Trop J Nat Prod Res, March 2024; 8(3):6663-6668
ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

Tropical Journal of Natural Product Research

Available online at https://www.tjnpr.org

Original Research Article

Evaluating the Renal Status of Wood Sawmill Workers Exposed to wood Dust: a Cross-sectional Study

Ozioma E. Obianyido[1]*, Hector O. Obianyido[2], Chukwugozie N. Okwuosa[1], Dorothy I. Nnakenyi[3]

[1]*Department of Medical laboratory Sciences, Faculty of Health Sciences and Technology, University of Nigeria Enugu Campus, Enugu, Nigeria.*
[2]*Department of Medical Biochemistry, Faculty of Basic Medical Sciences, University of Nigeria Enugu Campus Enugu, Nigeria.*
[3]*Department of Chemical Pathology, Faculty Basic Clinical Sciences, University of Nigeria Ituku Ozalla Campus, Enugu, Nigeria.*

ARTICLE INFO

Article history:
Received 02 July 2023
Revised 19 March 2024
Accepted 20 March 2024
Published online 01 April 2024

ABSTRACT

Chronic kidney disease is a global public health menace. Occupational exposure to pesticides, environmental pollutants and nephrotoxic pharmaceuticals contributes to chronic kidney. This cross-sectional study evaluated the renal status of wood saw millers exposed to wood dust. A total of hundred and ninety-five (195) age and sex-matched males (111 wood saw millers exposed to wood dust for ≥ two years and 84 office workers not exposed to wood dust) were recruited by simple random sampling. The Ethical Committee of the University of Nigeria Teaching Hospital, Enugu, approved the study. Atomic absorption spectroscopy was used to assay the level of cadmium, arsenic, and lead in wood dust obtained from the wood saw millers' work environment and the study participants' blood samples. High levels of arsenic, cadmium and lead were contained in the wood dust. A noteworthy increase ($p < 0.001$) in cadmium, arsenic and lead blood levels was observed in the wood saw millers' blood samples compared to the unexposed participants. The enzymatic and Jaffe methods were employed for the estimation of serum urea and creatinine, respectively. The chronic kidney disease epidemiology collaboration equation for estimated glomerular filtration rate was used to assess the kidney function. A noteworthy increase ($p<0.001$) was observed in the serum urea and creatinine levels of the wood saw millers compared to the unexposed subjects. In contrast to the unexposed, the estimated glomerular filtration rate of the wood saw millers showed a significant increase ($p<0.001$). This study suggests that occupational exposure to wood dust may harm the kidneys.

Keywords: wood sawmill workers, work duration, arsenic, cadmium, lead, atomic absorption spectroscopy, eGFR.

Introduction

Globally, chronic kidney disease (CKD) is a significant public health concern. Regarding morbidity and mortality, CKD was ranked 19th in 2013 by the Global Burden of Disease (GBD) report.[1, 2]. Age-standardised prevalence rates of CKD for men and women globally are 10.4% and 11.8%, respectively.[2] Prevalence rates are higher in low- and middle-income countries (LMIC) than in high-income countries (HIC) [2], with Sub-Saharan Africa (SSA) reporting prevalence of 13.9%.[1] Unfortunately, only a few countries have strong enough economies to handle the challenge of CKD complications, which significantly drain global healthcare resources.[3] In addition, socioeconomic status affects one's risk for mortality and morbidity; people with lower socioeconomic status are more likely to experience these complications than those with higher socioeconomic status. [4,5]

The burden of CKD in developing countries is not only influenced by 'established' causes such as diabetes and hypertension but also by environmental pollutants, environmental toxins, occupational exposure to pesticides, infections, nephrotoxic medicines, and herbal remedies. [6,7]

The burden of CKD of unexplained aetiology (uCKD) has been on the rise for the past 30 years in several LMICs, including Africa. [6,7] It has been hypothesised that several environmental and occupational risk factors may contribute to the growth of uCKD [6]. This may have tilted the curiosity of researchers to occupational exposures.

