Journal of Environment Pollution and Human Health, 2018, Vol. 6, No. 4, 165-173
Available online at http://pubs.sciepub.com/jephh/6/4/6

DOI:10.12691/jephh-6-4-6

Blood Lead, Zinc and Calcium Levels, and Dietary Intake Habits among Petrol Station Attendants and Nomadic Cattle Rearers in Ilorin, North Central Nigeria

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Received October 20, 2018; Revised November 27, 2018; Accepted December 09, 2018

Abstract This study documents blood lead, zinc and calcium levels, and dietary intake habits among petrol station attendants and nomadic nomadic cattle rearers in Ilorin City, North Central Nigeria. The study was a cross-sectional which involves both survey and laboratory analysis. Interviews were conducted among consented petrol station attendants (40) and Nomadic nomadic cattle rearers (29) using a semi-structured interviewer administered questionnaire. Also blood samples were collected and analysed for blood lead, calcium and zinc levels using standard procedures. Data were analysed using t-test and Pearson's product moment correlation at $p = 0.05$. The mean age of petrol station attendants and the nomadic cattle rearers were 28.7±3.4 and 30.3±2.8 years respectively. More petrol station attendants (42.5%) than none (0.0%) of the nomadic cattle rearers had blood lead level above 10µg/dL. Calcium and Zinc were significantly higher among nomadic cattle rearers (21.40±1.83mg/L and 13.28±3.01µg/dL) compared to those of the Petrol station attendants (13.73±1.88mg/L and 3.13±0.68µg/dL). An inverse correlation existed between blood lead level of nomadic cattle rearers and their calcium ($r = -0.531$, $p < 0.05$), and zinc ($r = -0.405$, $p < 0.05$) levels. Major food consumed by the nomadic cattle rearers daily were "Fura/Nunu (Sorghum palp/fresh cow milk)" (72.4%) and "Tuwo (staple meal made from milled corn)" (41.2%) while petrol station attendants (47.5%) consumed meat daily. Blood lead was higher among petrol station attendants compared to nomadic cattle rearers. Calcium and Zinc levels were higher among the nomadic cattle rearers compared to petrol station attendants. However, Nomadic cattle rearers consumed foods that are rich in calcium and zinc compared to their petrol attendant counterparts. The study indicated that nature of diet has a mitigating effect on exposure to toxic chemicals like lead. Education and awareness creation on dietary choices of foods could reduce lead toxicity.

Keywords: *blood lead, micronutrients, petrol station attendants, nomadic cattle rearers*

Cite This Article: Siddik Sulaiman Oba, Adejumo Mumuni, and Sridhar Mynepalli Kameswara Chandra, "Blood Lead, Zinc and Calcium Levels, and Dietary Intake Habits among Petrol Station Attendants and Nomadic Cattle Rearers in Ilorin, North Central Nigeria." *Journal of Environment Pollution and Human Health*, vol. 6, no. 4 (2018): 165-173. doi: 10.12691/jephh-6-4-6.

1. Introduction

Lead pollution has been a global phenomenon due to the anthropogenic sources, which superseded natural sources. Anthropogenic sources release enormous quantities of lead into the environment, which presently pose serious health implications among exposed populations. Leaded petrol, lead-contaminated land, lead containing cosmetics, lead piping, lead-containing roofing materials, lead-based paint, lead smelters, lead recycled from car batteries, or lead in ammunition in war zones were some of the major sources of lead [1]. Human exposure to lead is one of the most serious health problems facing populations especially children [2,3,4,5]. Irrespective of the sources, lead is readily inhaled or ingested in the body and can be found in the blood, in soft tissues and in bones, where it can remain for several years [1].

Lead can harm many of the body's organ systems. Human exposure to lead can result in a wide range of biological effects [6]. For instance, studies have reported impairment of mental and physical development at blood lead levels below 10µg/dL [7,8]. Furthermore, low blood lead concentrations have been associated with miscarriage [9,10], pregnancy hypertension, or preeclampsia [11,12,13,14,15], premature delivery [16], premature rupture of the membranes [17], and low birth weight [18,19] among pregnant mothers. However, increased lead level in blood can result in various serious diseases including certain types of cancers [20,21]. Some epidemiological studies showed excess lung cancer mortalities had been associated with abnormally increased blood lead levels [22,23].

Several factors have been attributed to the increase in the blood lead level after occupational exposure particularly in developing countries. These include absence of personal protective equipment, lack of education, poor personal hygiene and under nutrition [24]. However, the roles of

dietary intake have been identified in developing immunity or resistance against lead toxicity. Elevated levels of micronutrients such as calcium, zinc and iron have been observed to have reduced the level of blood lead. For example, [25] reported that children with high blood lead had low intake of calcium when compared to their control counterparts. Also, blood lead has been found to be inversely related with the consumption of foods high in calcium [26,27].

