MSI Journal of
Medicine and Medical Research (MSIJMMR)

Community-Based Survey of Socioeconomic, Occupational, Environmental Exposures on Heavy Metals and Health Outcomes in some part of Taraba State, Nigeria

Bilyaminu, Habibu[1*], Ezeonu, Chukwuma Stephen[2]

[1*,2]Department of Biochemistry, Faculty of Biosciences, Federal University Wukari, Taraba state, Nigeria.

*** Correspondence:** Bilyaminu, Habibu

The authors declare that no funding was received for this work.

OPEN ACCESS

Received: 10-January-2026
Accepted: 21-February-2026
Published: 01-March-2026

This article is published in the **MSI Journal of Medicine and Medical Research (MSIJMMR)**
ISSN 3049-1401 (Online)

The journal is managed and published by MSI Publishers.

Volume 3, Issue 1 (Jan-Apr), 2026

ABSTRACT: Background: Rural and peri-urban populations in low and middle income countries experience overlapping socioeconomic deprivation, occupational hazards, and environmental exposures that may exacerbate disease burden. In Nigeria, subsistence farming, widespread pesticide use, unsafe water sources, and emerging informal industrial activities create complex exposure pathways, yet community level evidence remains limited.

Objective: This study investigated socioeconomic and occupational characteristics, environmental exposures, dietary patterns, lifestyle behaviors, and health outcomes across nine Local Government Areas (LGAs) covering the three geo-political zones of Taraba State, Nigeria.

Methods: A cross-sectional community-based survey was conducted across the three geopolitical zones of Taraba State using a structured, interviewer administered questionnaire. Descriptive and comparative analyses were performed to characterize demographic distributions, exposure profiles, symptom prevalence, and self-reported or clinically diagnosed health conditions.

Results: The population was predominantly of low educational attainment with only 8 to 10% having attained tertiary education level and engaged mainly in subsistence farming with about 80 to 90% of the respondents from the surveyed areas. Pesticide exposure, reliance on borehole and well water, and proximity to small scale industrial activities were common. Diets were dominated by locally produced tubers (cassava, yam, and sweet potato), with widespread use of herbal and traditional remedies. Symptom prevalence was high, particularly fatigue, headache, skin diseases, abdominal pain, joint pain, and mood changes. Diagnosed conditions included Heavy metal exposure, kidney and liver disorders, and cancers. Most affected individuals were not receiving regular medical treatment due to poverty, illiteracy, and limited healthcare access.

Conclusion: The convergence of socioeconomic disadvantage, occupational and environmental exposures, and unmet healthcare needs represents a significant public health challenge in Taraba State. Integrated environmental, agricultural, and health-system interventions are urgently required.

Keywords: *Environmental exposure; community survey; pesticide use; heavy metals; tubers; Taraba State; Nigeria.*

Introduction

Communities in sub-Saharan Africa often experience complex exposure scenarios arising from poverty, low educational attainment, and dependence on agriculture for livelihoods. In Nigeria, smallholder farmers frequently use pesticides with limited training and inadequate protective equipment, increasing the risk of chronic exposure (Akinyemi *et al*., 2018). Concurrently, environmental contamination from informal industrial activities and unsafe water sources may contribute to heavy-metal exposure, notably lead, chromium, cadmium, arsenic and mercury which remains a significant public-health concern (WHO, 2019).

Dietary dependence on locally produced staples such as cassava (*Manihot esculenta*), yam (*Dioscorea* spp.), and sweet potato (*Ipomoea batatas*) is nutritionally important but may also represent a pathway for exposure to environmental contaminants when cultivated on polluted soils (FAO/WHO, 2011). Limited healthcare access, coupled