Wood dust exposure is among the primordial and most prevalent occupational exposures worldwide. Inhalation of wood dust or its deposition on the skin may be harmful systemically or locally.[8] The International Agency for Research on Cancer (IARC) classifies wood dust as Group 1 carcinogenic to humans and can lead to nasopharyngeal, paranasal sinus, and nasal cancer.[9-11]

In developing countries, woods are preserved using the organophosphate class of insecticide such as Dichlorovinyl dimethyl phosphate, the organophosphorus class of chemicals such as pentachlorophenol,(2,3,4,5,6-pentachlorophenol) and pytheroids such as tetrametrin and cypermethrin.[12] The Dichlorovinyl dimethyl phosphate has the molecular formulation, $C_4H_7Cl_2O_3P$, vapor pressure of 1.2×10–2 mmHg at 20 °C, molecular weight of 220.98 and density of 1.415 g/ml at 25°C.[12] Tetramethrin (Tm), a synthetic derivative of type I pyrethroid (pyrethrins), is commonly used in either aerosol formulation (0.1–0.25%), aqueous sprays (0.1–0.25%), emulsifiable concentrates (2.5%), or mosquito coils (~0.54%) for the control of indoor pest.[13] The active ingredient in Tm is either 3,4,5,6-tetrahydrophthalimidomethyl-(1RS)-cis-trans-chrysanthemate or 1,3,4,5,6,7-hexahydro-1,3-dioxo-2H-isoindol-2-yl) methyl-2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate. These preservatives protects the woods from decay and insect damage and have a high stability and water solubility which makes them persist in the environment.[14] The WSM apply preservatives on the wood by spraying or by hand brushing.

***Corresponding author. E mail: ozioma.obianyido@unn.edu.ng
Tel: +2348034734347

Citation: Obianyido OE, Obianyido HO, Okwuosa CN, Nnakeyi DI. Evaluating the Renal Status of Wood Sawmill Workers Exposed to wood Dust: a Cross-sectional Study. Trop J Nat Prod Res. 2024; 8(3):6663-6668. https://doi.org/10.26538/tjnpr/v8i3.28

Official Journal of Natural Product Research Group, Faculty of Pharmacy, University of Benin, Benin City, Nigeria

Pentachlorophenol and cresoate contain heavy metals, including arsenic, chromium, nickel, and copper.[15] Arsenic (As) is the most dangerous, followed by lead (Pb) and cadmium (Cd), the seventh [8-10.] Acute exposure to heavy metals is well known to have detrimental effects, including pulmonary inflammation, hepatic cell death, and renal and neurological damage.[11] Most of these heavy metals, along with the dust created during wood processing, are inhaled or unintentionally consumed by wood sawmill workers. As wood is sanded, a cloud of fine and plentiful dust is made, while milling or chopping wood produces more concrete dust. The concentration of these heavy metals in the wood dust depends on the wood being treated.

In Nigeria, the private sector dominates the forest industry (including the wood sawmill business). They use antiquated methods and machinery due to lack of funds to procure state-of –the –art equipments.[8] They lack a good engineering control systems and dust monitoring equipments. Furthermore, the WSM are ignorant of the occupational hazards and therefore do not care to use any form of safety equipment.

Due to these deficiencies, WSM in Nigeria are exposed to high quantities of wood dust. A thorough understanding of the effects of HM exposure on WSM's kidney health is essential. Unfortunately, limited studies have evaluated the association between occupational heavy metal and wood dust exposure and the renal health of WSW in Enugu, Nigeria. This study evaluated the renal status of wood sawmill workers exposed to wood dust in Enugu, Nigeria, to ascertain the effect occupational exposure to wood dust and heavy metals on the renal health of wood sawmill workers in Enugu, Nigeria. The findings of this study may enhance WSM commitment to preventive actions and regular health checks.

Materials and Methods

Study design

The study adopted a cross-sectional survey design to evaluate the renal status of wood saw millers (WSM) exposed to wood dust in Enugu municipality, Southeast Nigeria.

Ethical consideration

The study was reviewed and approved by the Ethical Committee of the University of Nigeria Teaching Hospital in Enugu (NHREC/05/01/2008B-FWA00002458-1RB00002323). All procedures used in this study adhered to the guidelines outlined in the 1964 Declaration of Helsinki. Participant's confidentiality was ensured.

Study area

The study was conducted between February and September 2022 in Enugu State, situated in the Southeastern region of Nigeria. Enugu State residents work in various sectors, including government, business, the arts, and agriculture. [8] Most sawmills in Enugu municipality are located in Enugu South local government area (LGA) (Kenyatta-Timber shed) and Enugu East LGA (Abakpa-Nike Timber Market and Orie Emene Market).

The types of wood commonly used by the WSM are Beechwood (*Gmelina arborea)*, African mahogany (*Khaya ivorensis*), cotton tree (*Ceiba petandra)* and Achi (*Brachystegia eurycoma).* The preservatives used for wood preservation include Tetramethrin and Dichlorovinyl dimethyl phosphate.

Study population

Wood saw millers operating at Kenyatta-Timber shed, Abakpa-Nike Timber and Orie Emene markets in Enugu metropolis who fulfilled the following criteria were recruited for the study:

Inclusion criteria

Adult (over 18 years of age) wood saw millers with at least three years of full-time exposure to wood dust were included in the study, as well as those who had no history of hypertension, liver disease, diabetes or any other self-reported systemic disease.

