KNOWLEDGE AND PRACTICES OF PESTICIDE USE AMONG COWPEA TRADERS WITHIN ABEOKUTA, SOUTHWEST NIGERIA

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ABSTRACT

Adequate knowledge and adoption of best practices, needed to avoid pesticide poisoning and ensure food safety was investigated among cowpea traders within Abeokuta, southwest Nigeria. Structured questionnaires were administered to cowpea traders to collect data such as knowledge about pesticide toxicity, practices and self-reported clinical effects following exposure. Obtained data were analyzed using descriptive statistical tools. Approximately 62% of chemicals used by the traders to treat pest infestation contained organophosphates, 12% contained pyrethroids while 26% were inorganic chemicals, all of which are moderately hazardous. Data from the Likert Scale on trader's knowledge about pesticides showed that 78% of traders had reasonable knowledge of the toxicity of pesticides. Traders however failed to adopt best practices on the use of pesticides. The major self-reported clinical symptoms following pesticide application were skin irritation (76%), vomiting (78%), sneezing (73%), back pain (80%) and nausea (48%). Majority of the traders neither sought medical help at hospitals nor took medication to ensure relieve despite the fact that these symptoms may be indicative of pesticide poisoning. Most (80%) of the traders interviewed did not observe a safe withdrawal period after pesticide application and would sell the produce when they need money or envisage a high profit. This practice is highly condemnable as it potentially exposes cowpea consumers to significant levels of toxic chemicals and their residues which can lead to chronic pesticide poisoning and in some cases death. Therefore, training and sensitization of cowpea traders is recommended to promote pesticide knowledge and safer practices.

Keywords: Pesticides, Toxicity, Safe Practices, Cowpea, Abeokuta

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp) are less expensive sources of dietary proteins, and rich in water-soluble vitamins. Out of the various legumes available in Nigeria, cowpeas are the most widely grown, traded and distributed food commodity (Akah, *et al.*, 2021). However, cowpea production and storage are greatly threatened by severe insect pest infestation, leading to damage to stored produce and reduced profits for farmers and traders (Dahiru *et al.*, 2014).

In order to reduce economic losses coupled with the absence of modern grain storage facilities, cowpea traders and storekeepers rely mostly on chemical pesticides to control insect infestation. These compounds include organophosphates, carbamates, organochlorines and pyrethroids which are potentially hazardous to humans and wildlife (Karami-Mohajeri and Abdollahi, 2011). In addition, there have also been global environmental concerns regarding the unsafe

use of pesticides for stored agricultural produce (Kariathi *et al.*, 2016).

Inappropriate use of agricultural pesticides as frequently observed in developing countries such as Nigeria is of grave concern due to its implication on human health and environmental safety. For years, there have been recurring reports of poisoning arising from the consumption of pesticide-treated cowpeas sometimes leading to death (Etonihu *et al.*, 2011). Several researchers have also found unsafe levels of pesticide compounds and their residues in food products bought in retail markets (Oyeyiola *et al.*, 2017; Olutona and Aderemi, 2019)

Some studies have shown disturbing practices by traders during the storage of agricultural produce. The direct application of pesticides with total disregard, and in most cases, ignorance of the potential of poisoning from pesticides and their residues in food have been observed in grain merchants and vegetable traders (Hassan *et al.*, 2018; Dahiru *et al.*, 2014; Karunamoorthi *et al.*, 2011). Adequate knowledge about the toxicities of pesticide products and the adoption of best practices in pesticide use is of prime importance to avoid poisoning, reduce pesticide residues in food and ensure environmental safety. Frequent exposure to pesticides by traders can cause both acute and chronic health complications such as skin dermatitis, respiratory disorders, neurologic disorders, cancer and death (Erhunmwunse *et al.*, 2012).

This study was conducted to investigate the level of pesticide knowledge and practices of pesticide use among cowpea traders within the Abeokuta metropolis, southwest Nigeria. It also sought to understand the magnitude of self-reported clinical effects and how they are managed among cowpea traders following pesticide exposure. Information from this study will serve as a guide to relevant agencies involved in the education, administration and control of hazardous chemical compounds within Abeokuta and Nigeria

Materials and Methods

Study Area

The study area, Abeokuta is an ancient town in Ogun State, southwest Nigeria (Fig. 1). It is metropolitan in nature with boisterous trading activities, possibly due to its closeness to Lagos, an economic nerve centre of Nigeria. Major trading of farm produce and foodstuffs take place in markets every four days. Of eight major markets within the town, five (Kuto, Lafenwa, Iberekodo, Elega and Bode Olude) were purposively selected for this study based on the high volume of cowpea sales taking place within these markets. In each selected market, ten (10) cowpea traders were randomly selected and interviewed.