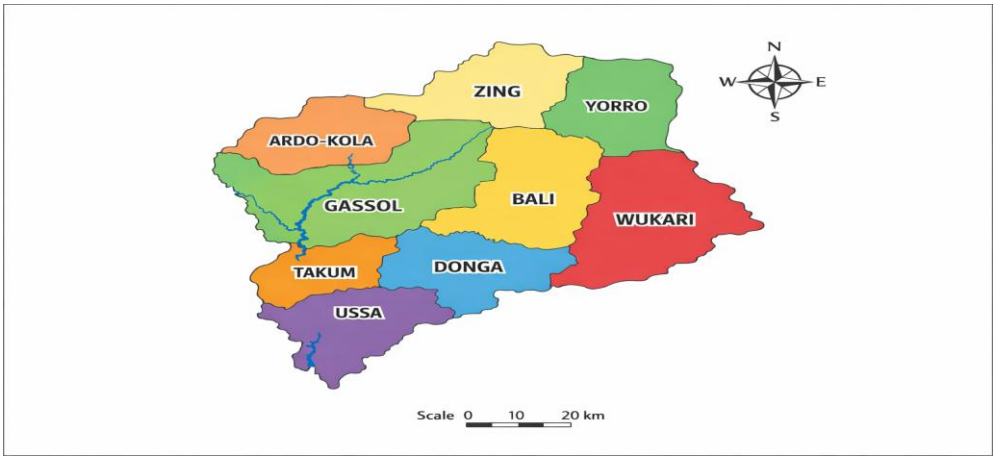
with poverty and illiteracy, further exacerbates disease burden, often resulting in under-treatment or complete absence of medical care for chronic conditions (Aregbeshola & Khan, 2018).

Taraba State, located in northeastern Nigeria, is characterized by ecological diversity, widespread agriculture, and emerging small-scale industrial activities. However, systematic community-level data linking socioeconomic conditions, occupational exposures, dietary habits, and health outcomes remain scarce. This study aimed to fill this gap by conducting a comprehensive survey across nine LGAs representing the three geopolitical zones of Taraba State.

Materials and Methods

Study Area

The study was conducted in nine LGAs of Taraba State, Nigeria: Zing and Yorro (Northern zone); Ardo-Kola, Gassol, and Bali (Central zone); and Ussa, Donga, Takum, and Wukari (Southern zone). The state lies between latitudes 6°25′–9°30′N and longitudes 9°30′–11°45′E and is predominantly agrarian (NPC, 2006).



Fig; 1. A Sketched Map Representing Some Study Areas of Taraba State. (UN OCHA, 2018)

Zing LGA

Zing LGA lies in the northern part of the study area, with undulating terrain influenced by the Mambilla highlands. The area experiences moderate rainfall and supports subsistence farming, particularly tuber crops, maize, sorghum, millet, and

groundnuts. Livestock rearing is also common, and settlements are largely rural with limited industrial activity (Taraba State Government, 2020).

Yorro LGA

Yorro LGA is located east of Zing and is predominantly agrarian. The LGA is known for root and tuber cultivation (yam, sweet potato and cassava) as well as cereals. Poor road infrastructure and dispersed settlements affect access to healthcare and markets. Streams draining into the Benue basin influence local water availability (Taraba State Government, 2020).

Ardo-Kola LGA

Ardo-Kola LGA lies close to Jalingo, the state capital, and is relatively more urbanized compared to other LGAs in the study area. Farming, trading, and civil service employment dominate livelihoods. The proximity to urban centers has increased land-use pressure, with implications for soil quality and environmental contamination (Taraba State Government, 2020).

Gassol LGA

Gassol is one of the largest LGAs in Taraba State and is traversed by the **River Benue**, making floodplain agriculture a major activity. Rice, maize, cassava, Yam, sweet potato and vegetables are extensively cultivated. Seasonal flooding enhances soil fertility but also raises concerns about pollutant transport and food safety (Taraba State Government, 2020).

Bali LGA

Bali LGA occupies a central position and serves as an agricultural and commercial hub. The fertile plains support large-scale cultivation of yam, cassava, potato, rice, and legumes. Informal mining and agrochemical use have been reported in surrounding rural communities, raising environmental and public health concerns (Taraba State Government, 2020).

Donga LGA

Donga LGA is located in southern Taraba State and is characterized by forest savanna mosaic vegetation. Agriculture is the mainstay, with cocoa, yam, cassava,

sweet potato and maize commonly produced. Small-scale processing of agricultural produce is prevalent, with limited regulatory oversight (Taraba State Government, 2020).

Takum LGA

Takum LGA is a major commercial center in southern Taraba State, linking Nigeria to Cameroon through cross-border trade. The LGA supports diverse agricultural activities and artisanal enterprises. Increased human activities and urban growth contribute to environmental pressure on land and water resources (Taraba State Government, 2020).

