyowo	28	0.9144 \pm 0.2313*	79 \pm 12*
Emure	17	0.7111 \pm 0.08940*	82 \pm 15*
Uso	15	0.6022 \pm 0.1391*	75 \pm 13*
Ogbesse	20	1.1160 \pm 0.2004*	91 \pm 17*
Akure	15	0.8414 \pm 0.1491*	73 \pm 14*
Control	30	0.4820 \pm 0.1473	62 \pm 16

Results are of mean \pm STD * $p < 0.05$ statistically significant compared with control

DISCUSSION

Lead is an established toxic and carcinogenic metal (4). It has also been proved that lead can be toxic at levels well below the current safety standards if the exposure is chronic (11). Most studies of the effects of this element in humans have focused on its association with increased blood pressure (12). Increased exposure to lead has been associated with cardiovascular complications (13, 14). Lead has been known to exert its adverse effects in humans through its ability to increase oxidative stress (15), affect endothelial function (16), promote inflammation (17), and down regulate nitric oxide production (18). All the adverse effects caused by exposure to Lead (Pb) could either be deleterious to renal cells

Table 1 below shows the plasma levels of lead and creatinine in subjects exposed to car exhaust fumes and control with very little exposure because of their business area location. The exposed groups have significantly higher levels of plasma lead and creatinine ($p < 0.05$) compared with the control groups. The plasma levels though higher amongst exposed groups were within the upper normal range.

through the effects of cardiovascular conditions such as a reduction in renal blood flow. The reduced blood flow in turn, results in renal dysfunction [19]. In this present research, there is a significant increase in lead (Pb) level and a proportional increase in plasma creatinine in all roadside groups, suggesting that blood lead (Pb) levels even well below safety cut off points, could have a potential adverse effect on renal function. The mechanism by which lead (Pb) impairs renal function is suggest in the recent past to be due to accelerated oxidative stress and promotion of inflammation, which consequently may lead to cardiovascular complications such as atherosclerosis, peripheral arterial disease and pre eclampsia as Stated by (3,15,17). Cardiovascular

complications such as arteriosclerosis may cause reduction in blood supply to organs, such effect can lead to reduced perfusion, which subsequently affects organ functional capacity (20, 21). Therefore, it is likely the effect of Lead (Pb) on organs such as brain with low functional reserve may be more severe. Loss of renal function is not always evident until approximately 50-70% of nephrons have been affected. This due to the fact that the kidney has high functional reserve (22). The observation that the plasma creatinine level in the exposed groups was at the upper end of the reference range (53 -97 $\mu\text{mol/L}$), despite the fact that the kidney has a high reserve is a cause of concern. The most probable cause of lead containing vehicle exhaust is through the combustion of lead containing fuel. Combustion renders lead(Pb) volatilized (4), making it easily assimilated through the lungs. Addition of lead tetraethyl (an anti knocking agent) has been phased out in so

many countries by 2007 (4). However, it is not known how the exhaust fumes could still have Lead content.

CONCLUSION AND RECOMMENDATION

Lead (Pb) contamination through the combustion of fuel has the potential of reducing renal function even at the levels which have been considered as safe limits. In view of this enlightenment campaign is desirable to protect the health of the citizenry. Though additive anti knock had been phased out since 2007, the source of lead in the fuel needs to be determined. Where total elimination of the use of the product is not achieved, the regulatory agencies should be tasked with the responsibility of implementing the policy in order to reduce the sources of Lead exposure.

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