Exclusion criteria

Subjects who tested positive for Hepatitis A, B or C on screening, as well as those who smoked cigarettes or sniffed tobacco, were excluded from participating in the study. Subjects who reported having been previously diagnosed with renal disease were excluded.

Sample size determination

The sample size was determined using the following formula for sample size determination in cross-sectional studies: [16], and a prevalence of renal disease in Southeast Nigeria put at 7.8%.[17]

Sample size $n = \frac{z^2 p(1-p)}{d^2}$

$$z = \, statistics\, for\, the\, level\, of\, 95\%\, confidence\, interval\, (1.96)$$

$$p = \, \%\, prevalence\, of\, renal\, disease\, in\, southeast\, Nigeria.$$

$$d = \, Preferred\, precision;\, in\, this\, case, 0.05$$

$$= \frac{3.842\text{x } 0.078\text{x } 0.922}{0.0025}$$

$$= \frac{0.2763}{0.0025}$$

$$= 110.52$$

$$Approximately;\ 111$$

$$An\ extra\ 10\%\ was\ added\ for\ attrition$$

$$111 + 11.1 = 122.1$$

$$Approximately\ 122.$$

One hundred and one (111) WSM and eighty-four (84) age and sex-matched controls were recruited, giving a total of one hundred and ninety-five (195) participants for the study.

Sampling technique

The selection of each participant was made by simple random sampling. Every third person who fulfilled the inclusion criteria was selected.

Data collection

Wood dust collection

Wood dust was collected from the WSM workshop in a sterile, dry universal container.

Questionnaire administration

After obtaining informed consent, the researcher used a pre-tested, semi-structured questionnaire to get their demographic, medical, and social history.

Specimen collection

The skin at the antecubital fossa was cleaned with methylated spirit. Venipuncture was used to obtain 7ML of venous blood, of which 4ML was put into a potassium salt of ethylene diamine tetra-acetic acid (K-EDTA) anticoagulant tube. At the same time, 3ML were put into a plain tube. The samples were taken to the laboratory for centrifugation at 1500 rpm for 10 minutes. The blood samples from the K-EDTA were collected for the estimation of lead, cadmium, and arsenic, while the serum from the plain tube was collected for urea and creatinine determination. The samples were stored in a freezer at -20^{0}C until analysis.

Specimen analysis

Determination of lead, cadmium and arsenic in wood dust and subjects' blood samples.

Atomic absorption spectroscopy was used to determine the levels of lead, cadmium and arsenic in wood dust collected from the WSM workshop and blood samples of the study participants using the Atomic Absorption Spectroscopy Model AA-7000 (Shimadzu, Japan). The wood dust and blood samples were subjected to conventional wet acid digestion to extract arsenic, cadmium, and lead before the actual analysis, as described by Iyengar.[18] The respective wavelengths used are as follows: Arsenic 193.7nm, cadmium 228.80 nm and lead 283.31 nm.[18]

Validation of the digestion procedure for quality assurance.

To eliminate any chance of contamination, the pipette tips, glass wares and stoppers were acid-cleansed using 10% nitric acid. After that, they were washed in deionized water before being used to analyze lead, cadmium and arsenic levels in the subjects' blood samples and wood sawdust obtained from the work environment of the WSM. Recovery trials and precision assessments were conducted to certify all instruments used for this study and further validate the digeston procedure.[15]

Analysis of serum urea and creatinine

The kinetic colorimetric assay, described by Jafee, was utilised to estimate the serum creatinine of the study participants.[18] The Jafee method of creatinine estimation is based on the principle that in an alkaline solution, creatinine forms a yellow-orange complex with picrate. The rate of dye formation is proportional to the creatinine concentration in the specimen. The serum creatinine results were used to calculate eGFR using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation.[20] The study participants' blood urea levels were estimated using the kinetic test with urease and glutamate dehydrogenase.[20] The assay principle is based on the fact that urea is hydrolysed by urease to form ammonium and carbonate. In the second reaction, two-oxoglutarate reacts with ammonium in the presence of glutamate dehydrogenase (GLDH) and the coenzyme NADH to produce L-glutamate. In this reaction, two moles of NADH are oxidised to NAD+ for each mole of urea hydrolysed. The rate of decrease in the NADH concentration is directly proportional to the urea concentration in the specimen and is measured photometrically.[21] The Cobas c111 system (ROCHE, utilises the abovementioned principles to analyse urea and creatinine and was utilised in carrying out the laboratory investigation of urea and creatinine in this study.