Ussa LGA

Ussa LGA is predominantly rural, with scattered settlements and heavy dependence on rain fed agriculture. Cassava, yam, potato and maize dominate food production. The LGA has limited infrastructure, and residents rely heavily on local water sources, increasing vulnerability to environmental contamination (Taraba State Government, 2020).

Wukari LGA

Wukari LGA is historically and economically significant, hosting the Kwararafa Kingdom and serving as an agricultural and educational center. The area supports mixed farming systems and growing urbanization. Increased population density and agricultural intensification have implications for soil and food quality (Taraba State Government, 2020).

Relevance to Environmental and Public Health Studies

The selected LGAs are representative of agrarian communities in Taraba State, where livelihoods depend heavily on soil, water, and food crops. Variations in land use, flooding patterns, agrochemical application, and proximity to urban centers make these LGAs suitable for environmental exposure, heavy-metal contamination, and food safety studies (Adejuwon, *et al.*, 2012).

Study Design and Population

A cross-sectional community-based survey was carried out among adult residents (≥18 years) who had lived in their respective communities for at least fifteen years, ensuring meaningful assessment of chronic environmental and dietary exposures.

Questionnaire Development and Administration

A structured questionnaire was developed based on validated community health and environmental exposure assessment frameworks. The instrument captured socioeconomic status, occupational history, pesticide use, proximity to industrial activities, water sources, dietary intake (with emphasis on tuber consumption), lifestyle behaviors, medical history, and access to healthcare. Face-to-face interviews were conducted by trained field assistants in English and local languages.

Integration with Heavy-Metal and Food Contamination Assessment

To enable seamless integration with laboratory-based environmental and food contamination analyses, the questionnaire was designed to capture detailed exposure surrogates relevant to heavy-metal intake pathways. These included frequency and quantity of consumption of cassava, yam, and sweet potato; source and treatment of drinking water; duration of residence; and occupational contact with agrochemicals and industrial materials (Alloway, *et al.,* 2013).

The study framework allows future incorporation of:

- **Food analysis:** Determination of heavy metals (e.g., Pb, Cd, Cr, As, Hg) in locally produced tubers using atomic absorption spectrophotometry or inductively coupled plasma mass spectrometry.
- **Soil and Water analysis:** Assessment of Soil, borehole and well water for heavy-metal contamination.
- **Risk assessment:** Estimation of estimated daily intake (EDI), hazard quotient (HQ), hazard index (HI), and lifetime cancer risk (LCR) based on measured concentrations and community specific consumption data.

This integrated approach strengthens causal inference between environmental contamination, dietary exposure, and observed health outcomes.

Data Collection

Trained field assistants administered the questionnaire through face-to-face interviews in English and local languages. Ethical approval was obtained from a relevant institutional review board, and informed consent was secured from all participants.

Data Analysis

Descriptive statistics summarized frequencies and percentages. Associations between demographic distributions, exposure profiles, and symptom prevalence where laboratory data become available, multivariable regression and health-risk assessment models can be applied to evaluate exposure response relationships (NBS, 2010).

Results

Education Attainment of Respondents by LGA

Across the nine LGAs, respondents were predominantly adults engaged in subsistence farming covering about 80% to 90%, with low levels of formal education. Tertiary education attainment was uncommon, while primary or no formal education predominated in all the study areas with more than 70% from the respondents (NBS, 2017). (Table 1).

Table 1. Education Attainment of Respondents by LGA

LGA	**Dominant Occupation (%)**	**No Education/Primary Education (%)**	**Secondary Education (%)**	**Tertiary Education (%)**
Zing	Farming (86.6)	68	25	7
Yorro	Farming (92.5)	71	22	7
Ardo-Kola	Farming (92.3)	65	27	8
Gassol	Farming (74.5)	70	23	7
Bali	Farming (76.5)	72	21	7

Ussa	Farming (63.3)	67	25	8
Donga	Farming (68.4)	66	26	8
Takum	Farming (72.0)	64	27	9
Wukari	Farming (60.4)	60	30	10

Occupational and Environmental Exposure Profile

Regular consumption of locally produced tubers by the populace from the respondents implies the level of exposure to heavy metals due to it transportation from soil to the plant and end up being consumed by human, Occupational exposure assessment revealed widespread pesticide use among farmers, frequently without adequate personal protective equipment. Environmental exposure was further shaped by proximity to informal or small-scale industrial activities and reliance on groundwater sources (World Bank, 2018).