People are less aware about the dangers the lead could cause, and also have little understanding of the role of some of the microelements in our day to day foods which may help in preventing lead accumulation and its toxicity in the body. For example, [28] observed that poor nutritional status could also increase the effect of lead on the human body aside age and income. Also, low dietary intakes of iron, zinc, and calcium have been associated with increased blood lead levels in humans, particularly children [29,30]. However, this has not been adequately proven especially among adults from different occupational settings.

Recently, in most of the Nigerian cities, there exist a fast growing number of petrol stations which has resulted to the increase in the number of petrol station attendants, mostly children and young adults. This urban phenomenon is also bringing faster encroachment to the suburbs or urban fringes where the nomadic cattle farmers reside. Though, these category of people, at present, are better comparative groups for the study, considering their lifestyle and attitudes towards the use of motor cars for mobility and urbanization. Lead contamination in Nigerian environment has been increasing due to proliferation of car washing outlets, mechanic garages, use of two wheelers as mode of transport and dust caused by transportation sector. These developmental and commercial activities are affecting remote settlements [31]. Lead is also released through discharge of the wastewater into the streams which are consumed by cattle and the nomadic cattle rearers or farmers as well. Further, unwholesome attitude of buying Premium Motor Sprit (Petrol) in plastic containers is on the increase due to poor power supply. There is paucity of empirical data on knowledge/awareness about the sources of lead and lead poisoning among petrol station attendants and nomadic cattle rearers in Nigeria. These categories of people differ in their lifestyles and food intake habits. Petrol station attendants are city dwellers and as a result of their occupational engagement, they are frequently exposed to lead from motor sprit inhalation and contact. Their major daily dietary intake includes foods that are rich in carbohydrate, protein, fat and oil. Whereas, nomadic cattle rearers are livestock farmers who live in urban fringes and surroundings and move from one location to another by foot in search of adequate and green pasture/grazing land for cattle, sheep and other ruminant animals in their custody. These people feed majorly of fresh cow milk and cereals with little meat intake and have little or no exposure to petroleum products. However, information on role of blood calcium and zinc on blood lead levels is inadequate. This study was therefore designed to document levels of blood lead, zinc and calcium among petrol station attendants and nomadic cattle rearers in Ilorin City, North Central Nigeria.