Statistical analysis

The statistical analysis software, GraphPad Prism version 7 (Graphpad Software Inc., USA), was used to analyse the data obtained from this study. . Values were expressed as frequency (percentage) and Mean ± standard deviation. A chi-square test was used to compare the differences in the participants' socio-demographic characteristics. The student's t-test was conducted to compare continuous variables such as the concentration of the heavy metals and renal parameters between the subjects and the controls. One-way ANOVA was used to compare the difference in the participants' mean concentration of heavy metals and WHO permissible blood limits. In addition, Pearson correlation was used to evaluate relationships between the measured parameters (years of wood dust exposure and eGFR, eGFR and arsenic, cadmium and lead). A p-value of <0.05 was used to assess statistical significance.

Results and Discussion

Impact of occupational wood dust exposure *on the renal function of wood sawmill workers.*

The impact of occupational wood dust exposure on the wood sawmill workers' renal function is shown in Table 4. We observed a statistically significant decrease ($p<0.001$) in the estimated glomerular filtration rate (eGFR) of WSM (85.40±0.73)ml/min/1.73m^2 in comparison to the controls (95.95±0.97)ml/min/1.73m^2 as shown in Table 4. Our findings agree with an African study conducted in South-South Nigeria on carpenters, where they observed a statistically significant decrease in the eGFR of carpenters (79.65±19.75) mls/min/1.73m^2 .[22] Most WSM had an eGFR within 88mls/min/1.73m3. The Kidney Disease Increased Global Outcome ranked a eGFR of 88ms/min/1.73m^3 as Class G2, mildly decreased glomerular filtration rate (GFR).[23] Heavy metals in wood preservatives may have a harmful effect on the renal function of the WSM. This study observed a statistically significant negative correlation between the duration of wood dust exposure in the WSM and eGFR. In addition, a statistically significant negative correlation was observed between eGFR and cadmium and between eGFR and arsenic. The mean blood concentrations of urea and creatinine were significantly higher ($p<0.001$) in the WSM when compared with the controls (Table 1). The kidney is the first organ affected by heavy metal intoxication because it tends to reabsorb and store divalent metals.[20] Also, according to accumulating evidence, oxidative stress plays a significant role in the decline of renal function[9,24] a pointer to the fact that exposure to wood dust may induce a decrease in the eGFR, considering the renal epithelium's exceptional ability to collect and transport these toxic metals. Heavy metals are ultimately excreted from various organs and plasma by the kidney, an organ whose principal function is to eliminate harmful toxins; exposure to heavy metals may be detrimental to kidney health.[9] The mechanism of arsenic-induced carcinogenicity and genotoxicity involves the production of reactive oxygen species (ROS) via the mitochondrial respiratory chain and oxidative stress events, resulting in DNA strand breaks, DNA cross-links, down-regulation of Bax proteins and P53, and up-regulation of HSP-70 and Bcl-2 proteins in human and animal cells.[23,26] Heavy metals buildup in experimental animals' liver, kidneys, and brain induces oxidative stress by raising ROS levels and lowering reduced glutathione levels.[27]

Pattern of blood arsenic, cadmium and lead levels of wood saw millers occupationally exposed to wood dust compared to the unexposed, control participants.

This study observed a statistically significant increase ($p<0.001$) in blood arsenic levels (31.90±0.64)µg/dl of the WSM in comparison to the controls (0.76±0.53) µg/dl, as shown in Table 2. Ibama *et al.*[22] documented a blood arsenic level of 46.0 µg/dl (0.46 ± 0.17 ppm) among carpenters in Port-Harcourt, Nigeria, which agrees with our study's findings. The increased blood levels of arsenic detected in the WSM may be due to increased arsenic in industrial procedures used in making antifungal wood preservatives.[22] Wood dust contains increased industrial wood preservatives, such as Boliden (BIS), zinc sulfate, and chromate copper arsenate (CCA)[22,28]. Furthermore, we observed that WSM in Enugu municipality applied preservatives manually without putting on any personal protective equipment. The WSM also do not use any form of personal protective equipment while sanding the wood due to this, WSM are bathed with the cloud of plentiful wood dust produced while sanding the wood; this, we also observed they inhale. Wood dust obtained from the work environment of the wood saw millers contained a high concentration of heavy metals, particularly arsenic[22,29], as we observed from our assay. The findings of this study is above 0.1µg/dl, which is the Agency for Toxic Substances and Disease Registry (ATSDR) permissible human blood level for arsenic[29], as shown in Table 3.