Table 2. Occupational and environmental exposure profile of respondents

Exposure Variable	Number of Respondents	(%)
Regular consumption of locally produced tubers	306	24.3
Regular pesticide use	194	15.3
Use of PPE during pesticide application	87	7.6
Residence near industrial/artisanal activities	113	9.4
Primary water source: Borehole	201	15.5
Primary water source: Hand-dug well	274	21.2
Primary water source: Surface water	78	6.7
Total	1340	100

Dietary Patterns and Lifestyle Behaviors

Dietary intake was characterized by heavy dependence on locally produced tubers, particularly cassava, yam, and sweet potato. Herbal and traditional remedies were commonly used alongside conventional foods, while imported canned foods were consumed intermittently. Smoking and alcohol consumption were reported by a minority of respondents (<20%).

Prevalence of Symptoms and Diagnosed Health Conditions

Self-reported symptom prevalence was high across all LGAs, with headaches covering about 258 respondents amounting to over 15% followed by fatigue with a

report of about 224 covering about 13% being the most common complaints. Respondents also reported a range of clinically diagnosed conditions such as cancer, kidney and liver diseases (Table 3).

Table 3. Prevalence of Reported Symptoms and Diagnosed Health Conditions

Health Indicator	Prevalence on respondents	(%)
Fatigue	224	13.03
Headache	258	15.06
Skin diseases	144	8.37
Abdominal pain	139	8.08
Joint pain	186	10.82
Mood changes	201	11.69
Diagnosed Heavy metals exposure	56	3.25
Anemia	135	7.85
Cancer (all types)	132	7.67
Kidney disorders	118	6.86
Liver disorders	126	7.32
Total	1719	100

Access to Healthcare and Medication Use

Despite the burden of symptoms and diagnosed illnesses, the majority of affected respondents reported not being on regular medication. Key barriers included poverty, illiteracy, long distance to health facilities, and inconsistent availability of healthcare services (NBS, 2010).

Discussion

Interpretation of Key Findings

This study provides one of the most comprehensive community-level assessments linking socioeconomic status, occupational practices, environmental exposures, dietary habits, and health outcomes across multiple LGAs in Taraba State. The dominance of subsistence farming, low educational attainment, and widespread pesticide use reflects structural vulnerabilities that heighten exposure risks (Akinyemi *et al.,* 2018). Reliance on borehole and well water, particularly in areas

proximal to informal industrial activities, further suggests potential pathways for chronic heavy-metal exposure (Edokpayi *et al.,* 2018).

Relevance to Heavy-Metal and Food Contamination Research

The heavy dependence on locally produced cassava, yam, and sweet potato underscores the importance of food-based exposure pathways (FAO/WHO, 2011). Previous studies have demonstrated that tubers cultivated on contaminated soils can accumulate toxic metals, notably lead and cadmium, which are associated with anemia, renal impairment, hepatic dysfunction, and carcinogenic outcomes. The diagnosed conditions reported by respondents in this study are biologically plausible consequences of long-term low-dose heavy-metal exposure, reinforcing the need for integrated biological, environmental and dietary assessments (WHO, 2019).

Policy and Public Health Implications

From a policy perspective, the findings highlight critical gaps in environmental regulation, occupational safety, and rural healthcare delivery. Strengthening pesticide governance, enforcing environmental monitoring around industrial activities, and instituting routine surveillance of food crops and drinking water are essential. Public-health interventions should prioritize community education, expansion of primary healthcare services, and subsidized screening for heavy-metal exposure in high-risk populations (World Bank, 2018).

Strengths and Limitations

A major strength of this study is its wide geographic coverage across three geopolitical zones and nine LGAs, providing a robust representation of rural and peri-urban communities in Taraba State. The comprehensive questionnaire captured multiple exposure domains, enabling integration with future laboratory analyses. However, the cross-sectional design limits causal inference, and reliance on self-reported diagnoses may introduce recall bias. The absence of contemporaneous environmental and biological measurements is a limitation that future studies should address.