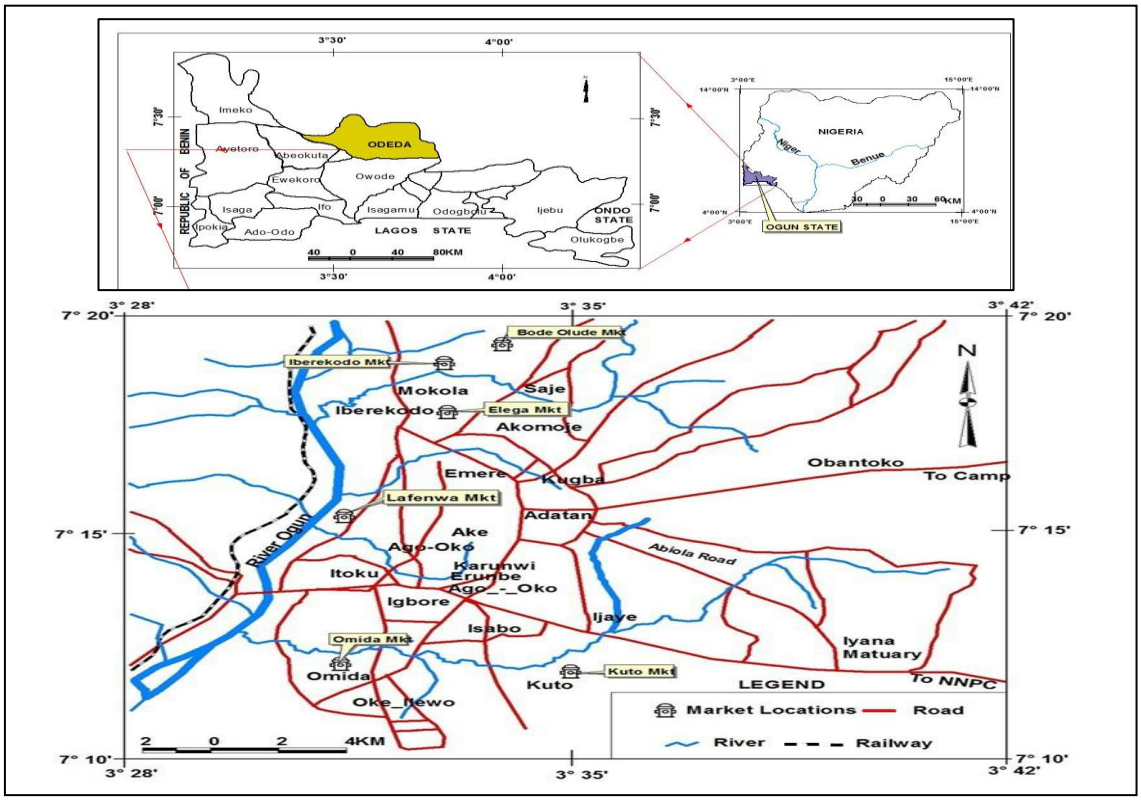


Fig 1: Map of the study area showing selected markets within Abeokuta, southwest Nigeria

Data Collection

Verbal consent was obtained from all the participants prior to questionnaire administration and interviews were conducted in the local languages of traders (Hausa, Yoruba) to avoid loss of meaning in questions. A structured questionnaire was administered to the randomly selected traders in each market. The questionnaire addressed the extent of knowledge the traders have on the hazardous nature of chemicals used as pesticides used against the cowpea weevil (*Callosobruchus maculatus* (F.)), their practices related to pesticide use, self-reported clinical effects following pesticide application, and ways of managing them. The questionnaire also sought details about the socio-demographic characteristics of the traders such as their age and education status.

Data Analysis

Data obtained from questionnaire administration were subjected to descriptive statistical tools such as percentages and charts using IBM SPSS 23.0 software. The knowledge of cowpea traders regarding the hazardous nature of chemicals used as pesticides was assessed using the Likert Scale of four scaled questions to which respondents either agreed or disagreed. Respondents who scored above 14 out of a total attainable score of 20 were classified as having "good" pesticide knowledge. Knowledge of traders was inferentially compared across markets using the analysis of variance (ANOVA) tool.

RESULTS AND DISCUSSION

The demographic characteristics of 50 cowpea traders within the Abeokuta

metropolis interviewed in this study are given in Table 1. The majority (82%) of the respondents were male while only 18% were females. About 70% of the respondents were between the ages of 25 and 44. Forty per cent of the respondents had no formal education while only about 4% had tertiary education. Almost half (48%) of the respondents engaged in both wholesale and retailing. Wholesale cowpea traders sell in bags while retail sellers sell in cups and bowls to buyers.