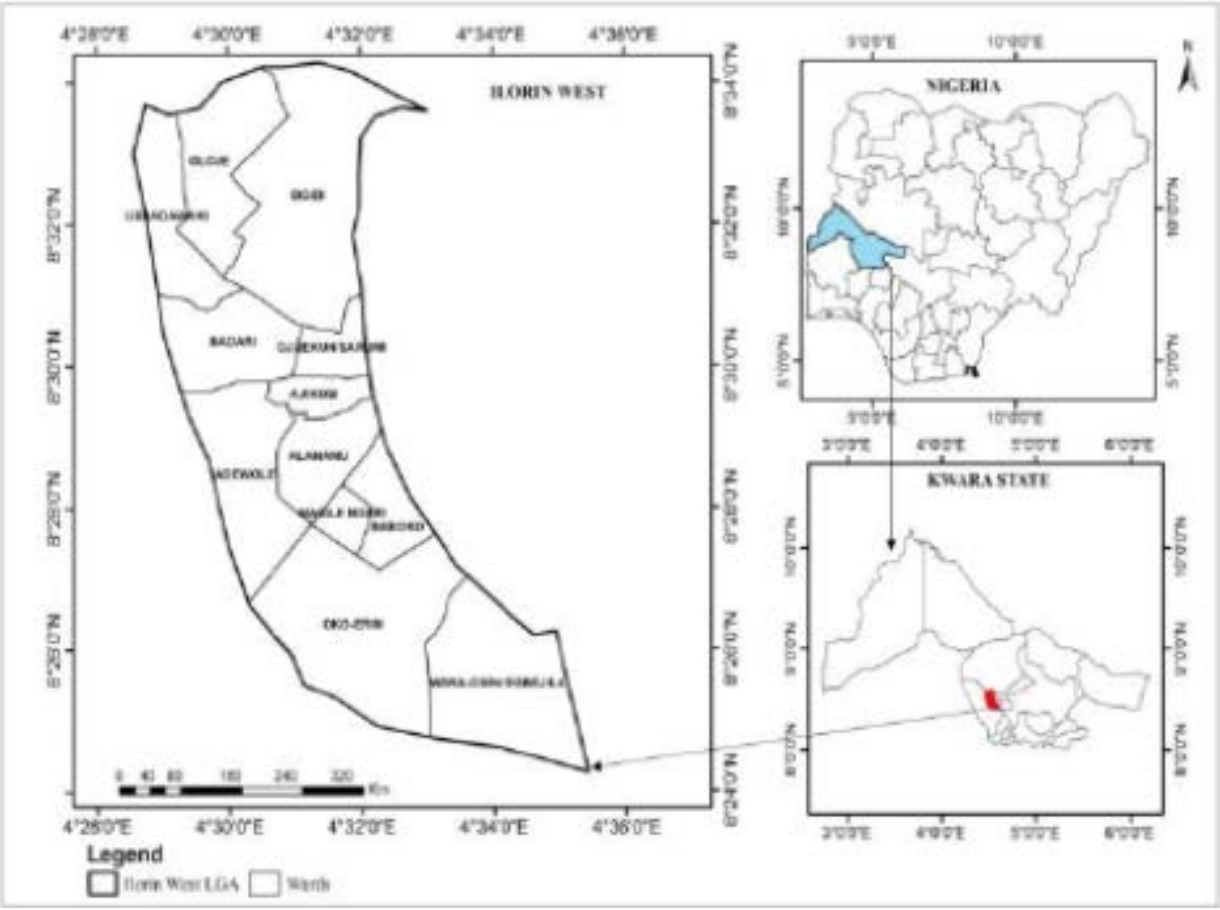

Figure 1. Map of Ilorin West Local Government Area

2. Materials and Methods

2.1. Study Area and Study Location

Kwara state is one of the 36 states of the Federal Republic of Nigeria and is located in the middle belt zone of the country. The state is between Longitudes 2° and 7°E and Latitudes 3° and 10°N, bounded on the North by Niger state, on the South by Oyo state, on the West by the republic of Benin and Eastern side by Kogi and Ekiti states. The area of about 32, 500 square kilometer and a population of over 1.5 million people made of four ethnic groups viz, Yoruba, Nupe, Fulani and Baruba. The vegetation of the state is mainly guinea savannah and rain forest. It enjoys both wet and dry seasons and has a maximum temperature of 30-35°C and annual rainfall of 1000-1500mm [32]. With a cultivable land area of 2,447, 250 ha, the State is significant for food production in Nigeria because of its rich soil that supports the cultivation of many crops [33]. The arable soil support farming and rearing of livestock. Agriculture is thus the main stay of the economy of the state.

The study was carried out in Ilorin West Local Government Area which is one of the 16 local government area in Kwara state. Ilorin West Local Government Area (LGA) lies within 4°28 ′10″E, 8°34 ′28″N and 4°35 ′35″E, 8°24 ′09″N with its headquarters in the town of Oja Oba. It has a total land area of about 105 square kilometer and a population of 364,666 as at 2006 census with population density of 3501 per. square kilometer. Ilorin West serves as host for the state capital administrative headquarters with major markets such as Oja-Oba, Oja-Tuntun, and Mandate. The Local Government consist of Twelve (12) electoral wards (Adewole, Ajikobi, Alanamu, Badari, Baboko, Magaji Nngeri, Ogidi, Oko-erin,Oloje, Ojuekun/Sarumi, Ubandawaki and wara/Osin/ Egbejila) as depicted in Figure 1.

2.2. Study design and Study Location

This study was cross-sectional in design and involves both survey and laboratory analysis. All consented Petrol station attendants and Nomadic cattle rearers within Ilorin West Local Government are participated in the study. A set of semi structured questionnaire was developed to collect respondents' demographic characteristics, occupational features, knowledge about lead and awareness of lead toxicity. In addition, blood samples from Petrol station attendants and Nomadic cattle rearers were collected and analysed for blood lead, Calcium and Zinc levels.

2.3. Study Population and Sampling Techniques

This study was carried out among Petrol station attendants and Nomadic cattle rearers in Ilorin West Local Government Area. Consented Petrol station attendants (40) and Nomadic cattle rearers (29) participated in the study. Petrol station attendants are city dwellers and their main foods include meat fish and cereals rich in carbohydrate, protein, fat and oil, and are frequently exposed to lead from petroleum products. Whereas, Nomadic cattle rearers are livestock farmers that move from one location to another in search of adequate and green pasture/graze land for cattle, sheep and other ruminant animals in their custody. They feed majorly of fresh cow milk and cereals with little meat intake and have little or no exposure to motor sprit which is one of the major sources of lead. Consenting participants were interviewed using a validated interviewer administered questionnaire while blood samples were also collected for blood lead, calcium and zinc analysis.