Future Research Directions

Future studies should incorporate direct measurement of heavy metals in food crops, Soil and water sources, and biological samples (blood or urine) to validate exposure health relationships. Longitudinal designs would strengthen causal inference, while geospatial analysis could identify contamination hotspots. Integrating socioeconomic interventions with environmental remediation and healthcare access research will be critical for reducing disease burden in vulnerable Nigerian communities.

Conclusion

Communities across the nine LGAs of Taraba State are predominantly agrarian, with approximately 80–90% of respondents engaged in farming and exhibiting low educational attainment. The high prevalence of self-reported symptoms such as headaches and fatigue, alongside some minor reported diagnoses of cancers kidney and liver disorders, aligns with potential chronic exposure to environmental toxicants through multiple pathways. Within a human health risk-assessment framework, regular pesticide application without personal protective equipment represents a significant direct exposure route via dermal contact and inhalation, while dependence on wells and boreholes as primary drinking-water sources introduces an ingestion pathway for dissolved heavy metals and agrochemical residues.

These combined exposure routes increase the likelihood of elevated non-carcinogenic risk, where hazard quotients (HQs) for individual contaminants may exceed acceptable thresholds, and cumulative hazard indices (HI) may surpass unity due to simultaneous exposure to multiple metals and pesticide compounds. Moreover, the reported occurrence of cancer cases raises concern for long-term carcinogenic risk, particularly through chronic ingestion of contaminated water and food crops, where lifetime cancer risk (CR) may exceed internationally accepted benchmarks. The interaction of occupational exposure, environmental contamination, and socioeconomic constraints further amplifies cumulative risk, reducing community resilience and adaptive capacity.

Overall, the findings highlight a scenario of compounded non-carcinogenic and carcinogenic health risks driven by pesticide misuse and potential heavy-metal

contamination of environmental media. Integrated interventions are urgently required, including environmental monitoring to quantify contaminant concentrations, formal HQ, HI, and CR assessments, promotion of safer pesticide handling and PPE use, protection of groundwater sources, and strengthened primary healthcare services. Such risk-informed strategies are essential for mitigating exposure, reducing cumulative health burdens, and supporting evidence-based policy decisions in rural agrarian communities of Taraba State.

Recommendations

- Community education on safe pesticide handling and use of protective equipment.
- Regular monitoring of water quality and agricultural soils for heavy metals.
- Strengthening of primary healthcare infrastructure and outreach services.
- Policy support for poverty alleviation and adult literacy programs.

References

1. Adejuwon, J. O. (2012). *Rainfall seasonality in the Niger Basin*. Journal of Geography and Regional Planning, 5(2), 51–60.
2. Akinyemi, O., *et al.* (2018). Pesticide use practices and health effects among Nigerian farmers. *Environmental Health Insights*, 12, 1–9.
3. Alloway, B. J. (2013). *Heavy metals in soils* (3rd ed.). Springer.
4. Aregbeshola, B. S., & Khan, S. M. (2018). Out-of-pocket payments, catastrophic health expenditure and poverty among households in Nigeria. *International Journal of Health Policy and Management*, 7(9), 798–806.
5. CDC (2015). *Community Health Assessment and Group Evaluation (CHANGE) Tool*. Centers for Disease Control and Prevention.

6. Edokpayi, J. N., *et al*. (2018). Groundwater contamination and health implications in developing countries. *International Journal of Environmental Research and Public Health*, 15(2), 1–24.

7. FAO/WHO (2011). *Joint FAO/WHO Food Standards Programme: Codex Alimentarius Commission Working document on contaminants in foods*.

8. FAO/WHO. (2011). *Joint FAO/WHO food standards programme: Contaminants in food*. Rome.

9. https//www.unocha.org/publications/map/nigeria/nigeria-reference-map-taraba-state-24-december-2018

10. National Bureau of Statistics (NBS). (2010). *Nigeria Living Standards Survey*. Abuja, Nigeria.
National Population Commission (NPC). (2006). *Population and Housing Census of the Federal Republic of Nigeria*. Abuja.

11. National Bureau of Statistics (NBS). (2017). *Demographic statistics bulletin*. Abuja.

12. Taraba State Government. (2020). *Taraba State Development Profile*. Jalingo, Nigeria.

13. WHO (2019). *Preventing disease through healthy environments: Exposure to lead*. World Health Organization.

14. World Bank. (2018). *Agriculture and rural development in Nigeria: Policy and practice*. Washington, DC.