The blood cadmium level (5.82±0.39)µg/dl of the WSM from our study was significantly increased ($p<0.001$) in comparison to the unexposed controls (2.90±0.44)µg/dl, as shown in Table 2. This study may be the first to report blood cadmium levels in WSM in Nigeria. The findings of this study were higher than 4.145 ± 0.129 µg/dl documented by Musa *et al.*[30] among occupationally exposed subjects in Zaria.[31] The difference in the values may be due to differences in occupational exposures or environment.

Table 1: Comparison of the mean values of the serum renal parameters of the participants.

Parameter	Wood saw millers	Controls	p-value
Urea(mmol/l)	3.44 ± 0.54	3.16 ± 0.02	<0.001*
Creatinine (mg/dl)	1.14 ± 0.01	1.04 ± 0.01	<0.001*
eGFR(ml/min/1.73m^2)	85.40 ± 0.73	95.95 ± 0.97	<0.001*

*: Statistically significant, eGFR: Estimated glomerular filtration rate

Table 2: Comparison of the mean blood arsenic, cadmium and lead levels of the WSM and the unexposed, reference groups

Parameter	Wood saw millers	Controls	p-value
Arsenic(µg/dl)	31.90 ± 0.64	0.76 ± 0.53	<0.001*
Cadmium(µg/dl)	5.82 ± 0.39	2.90 ± 0.44	<0.001*
Lead(µg/dl)	5.03 ± 0.53	2.07 ± 0.23	<0.001*

Table 3: Mean blood arsenic, cadmium and lead levels of the study participants in comparison to WHO/ATSDR permissible limit.

Parameters	WHO/ATSDR Permissible limit	WSM	Control	p-value
Arsenic(µg/dl)	0.10(ATSDR)	31.90 ± 0.64	0.76 ± 0.53	<0.001*
Cadmium(µg/dl)	0.12(WHO)	5.82 ± 0.39	2.90 ± 0.44	<0.001*
Lead(µg/dl)	10.00(WHO)	5.03 ± 0.53	2.07 ± 0.23	<0.001*

*: significant WHO: World Health Organisation ATSDR: Agency for Toxic Substance and Disease registry

Burning wood as a waste disposal method was observed in the WSM environment. This may contribute to the observed increased blood cadmium level. Our findings exceeded 0.12 µg/dl, the WHO-permitted blood level for cadmium[30-31], as shown in Table 3.

The findings of this study revealed a statistically significant increase in the mean blood lead level of WSM (5.03±0.53)µg/dl compared to the unexposed (2.07±0.23)µg/dl. The blood lead levels observed in our study were below ten µg/dl, the WHO permissible range for blood lead level.[32] Lead in the earth's crust is absorbed through plant roots. Wood type and soil may also have contributed to the lower lead levels in our study. Lead was not included in the list of constituents in the preservatives.

Correlating the eGFR, arsenic, cadmium and lead levels of WSM with years of wood dust exposure

A statistically significant negative correlation was noted between eGFR and the WSM's years of wood dust exposure (r = -0.656, p<0.001) (Figure 1). This study observed a statistically significant negative correlation between eGFR and WSM blood arsenic levels (r= -0.497, p<0.001), blood cadmium levels (r= -0.188, p<0.001), and blood lead levels (r = -0.100, p = 0.282). However, the latter (blood lead levels) was not statistically significant (p>0.05) (Figure 2, 3, and 4).

Levels of lead, cadmium, and arsenic in wood dust particles were collected from the work environment of wood saw millers.

Wood dust collected from the work environment of the WSM was assayed for levels of lead, cadmium and arsenic, as shown in Table 4. Lead, cadmium and arsenic were observed to be contained in large amounts in wood dust. Nwajei *et al.*[33] reported a high concentration of heavy metals in wood dust collected in Sapele, south-south Nigeria.[33] This report is consistent with our findings. The maximum permitted exposure level set by the Occupational Safety and Health Administration (OSHA) for inhaling sawdust or smoke from burning wood containing arsenic is $10µgm^{-3}$.[33] Our findings suggest that heavy metals in chemicals used as wood preservatives may be responsible for the elevated amount of the heavy metals found in wood dust collected from the work environment of the WSM.

Demographic characteristics of the participants

One hundred and ninety-five (195) males (100%), comprising 111 WSM and 84 controls, completed this study. The mean±SD age of the WSM was 52.44±1.07, while for the controls, 50.67±1.24 (p=0.078). Although the majority (93.7%, 104/111) of the WSM had some form of formal education, others (6.3%, 7/111) had no formal education (p<0.001). In addition, the majority of the WSM (33.3%, 37/111) do not wash their hands before eating when at work, but for the controls (100%, 84/84), (p<0.001), all of them admitted to hand washing before eating (Table 5). They, therefore, run the risk of ingesting most of these particles while eating. Major heavy metal intake routes include the gut, skin and respiratory system.[32] The human body can absorb heavy metals by consumption of contaminated food or drink and by inhalation.

