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Assessment of Occupational Exposure to Carcinogenic Agrochemicals Among Farmers in Ilorin Metropolis, Kwara State, Nigeria

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ABSTRACT

Background: Farmers are at high risk of occupational exposure to carcinogens found in agrochemicals, which are linked to hematological cancers. In Nigeria, particularly in Ilorin Metropolis, there is a paucity of localized data on exposure levels and associated health risks.

Objective: To assess the level of occupational exposure to carcinogens in agrochemicals among farmers in Ilorin Metropolis, Kwara State, Nigeria.

Methods: A descriptive cross-sectional study was conducted among 343 farmers using a structured, interviewer-administered electronic questionnaire. Data were analyzed using SPSS version 23, employing descriptive statistics, regression analysis, and ANOVA to examine agrochemical usage, safety practices, exposure levels, and associated health outcomes.

Results: The study revealed widespread use of agrochemicals classified as known or suspected carcinogens, including glyphosate (9.33%), 2,4-D (16.91%), and malathion (12.83%). Regression analysis identified significant associations with carcinogenic agrochemicals ($p = 0.011$). Although 71.14% reported consistent use of Personal Protective Equipment (PPE) and 65.89% had safety training, 41.11% experienced symptoms such as skin irritation (29.74%) and respiratory issues (26.82%). ANOVA showed PPE significantly reduced exposure ($p < 0.05$). However, regression indicated that most farmers were not at significant exposure levels due to protective measures. All respondents expressed interest in safety training.

Conclusion: Farmers in Ilorin face moderate to high exposure to known carcinogens, mitigated by existing safety practices. Persistent gaps in knowledge and practice necessitate enhanced regulatory enforcement, affordable PPE provision, and sustained farmer education

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Introduction

Agricultural workers, particularly farmers, are disproportionately exposed to known and suspected carcinogenic agrochemicals, including herbicides, insecticides, and pesticides, which are linked to hematological malignancies such as leukemia, lymphoma, and myeloma (Zahm *et al*., 1998; International Agency for Research on Cancer [IARC], 2015). In Nigeria, agriculture remains a primary livelihood, with increasing reliance on chemical inputs

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to boost productivity. However, regulatory oversight, safety training, and access to protective equipment are often inadequate, elevating health risks (Olayemi et al., 2018).

Ilorin Metropolis, Kwara State, is an agrarian hub where farming is central to the economy. Despite evidence linking agrochemicals to cancers, localized data on exposure patterns and health outcomes are scarce. This study aims to bridge this gap by assessing occupational exposure to known and suspected carcinogenic agrochemicals among farmers in Ilorin, providing evidence for targeted interventions.

Methodology

Study Design and Setting

A descriptive cross-sectional study was conducted in Ilorin Metropolis, comprising Ilorin East, South, and West Local Government Areas, between June and August 2024.

Study Population and Sampling

The study included 343 actively farming adults (≥18 years) with at least one year of agrochemical handling experience. A two-stage sampling technique was used: random selection of five agrochemical stores, followed by systematic sampling of farmers. Sample size was calculated using the formula for proportion estimation, with a 10% non-response adjustment.

Data Collection

A structured, interviewer-administered e-questionnaire adapted from Darcey et al. (2018) was used. It covered socio-demographics, agrochemical use, safety practices, health symptoms, and perceptions. Data were collected over four weeks by trained assistants using mobile devices.

Data Analysis

Data were analyzed using IBM SPSS Statistics 23. Descriptive statistics summarized variables. Inferential analyses included regression to test associations with carcinogenic agrochemicals and ANOVA to assess PPE effectiveness. A p-value <0.05 was considered significant.

Ethical Considerations

Ethical approval was obtained from the state Ministry of Agriculture, Ilorin, Kwara state. Informed consent was secured from all participants, with assurance of confidentiality.

Results

Socio-demographic Characteristics

Most respondents were male (91.8%), aged 30–39 years (31.2%), with 6–10 years of farming experience (37.0%). Majority engaged in crop farming (89.5%) commercially (60.3%).

Agrochemical Usage and Associations with Known Carcinogens

Herbicides (38.48%) and synthetic fertilizers (28.57%) were most used. Common agrochemicals classified as known or suspected carcinogens included 2,4-D (16.91%), malathion (12.83%), and glyphosate (9.33%). Regression confirmed significant associations with these chemicals ($p = 0.011$). Most farmers applied chemicals 1–5 times annually (64.14%), with 55.39% using them for over five years.