Table 1: The socio-economic characteristics of respondents in selected markets

Variables	Frequency	
	N	%
Gender		
Male	41	82
Female	09	18
Age		
25-34	10	20
35- 44	25	50
45-54	14	28
Above 55	01	02
Highest level of Education		
No formal	20	40
Primary	20	40
Secondary	08	16
Tertiary	02	04
Type of Sale		
Wholesale	10	20
Retails	16	32
Both	24	48

N refers to the number of respondents out of a total of 50

Knowledge of Traders About Pesticides

Approximately 62% of respondents use pesticide products like DDForce, some local formulations which contain mainly dichlorvos as active ingredients. Other pesticides used include phostoxin, a pellet-like solid which produces phosphine gas when in contact with moisture. Some traders (12%) also used Rambo insecticide powder which contains permethrin as the active ingredient (Table 2). All the pesticides used belonged to the WHO Class II which are moderately hazardous chemicals and are to be used with caution.

The pesticides applied by cowpea traders are hazardous to human health and the environment if used inappropriately, or without adequate knowledge of their toxic nature. The Likert scale showed that the majority (78%) of the cowpea traders scored 14 and above and therefore had good knowledge regarding the toxicity of pesticides. Twenty-two per cent of cowpeas traders scored <14 and are classified as

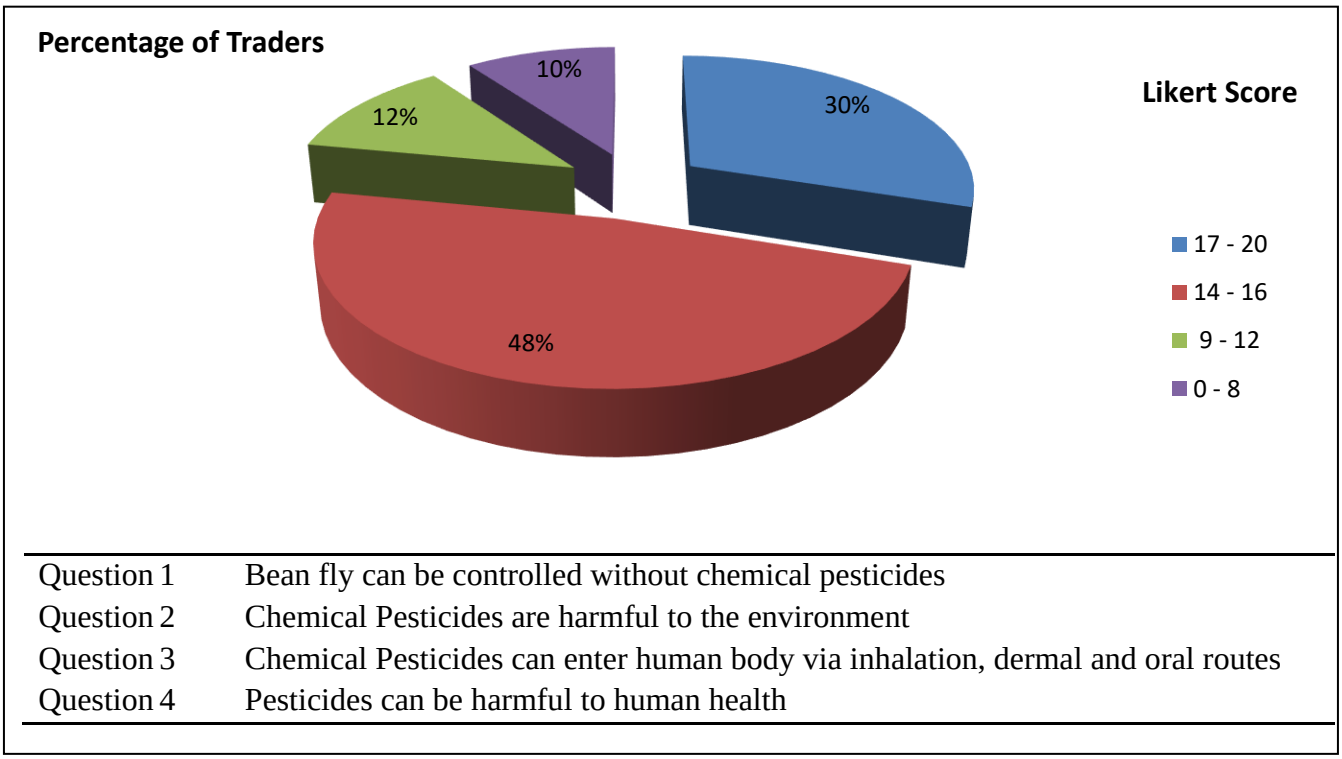
having low knowledge of pesticide toxicity (Fig 2). An analysis of variance between markets shows no significant difference (P = 0.82) in trader knowledge about pesticide toxicity across markets.