Conclusion

The negative correlation between eGFR, WSM years of wood dust exposure, blood cadmium and arsenic levels implies that occupational exposure to wood dust may harm the kidneys. Occupational exposure to wood dust may have increased the concentration of the WSM's arsenic and cadmium blood levels. This study revealed blood arsenic and cadmium levels that exceeded the WHO-permitted limit in the WSM and control subjects. These findings may imply a significant environmental contamination of the study sites by these metals or other lifestyle practices by the respondents that were not considered.

Table 4: Atomic absorption spectroscopy of heavy metals (arsenic, cadmium and lead) in the wood dust collected from the work environment of the wood saw millers

Heavy metals	Concentration (µg/g)
Lead	253.2 ± 13.2
Cadmium	536.7 ± 9.28
Arsenic	3017 ± 151.6

Values are Mean ± SD

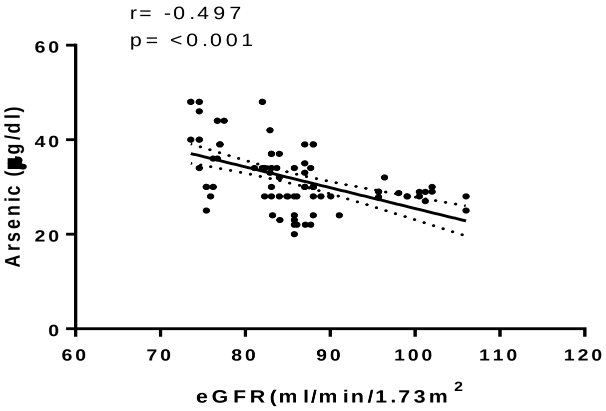

Figure 1: Plots show a correlation and a corresponding 95% confidence line of best fit for eGFR and WSM work duration. The duration of WSM work is negatively correlated to the eGFR value.
eGFR:estimated glomerular filtration rate, r:coefficient of correlation.

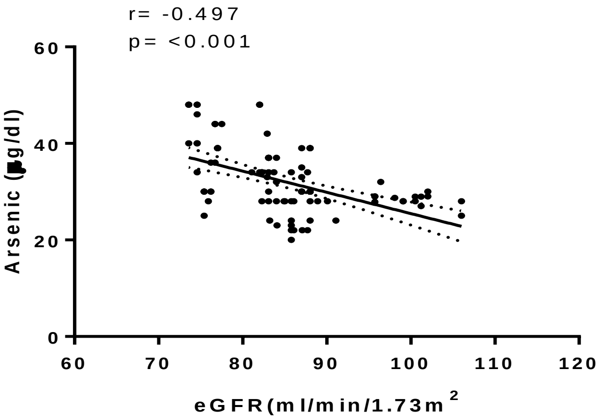

Figure 2: Plots show a negative correlation and a corresponding 95% confidence line of best fit for arsenic levels and eGFR of the WSM. Occupational exposure to arsenic over time maybe associated with a decreased eGFR.
eGFR: estimated glomerular filtration rate, r:coefficient of correlation.

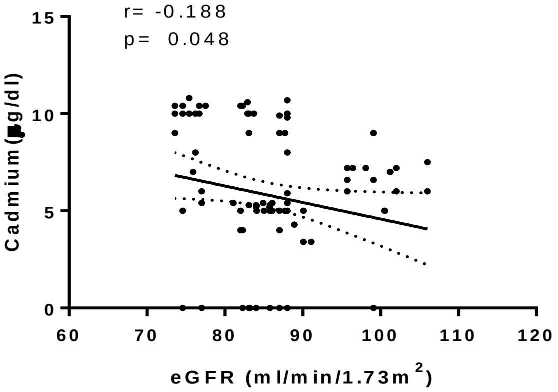

Figure 3: Plots show a negative correlation and a corresponding 95% confidence line of best fit for cadmium levels and eGFR of the WSM. Occupational exposure to cadmium over time maybe associated with a decreased eGFR.
eGFR: estimated glomerular filtration rate, r: coefficient of correlation.