2.4. Data Collection Procedure

During data collection, the research assistants explained the study objectives to the participants to ensure that they understood all aspects of the study. Also, consent forms after they had been completed and signed, were obtained from Petrol Station Attendants and Nomadic cattle rearers who participated in the study. Participants that declined to participate were excluded from the study. At the planning stage of the study, the researchers approached the authorities' in-charge of the selected petrol station particularly the owner and the manager in charge of the selected station with formal letters to obtain permission to carry out the work among the petrol station attendants in the station. Similarly, "Seriki" (Head of the selected Nomadic cattle rearers were approached with formal request to obtain approval for questionnaire administration and blood sample collection among consented Nomadic cattle rearers village. Moreover, a meeting session each was organized with all the consented petrol station attendants and Nomadic cattle rearers to discuss the purpose and objective of the study. These schedules were made necessary to ensuring that they understood all aspects of the study and both informed consent taken. The petrol station authority and "Seriki" granted permission and assigned two people each to supervise the collection of blood samples from their members. Consent forms after they had been completed and signed, were obtained from petrol station authority, the "Seriki" and the individual who participated in the study. Consenting individuals (petrol station attendants and Nomadic cattle rearers) were interviewed while blood samples were collected immediately after the interview from the participants. Interviews were conducted by four trained research assistants (male and female) who had post-secondary education certificate and were acquainted with questionnaire research. They were trained on how to use the instrument and how they should introduce themselves and the research objectives modestly to the participants during the data collection.

2.5. Laboratory Analysis

Blood samples (about 5 ml) were collected from each consented participant through the antecubital fossa using disposable, pyrogen-free 5ml needle and syringe with the help of a trained laboratory scientist. The scientist employed the change of gloves, and needle and syringe with each participant during sample collection. The blood sample obtained was dispensed into Lithium-heparinized vacutainer for the analysis of lead in blood, calcium (Ca) and Zinc (Zn). These were mixed thoroughly immediately after been dispensed into the vacutainers. The blood samples obtained were put in an ice pack and transported to the laboratory. The blood lead, Calcium and Zinc level determination was carried out using Atomic Absorption Spectrophotometer (Model PU9100X).

2.6. Data Analysis

Data generated from the field were edited daily. Then they were coded and entered into the computer for analyses using the SPSS Windows Version 20 statistical software packaged. Data were presented as mean standard deviation for continuous variables and percentages for categorical variables. Statistical difference in the mean of lead, calcium and zinc between the petrol station attendants and Nomadic cattle rearers were determined using t-test. Pearson's product moment correlation coefficients were computed to determine the associations between continuous variables. Statistical significance was defined at $p < 0.05$.

2.7. Ethical Consideration

The study was approved by the joint Ethical committee of University of Ibadan and University College Hospital, Ibadan, Nigeria. Consent was obtained from the authorities' in-charge of the selected petrol station and "Seriki" (head of the selected Nomadic cattle rearers). Also, informed consent was obtained from the individual petrol station attendants and nomadic cattle rearers.

3. Results

3.1. Sociodemographic Characteristics

Table 1. Sociodemographic characteristics

Characteristics	Petrol Station Attendants (%)	Nomadic cattle rearers (%)
Age group (In years)		
< 20	0 (0.0)	6 (20.7)
20-29	20 (50.0)	12 (41.4)
30-39	10 (25.0)	8 (27.6)
40+	10 (25.0)	3 (10.3)
Mean±SD	**28.7±3.4**	**30.3±2.8**
Sex		
Male	22 (55.0)	20 (69.0)
Female	18 (45.0)	9 (31.0)
Religion		
Christian	10 (25.0)	0 (0.0)
Islam	30 (75.0)	29 (100.0)
Ethnicity		
Yoruba	37 (92.5)	0 (0.0)
Igbo	3 (7.5)	0 (0.0)
Fulani	0 (0.0)	29 (100.0)
Marital status		
Single	6 (15.0)	11 (37.9)
Married	31 (77.5)	18 (62.1)
Separated	3 (7.5)	0 (0.0)
Education		
No formal education	2 (5.0)	5 (17.2)
Arabic	0 (0.0)	11 (37.9)
Primary	25 (62.5)	5 (17.2)
Secondary	9 (22.5)	6 (20.7)
Tertiary	4 (1.0)	2 (6.8)

Sociodemographic characteristics of the participants is presented in Table 1. The mean ages of the petrol station attendants and the nomadic cattle rearers were 28.7±3.4 and 30.3±2.8 years respectively. More than half (55.0%) of the petrol station attendants and 69.0% nomadic cattle rearers were male. Most of the respondents 75.0% (petrol station attendants) and 100% nomadic cattle rearers were practicing Islam. Most 92.5% of the petrol station attendants were Yoruba while 100.0% of the nomadic cattle rearers were Fulani. Majority 77.5% petrol station attendants and 62.1% nomadic cattle rearers were married. Majority 62.5% of the petrol station attendants had completed primary education while 37.9% of the nomadic cattle rearers had completed Arabic education.