Protective Practices and Exposure Reduction

Most farmers (65.89%) received safety training, and 71.14% consistently used PPE, primarily protective clothing (46.94%). ANOVA demonstrated that PPE use significantly reduced exposure levels ($p < 0.05$). However, 65.01% stored chemicals on their farms, and only 21.28% underwent regular medical check-ups.

Health Outcomes and Perceptions

A total of 41.11% reported symptoms after handling chemicals: skin irritation (29.74%), respiratory issues (26.82%), and fatigue (9.33%). Only 6.12% reported a family history of cancer. Despite 60.64% acknowledging health risks from agrochemicals, 100% expressed interest in safety training. Government support was limited, with 47.81% reporting no interventions.

Table 1: Key Exposure and Protective Practice Patterns

Variable	Category	Frequency (n=343)	Percentage (%)
Agrochemical Use	Herbicides	132	38.48
	Synthetic Fertilizers	98	28.57
	2,4-D	58	16.91
	Malathion	44	12.83
	Glyphosate	32	9.33
PPE Usage	Always	244	71.14
	Sometimes	83	24.20
	Never	16	4.66
Reported Symptoms	Skin Irritation	102	29.74

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	Respiratory Issues	92	26.82
	Fatigue	32	9.33

Table 2: Effectiveness of PPE in Reducing Exposure Symptoms

PPE Usage	Symptom Prevalence (%)	p-value
Always 31.15	31.15	<0.05
Sometimes	48.19	
Never	68.75	

Discussion

This study highlights significant occupational exposure to known and suspected carcinogenic agrochemicals among Ilorin farmers, consistent with global findings (Andreotti et al., 2018; Guyton et al., 2015). While safety practices like PPE use are prevalent and effective—aligning with studies from Ghana and India (Ntow et al., 2016; Damalas & Koutroubas, 2018)—gaps in consistent practice and knowledge persist. The high symptom prevalence (41.11%) underscores ongoing health risks, similar to reports from Bolivia and Ethiopia (Jørs et al., 2018; Mekonnen & Agonafir, 2002).

Notably, farmers' high receptivity to training presents an opportunity for intervention. However, inadequate governmental support and regulatory enforcement remain critical barriers, echoing challenges across Sub-Saharan Africa (Musinguzi et al., 2020). The study's cross-sectional design limits causal inferences, and self-reported data may introduce bias. It is important to note that this study did not measure biological exposure markers or cancer outcomes; findings reflect associations with known carcinogens rather than direct carcinogenic risk.

Conclusion

Farmers in Ilorin Metropolis face measurable occupational exposure to known and suspected carcinogenic agrochemicals, though current safety practices mitigate some risks. Enhanced regulatory frameworks, accessible PPE, regular health monitoring, and community-based education are essential to reduce long-term exposure-related health risks. Future research should employ longitudinal designs and biomonitoring to better quantify exposure and health outcomes.

Recommendations

Based on the study findings, the following multi-level recommendations are proposed:

Personal Level:

Farmers should consistently use appropriate PPE and adhere to safe chemical handling, storage, and disposal practices.

Regular health check-ups should be prioritized for early detection of chemical-related health issues.

Community Level:

Local agricultural cooperatives and community health workers should organize ongoing safety training and awareness programs.

Communities should promote integrated pest management and organic farming alternatives to reduce chemical dependence.

Government and Policy Level:

Regulatory agencies such as NAFDAC should enforce stricter controls on the importation, sale, and use of highly hazardous agrochemicals.

Government should subsidize or provide free PPE to small-scale farmers and integrate occupational health screening into primary healthcare services.

Agricultural extension services should be strengthened to deliver targeted, practical education on chemical safety.

Public Health Impact

This study provides critical, locally relevant data that can inform public health policy and practice in Nigeria. By quantifying exposure levels and identifying modifiable risk factors, the findings support the development of evidence-based interventions aimed at reducing the burden of exposure to carcinogenic agrochemicals among farmers. Strengthening chemical safety regulations, improving access to protective equipment, and enhancing farmer education can contribute to sustainable agricultural practices and better health outcomes, aligning with national and global goals for cancer prevention and occupational health safety.

Conflict of Interest

The author declares no conflict of interest.

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