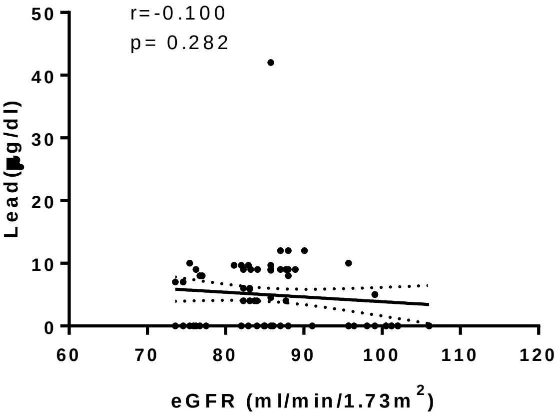

Figure 4: Plots show a negative correlation and a corresponding 95% confidence line of best fit for blood lead levels and eGFR of the WSM.
eGFR: estimated glomerular filtration rate, r:coefficient of correlation.

Table 5: Demographic characteristics of the study participants.

	Wood saw millers		**Controls**		
Characteristics	N	%	N	%	p-value
Male sex	111	100	84	100	
Age(years)					0.078
21-30	9	8.1	5	6	
31-40	7	6.3	14	16.7	
41-50	27	24.4	29	34.5	
51-60	43	38.7	21	25	
61-70	25	22.5	15	17.8	
Total	111	100	84	100	
Educational status					<0.001*
No formal education	7	6.3	1	1.2	
Primary education	27	24.3	3	3.6	
Secondary education	68	61.3	35	41.6	
Tertiary education	9	8.1	45	53.6	
Total	111	100	84	100	
Hand washing before eating at work					<0.001*
No	37	33.3	0	0	
Not always	69	62.2	4	4.8	
Yes	5	4.5	80	95.2	
Total	111	100	84	100	

*: significant N: number of cases

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

References

1. Olanrewaju TO, Aderibigbe A, Popoola AA, Braimoh KT, Buhari MO, Adedoyin OT, Kuranga SA, Biliaminu SA, Chijioke A, Ajape AA, Grobbee DE. Prevalence of chronic kidney disease and risk factors in North-Central Nigeria: a population-based survey. BMC nephrology. 2020; 21(1):1-0.
2. Kovesdy CP. Epidemiology of chronic kidney disease: an update 2022. K I Suppl. 2022; 12(1):7-11.
3. Jha V, Al-Ghamdi SM, Li G, Wu MS, Stafylas P, Retat L, Card-Gowers J, Barone S, Cabrera C, Garcia Sanchez J J.