3.2. Levels of Lead, Calcium and Zinc

Level of lead concentrations was obtained from the petrol station attendants and nomadic cattle rearers and the result presented in Table 2. The blood lead of the nomadic cattle rearers were relatively low compared to petrol station attendants. All the petrol station attendants (100%) and 5 (17.2%) of the nomadic cattle rearers had blood lead level. The mean blood lead (µg/dL) of the petrol station attendants and nomadic cattle rearers were 14.22±3.24 and 2.24±0.64 respectively. There was a significant difference between the petrol station attendants and nomadic cattle rearers blood lead level. Calcium was significantly higher among nomadic cattle rearers (21.40±1.83mg/L) compared to those of the Petrol station attendants (13.73±1.88mg/L). Likewise, the mean blood zinc in the nomadic cattle rearers (13.28±3.01µg/dL) was significantly higher than those of the Petrol station attendants (3.13±0.68µg/dL). Several petrol station attendants (42.5%) and none (0.0%) of the nomadic cattle rearers had blood lead level of 10µg/dL and above (Figure 2).

Table 3 presents the correlation of the study parameters-blood lead, calcium and zinc. There were no significant correlation between the blood lead of petrol station attendants and their blood calcium level ($r = 0.273$, $p > 0.05$), and zinc level ($r = 0.395$, $p > 0.05$). These findings suggest that increase in the blood lead level of the petrol attendant may not be associated with their level of blood calcium and zinc. However, there was an inversely correlation between blood lead level of nomadic cattle rearers and their calcium level ($r = -0.531$, $p < 0.05$), and zinc level ($r = -0.405$, $p < 0.05$). This is an indication that nomadic cattle rearers had lower blood lead level with an elevated blood calcium and zinc concentration.

Table 2. Level of Lead, Calcium and Zinc

Parameter	Petrol station attendants	Nomadic cattle rearers	F statistics	p-value
	Mean±SD	Mean±SD		
Lead (Pb) (µg/dL)	14.22±3.24	2.24±0.64	231.457	<0.001
Calcium (Ca) (mg/L)	10.73±1.88	21.40±1.83	201.117	<0.001
Zinc (Zn) (µg/dL)	3.13±0.68	13.28±3.01	340.83	<0.001

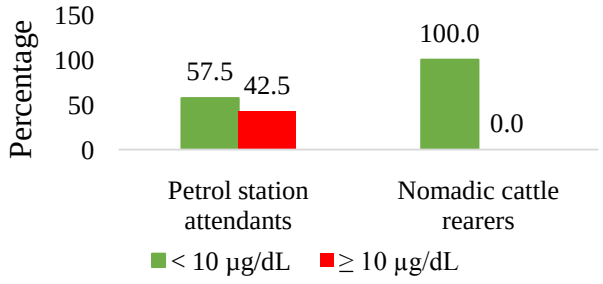

Figure 2. Category of blood lead level

Table 3. Correlation matrix of the concentration of blood lead, calcium and Zinc

Variables	Blood lead	Clacium	Zinc
Petrol station attendants			
Blood Lead	1		
Calcium	0.273	1	
Zinc	0.395	0.092	1
Nomadic Cattle Rearers			
Blood Lead	1		
Calcium	-0.531*	1	
Zinc	-0.405*	0.174	1

*Correlation is significant at the 0.01 level (2-tailed).

3.3. Knowledge and Awareness of Lead and Causes of Lead Poisoning

Information on knowledge and awareness of lead, and the causes of lead poisoning were collected and presented in Table 4. Majority (95.0%) of the petrol station attendants and 10.3% of nomadic cattle rearers reported that lead exist. Exactly a half (50.0%) of the petrol station attendants and 6.9% of nomadic cattle rearers said that lead is present in petrol. Most (95.0%) of the petrol station attendants and 3.4% of the nomadic cattle rearers stated that they have heard about lead poisoning. The major sources of information about lead poising reported by the petrol station attendants were newspaper (65.0%) friends (15.0%) and boss (5.0%). Most of the petrol station attendants (87.5%) and nomadic cattle rearers (96.6%) reported that they don't know the actual causes of lead poisoning.