Global Economic Burden Associated with chronic kidney disease: a pragmatic review of medical costs for the Inside CKD Research Programme. Adv Ther. 2023; (10):4405-20.
4. Norton JM, Eggers P. Poverty and chronic kidney disease. In Chronic renal disease (2nd ed.), London: Academic Press. 2020. 181-196 p
5. Hounkpatin HO, Fraser SD, Johnson MJ, Harris S, Uniacke M, Roderick PJ. The association of socioeconomic status with incidence and outcomes of acute kidney injury. *Clin. Kidney J* 2020; 13 (2):245-52.
6. Fiseha T, Osborne NJ. Burden of end-stage renal disease of undetermined etiology in Africa Ren Rep Ther. 2023;9(1):44.
7. Rao IR, Bangera A, Nagaraju SP, Shenoy SV, Prabhu RA, Rangaswamy D, Bhojaraja MV. Chronic kidney disease of unknown aetiology: A comprehensive review of a global public health problem. Trop Med Int Health. 2023; 28(8):588-600
8. Obianyido OE, Obianyido HO, Okwuosa CN. Assessment of the liver biochemical status of carpenters occupationally exposed to wood dust in Enugu metropolis South-East Nigeria. Bio-Research. 2023; 21(3):2177-86.
9. Huang JL, Li ZY, Mao JY, Chen ZM, Liu HL, Liang GY, Zhang DB, Wen PJ, Mo ZY, Jiang YM. Contamination and health risks brought by arsenic, lead and cadmium in a water-soil-plant system nearby a non-ferrous metal mining area. Ecotoxicol Environ Saf. 2024 15; (270):115873.
10. Omrane F, Gargouri I, Khadhraoui M, Elleuch B, Zmirou-Navier D. Risk assessment of occupational exposure to heavy metal mixtures: A study protocol. BMC Public Health. 2018;18(1):1–11
11. Olujimi O, Nofiu M, Oguntoke O, Soaga J. Occupational exposure to wood dust and prevalence of respiratory health issues among sawmill workers in Abeokuta metropolis, Ogun state, Nigeria. J Nat Sci Eng Tech. 2023; 22(1):11-27.
12. Vani CN, Prajwal S, Sundararaj R, Dhamodaran TK. Chemical Preservatives in Wood Protection. InScience of Wood Degradation and its Protection (1st ed.) Singapore: Springer Singapore; 2022; 17559-587.
13. Okoroiwu HU, Iwara IA. Dichlorvos toxicity: A public health perspective. Interdisciplinary toxicology. 2018; 11(2):129.
14. Nguyen HT, Polimati H, Annam SS, Okello E, Thai QM, Vu TY, Tatipamula VB. Lobaric acid prevents the adverse effects of tetramethrin on the estrous cycle of female albino Wistar rats. Plos one. 2022;1 (17): 7.
15. Ohiagu FO, Chikezie PC, Ahaneku CC, Chikezie CM. Human exposure to heavy metals: toxicity mechanisms and health implications. Mat Sci Eng Int J 2022; 6(2):78-87.
16. Naing L, Nordin R Bin, Abdul Rahman H, Naing YT. Sample size calculation for prevalence studies using Scalex and ScalaR calculators. BMC Med Res Methodol 2022;22(1):209.
17. Okwuonu CG, Chukwuonye II, Adejumo OA, Agaba EI, Ojogwu LI. Prevalence of chronic kidney disease and its risk factors among adults in a semi-urban community of South-East Nigeria. Nat Pg Med J. 2017; 24(2):81-7.
18. Iyengar, G. Venkatesh, K.S. Subramanian JRWW. Element Biological. (1st ed.)New York: CRC Press; 1998.175–239p
19. Choosongsang P, Bhornsrivathanyou N, Aiadsakun P, Choosongsang P, Bodhikul A, Yamsuwan Y, Sriwimol W, Soonthornpun S. Glucose interference in serum and urine samples with various creatinine concentrations measured by the Jaffe kinetic method. Ele J Int Fed Clin Chem. 2023;34(1):57.
20. Levey Andrew S, Stevens Lesley A, Schmid Christopher H, Kusek John W, Egers Paul, Lente Van Frederick, Greene Tom CJ. A New equation to estimate glomerular filtration rate. Ann Intern Med 2009;150(9):604–12.
21. Kumari S, Bahinipati J, Pradhan T, Sahoo DP. Comparison of test performance of biochemical parameters in semiautomatic method and fully automatic analyzer method. J Fam Med Pri C 2020; 9(8):3994.
22. Ibama O, Brown H, Briggs ON. kidney function in carpenters exposed to wood dust. Eur J Pharm Med Res. 2018;5 (8):197–9.
23. Kidney Disease Increased Global Outcome (KIDGO) Working Group. Clinical practice guideline for the evaluation and management of chronic kidney disease. Kidney Int Suppl. 2013;3(1):11–5.
24. Verma S, Singh P, Khurana S, Ganguly NK, Kukreti R, Saso L, Rana DS, Taneja V, Bhargava V. Implications of oxidative stress in chronic kidney disease: a review on current concepts and therapies. Kidney Res Clin Pract. 2021:40(2):183-193.
25. Tam LM, Price NE, Wang Y. Molecular mechanisms of arsenic-induced disruption of DNA repair. Chemical research in toxicology. 2020, 33(3):709-26.
26. Renu K, Chakraborty R, Myakala H, Koti R, Famurewa AC, Madhyastha H, Vellingiri B, George A, Gopalakrishnan AV. Molecular mechanism of heavy metals (Lead, Chromium, Arsenic, Mercury, Nickel and Cadmium)-induced hepatotoxicity–A review. Chem. 2021 1;(271):129735
27. Soleimani N, Faridnouri H, Dayer MR. The Effect of Dusts on Liver Enzymes and Kidney Parameters of Serum in Male Rats in Khuzestan, Iran. J Chem H R (2020) 10(4), 315-326
28. Meena RK. Hazardous effect of chemical wood preservatives on environmental conditions, ecological biodiversity and Human being and its alternatives through different botanicals: A Review. Env and Eco 2022 l; 40(3):1137-43.
29. Agency For Toxic Substances And Disease Registry (ASTDR). Toxicological Profile for Arsenic. ATSDR's Toxicol Profiles. 2002; 32–45.
30. Musa A, Garba M, Yakasai IA, Odunola MT. Determination of blood levels of cadmium and Zinc in humans from Zaria, Nigeria. New Clues Sci. 2011; 2:49-54.
31. Alli LA. Blood level of cadmium and lead in occupationally exposed persons in Gwagwalada, Abuja, Nigeria. Interdisc tox. 2015; 8(3):146-50.
32. World Health Organization(WHO). Exposure To Lead: A Major Public Health Concern. In: Preventing Disease Through Healthy Environments Exposure. (2nd ed.) Geneva Switzerland; 2021. 1–6p.
33. Nwajei GE, Iwegbue CM. Trace elements in sawdust particles in the vicinity of sawmill in Sapele, Nigeria. Pak J of Bio Sci. 2007; 10(23):4311-4.