Comparison of respondents mean knowledge score about lead and lead poisoning (Table 5) revealed a significant difference in the mean knowledge score about existence of lead between petrol station attendants (16.5 ± 2.9) and nomadic cattle rearers (11.2±2.2). Likewise, petrol station attendants were more knowledgeable (14.3 ± 1.9) about lead poisoning compared to nomadic cattle rearers (t = 3.731, p = <0.001).

Table 4. Knowledge and awareness of lead and causes of lead poisoning

Knowledge of lead and lead poisoning	Petrol station attendants (%)	Nomadic Cattle rearers (%)
Knew that lead exist	38 (95.0)	3 (10.3)
Presence of lead in petrol	20 (50.0)	2 (6.9)
Heard about Lead poisoning	38 (95.0)	1 (3.4)
Informed about lead by friends	10 (15.0)	0 (0.0)
Informed about lead by their boss	3 (5.0)	0 (0.0)
Informed about lead through news papers	26 (65.0)	1 (3.4)
Reported causes of lead poisoning		
Disease	1 (2.5)	1 (3.4)
Smoking	0 (0.0)	28 (96.6)
Food	2 (5.0)	1 (3.4)
Don't know the causes	35 (87.5)	28 (96.6)

Table 5. Comparison of respondents Knowledge about Lead and Blood Lead level

Knowledge category	Respondents	N	Mean ± SD	t-statistics	p-value
About lead	Petrol station attendants	40	16.5 ± 2.9	3.687	<0.001
	Nomadic cattle rearers	29	11.2 ± 2.2		
Lead poisoning	Petrol station attendants	40	14.3 ± 1.9	3.731	< 0.001
	Nomadic cattle rearers	29	9.3 ± 1.2		

3.4. Dietary Intake Habits

Dietary intake habits of participants from the two occupational groups was carried out to investigate the source of calcium in the blood as presented in Table 6. It was observed that 20.0% of the petrol station attendants and 34.5% of nomadic cattle rearers reported that the usually eat pounded yam. About one-fifth (22.5%) of the petrol station attendants and 62.5% of the nomadic cattle rearer said they eat "Tuwo" (staple meal made from milled corn) while 30.0% (petrol station attendants) and 31.1% (nomadic cattle rearers) stated that they eat rice. More petrol station attendants (62.5%) than nomadic cattle rearer (44.8%) reported that they consumed meat while 42.5% petrol station attendants and 86.2% nomadic cattle rearer said they consumed Fura/Nunu (Sorghum palp/fresh cow milk). The two major food consumed by the nomadic cattle rearer daily were Fura/Nunu (Sorghum palp/fresh cow milk) (72.4%) and "Tuwo" (staple meal made from milled corn) (41.2%) while petrol station attendants (47.5%) consumed meat daily than nomadic cattle rearer (31.0%) as depicted in Figure 3.

Table 6. Common food taken by the Petrol station attendants and Nomadic cattle rearers

Common food	Petrol station attendants (%)	Nomadic cattle rearers (%)
Pounded yam	8 (20.0)	10 (34.5)
"Tuwo" (staple meal made from milled corn)	9 (22.5)	19 (65.5)
Rice	12 (30.0)	9 (31.0)
Meat	25 (62.5)	13 (44.8)
"Fura/Nunu" (Sorghum palp/fresh cow milk)	17 (42.5)	25 (86.2)

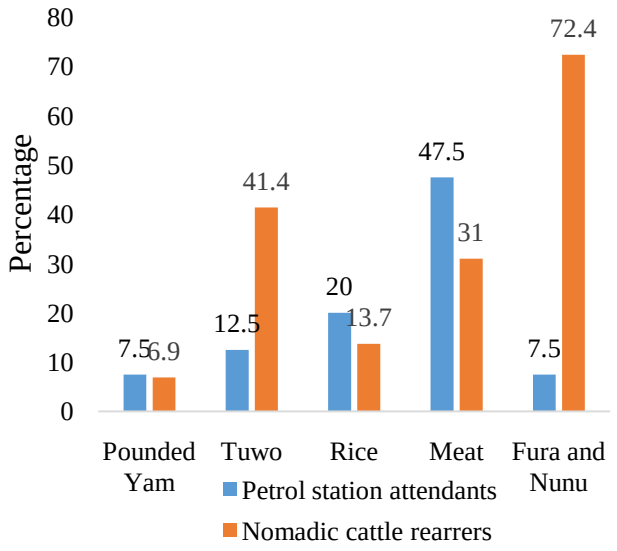

Figure 3. Food Consumption Style (consuming one of the food type at least once per day)

4. Discussion

The study documented levels of blood Lead, Zinc and Calcium among Petrol station attendants and Fulani Nomadic cattle rearers in Ilorin West Local Government Area, Nigeria. It was found that the mean blood lead (µg/dL) of the petrol station attendants and nomadic

cattle rearers were 14.22±3.24 and 2.24±0.64 respectively. However, 42.5% of the petrol station attendants and none (0.0%) of the nomadic cattle rearers had blood lead level of 10µg/dL and above. This proportion, among petrol station attendants, exceeded the accepted threshold limit of 10µg/dL and 5µg/dL recommended by the CDC [34]. The percentage (42.5%) among petrol station attendants with blood lead levels of 10 mg/dl or greater was higher to the proportion observed (34%) in Nigeria among individuals of all ages [35]. Although, the blood lead of the nomadic cattle rearers was significantly low compared to petrol station attendants. The study showed that the nomadic cattle rearers had lead in the blood despite their traditional life style and non-exposure to urban style of living.

The presence of lead in the blood of some nomadic cattle rearers indicated some level of exposure. Exposure to lead could be from any sources aside gasoline fuel. For instance, [36], in a study reported a significant correlation between blood lead and hair lead in people who used lead contained hair dyes. Also, lead with relatively high levels in a few instances has been found in most commonly sold household paints in Nigeria [37]. Other sources which may contribute to the body burden of toxic heavy metals in Nigeria includes soil, water, and foodstuff [38]. Furthermore, car washes could be potential sources of lead into the food chain through surface water. Unhygienic practices of handling leaded gasoline also occurred during inadequate fuel supply that usually resulted into panic buying using plastic containers by people from various professions. These plastics containers might often be reused for drinking water collection and storage without proper cleaning. These practices could result into accidental ingestion of lead. This explanation is supported by Saliu [39] that occupational exposure to lead has been observed to occur both through inhalation of lead particles in aerosols or by accidental ingestion in the work place.

Calcium and zinc concentrations were significantly higher among nomadic cattle rearers compared to those of the Petrol station attendants. Reduction in the calcium and zinc in petrol attendant suggests that there are disparities in the types of food consumed among the two occupational categories. Wide variations in the levels of trace elements have been recorded to have suggested a wide nutritional disparity among the study participants [40]. Furthermore, the decrease in calcium and zinc concentrations among petrol station attendants might accounted partly for the high lead level observed. This revealed some similarity with the findings of [41] that high blood lead occurred with low blood calcium. There was no significant correlation between the blood lead of petrol station attendants and their blood calcium level and zinc level. This finding is an indication that increases in the blood lead level of the petrol attendant may not be associated with their decrease in level of blood calcium and zinc. This contradicts some empirical observations that iron [42] and zinc [28] de-ficiencies have been reported to have increase lead absorption among the study participants. However, inverse positive correlation occurred between blood lead level of nomadic cattle rearers and their calcium level, and zinc level. This suggests that nomadic cattle rearers had lower blood lead level with an elevated blood calcium and zinc concentration. The low level of lead among the nomadic cattle rearers may be as a result of the diet, which included fresh milk from cattle. Milk belonged to the group of food that are good sources of calcium while meat belonged to the moderately good sources and rice, poor sources of calcium [43].

In the present study, the Zn level was significant lower among the petrol station attendants compared to nomadic cattle rearers. Similar results have been reported by Mehdi [44] and [45]. Also, [46] observed that the Zn blood level decreased by 34 % in artisans who were occupationally exposed to lead. When examining zinc-lead miners, [47] observed a positive correlation amongst Zn and lead blood levels and significant elevation of these parameters among exposed workers compared with the non-exposed. However, it is possible to expect that simultaneous exposure to Zn may improve antioxidant defense and, therefore, alleviate lead toxicity. This could be used to explain why the blood lead level in the petrol station attendants was higher than those of the nomadic cattle rearers. Nevertheless, the total concentration of zinc alone was not a good predictor of lead toxicity [48]. The high blood zinc in the cattle farmers might not be as a result of decrease in blood lead but of nutrition status.

Studies have documented inadequate knowledge and awareness of lead exposure and its health effect among adults in Nigeria, particularly from domestic sources [49], [50]. This study revealed that petrol station attendants were more knowledgeable about the existence of lead and its occurrence in petrol. This ascertain the disparities in the knowledge about lead and its occurrence in petrol among the two occupational groups that participated in this study. It shows that nomadic cattle rearers were not aware about lead by nature of their occupations. This is similar to Mehta and Binns [51] in a study which observed that both youth and adults demonstrated high awareness and accurate knowledge of paint and dust, but their knowledge of other exposure sources was inadequate. However, petrol attendant could not translate their knowledge into practice of preventing possible exposure through inhalation and ingestion. This is in accord with a study conducted by Poliuka [52]. The study observed that rural residents' knowledge and awareness of lead poisoning had no impact on the handling of leaded gasoline. Those that had previous knowledge of lead also had high blood lead level despite that there were awareness of lead poisoning.

Low proportion (3.4%) of the nomadic cattle rearers reported that they have heard about lead poisoning and the major sources being friends. This source alone (friend) might not be fortified with enough information about lead, thus providing inadequate information to their peers which could hinder their action against exposure to source of lead. This corroborates [53] finding that available sources of environmental health information as barrier to move towards engaged environmental health action. According to Berner [54], most of the workers have little or no idea about the toxic effects of this metal they exposed, hence they pay little attention to protecting themselves from the possible inhalation or ingestion of such toxic substance. They were neither given awareness on the issue nor advised to take the necessary protective measures. However, bad practice of handling leaded gasoline occurred during inadequate fuel supply that usually resulted into panic buying using plastic containers by people from various

professions. These plastics were often reused at home as water storage containers. This is similar to findings of Kumar [55], that lack of proper hygiene and education was one of the reasons for the observed high Blood Lead Levels in some of the workers under investigation. Appropriate hygienic practices could be the preferred way of reducing lead exposure at the workplace, especially in developing countries [54].

Nutritional factors such as irregular patterns of feeding, high fat intake, marginal calcium ingestion and iron deficiency have been associated with susceptibility to lead (Pb) toxicity [56]. Similarly diets low in calcium, zinc, and phosphorus are associated with increased lead absorption and toxicity [27]. Although, large proportion of participants have been reported to have unsatisfactory level of knowledge about lead exposure in the domestic environment, preventive measures and the role of nutrition in decreasing the effect of exposure [50]. This study, however, revealed that more nomadic cattle rearers than the petrol station attendants reported that they consumed "Tuwo" (staple meal made from milled corn) and rice. The primary source of these staple food is cereals. This is one of the food that are rich in zinc, others include millet, sorghum and groundnuts. These findings ascertained that nomadic cattle rearers consumed more food that are rich in zinc compared to their petrol attendant counterpart. This might be one of the reasons for low lead level among the nomadic cattle rearers. Zinc has been recognized as a potent antagonist to lead intoxication and its administration has been shown to decrease the accumulation of lead in body organs [26]. Therefore, diets rich in zinc reduces severity of lead poisoning by restoring lead-induced biological alteration in urinary and blood parameters in animals. Diets that are deficient in calcium, phosphorus and zinc may therefore result in increased lead absorption [35,57]. Foods that are rich in calcium and phosphorus include milk, beans, butter, cheese, beef and eggs. This study, however, found that most of the nomadic cattle rearers compared to the petrol station attendants reported that they consumed Fura/Nunu (Sorghum palp/fresh cow milk). The major food consumed by the cattle rearer daily were Fura/Nunu (Sorghum palp/fresh cow milk) and "Tuwo" (staple meal made from milled corn).

5. Conclusion

The effect of occupational exposure to lead on the metabolism of trace metals appears to be limited and concerns mainly their tissue distribution. However, results of the present study indicate that blood lead level was significantly higher among petrol station attendants compared to nomadic cattle rearers. Though some level of blood lead was observed among the latter study group. Calcium and Zinc level was significantly higher among the nomadic cattle rearers compared to petrol attendant. However, higher values of calcium and zinc observed among the nomadic cattle rearers were not only attributed to low lead level, also to nutrition status. Nomadic cattle rearers consumed more food that is rich in calcium and zinc compared to their petrol attendant counterpart. The reported foods commonly consumed among the nomadic cattle rearers were Fura/Nunu (Sorghum palp/fresh cow milk) and "Tuwo" (staple meal made from milled corn). These staples are rich in calcium and zinc. The study found that calcium and zinc from certain staple foods were higher among nomadic cattle rearers than their petrol attendant counterpart. This micronutrient could contribute to the low blood lead among nomadic cattle rearers. However, knowledge about the lead poisoning and it sources were poor among the nomadic cattle rearers. There is need for education and enlightening programme about lead poising and awareness about dietary intake which are rich in micronutrients that could reduce lead toxicity.

Acknowledgements

The Authors acknowledge the immeasurable contribution of nomadic cattle rearer head ("Seriki") and petrol station attendants' authority in Ilorin West Local Government Area and the individual cattle rearer and petrol attendant who gave their consent to ensure the work was successful.

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