Most of the cowpea traders believed that using chemicals was the only effective means of controlling cowpea weevil. Unfortunately, due to the lack of efficient storage facilities, the use of chemical pesticides remains the only available approach to local traders. The traders also agreed that the pesticides they use are harmful to human health as evident in the clinical effects and/or symptoms they observed on their skin or respiratory organs after application. However, most of the traders were not sure of the potential of these chemicals on other components of the environment.

Table 2: Pesticide products applied by cowpea traders in the study area and their description

Pesticide product	Active ingredient	Chemical family	WHO class	Frequency (%)
DDForce	Dichlorvos (DDVP)	Organophosphate	Class II	17(34)
Phostoxin	Aluminum Phosphide	Inorganic Pesticide	Class II	13(26)
Rambo	Permethrin	Pyrethroid	Class II	6(12)
*Jule	Dichlorvos (DDVP)	Organophosphate	Class II	6(12)
*Onpaayan	Dichlorvos (DDVP)	Organophosphate	Class II	8(16)

* Locally formulated insecticides



Question 1	Bean fly can be controlled without chemical pesticides
Question 2	Chemical Pesticides are harmful to the environment
Question 3	Chemical Pesticides can enter human body via inhalation, dermal and oral routes
Question 4	Pesticides can be harmful to human health

Fig 2: Traders' knowledge of pesticide toxicity according to Likert scale

Traders' Practices Regarding Pesticide Use

The practices and approach of cowpea traders within the study area to pesticide use are presented in Tables 3 and 4. The majority (78%) of the cowpea traders had no prior training regarding pesticide application and 68% of the traders did not read pesticide labels before use but followed procedures employed by colleagues or experienced traders. Similarly, a large proportion of the traders sampled (>60%) were not aware that some pesticides had been banned, and neither did they use any form of personal protective clothing during the application of the pesticides. Poor utilization of protective clothing during pesticide application is a major characteristic of the informal workforce. This increases a trader's exposure to the chemical via dermal contact and can be a risk factor for acute and chronic pesticide poisoning among cowpea traders within the study area. This is indicative that the majority of the traders do not adhere to best practices in pesticide application and would require reorientation.

Table 3: Safe practices and caution before pesticide use among cowpea traders in selected Abeokuta markets

Variables	Frequency	
	N	%
Do you have pesticide training?		
Yes	11	22
No	39	78
Do you read and follow pesticide instructions on labels before application?		
Yes	16	32
No	34	68
Do you know some pesticides are banned?		
Yes	18	36
No	32	64
Do you use PPE		
Yes	20	40
No	30	60

N refers to the number of respondents out of a total of 50

While applying pesticides to their products, almost all (94%) of the respondents refrained from food and drinks. Food consumption during pesticide application increases the chances of pesticide entry into the body through inhalation and ingestion. About 20% of the cowpea traders used one form of PPE or two (masks, gloves, boots) and only a few of the traders (10%) used sprayers during application. The majority of the traders

(90%) applied the pesticide by shaking the chemical out of the container or using their bare hands (Table 4). The majority of the cowpea traders (96%) either stored the pesticide containers properly in locked areas or use them immediately after purchase to prevent accidental consumption by children. Some (44%) of the traders interviewed reported disposing of used containers in waste bins while others just leave the containers lying around. Proper disposal of pesticide containers is a vital part of pesticide management in order to prevent the reuse of containers and reduce risk to human health and the environment (Karunamoorthi *et al.*, 2011).

After pesticide application, agricultural produce should be left and not consumed for a period termed the 'withdrawal period' depending on the nature of the chemicals used during which the chemicals used in preservation are allowed to break down into harmless metabolites. A majority (80%) of the traders interviewed did not observe this safe withdrawal period and sold the cowpea once a buyer approached them.

Appropriate use of authorized pesticide products is of utmost importance to protect the health of consumers and the environment. Misuse or abuse of pesticides can lead to serious environmental contamination with associated danger to health. When treated food products are consumed without observing the appropriate withdrawal periods following pesticide application, consumers can be exposed to unsafe levels of chemical or their residues with serious health consequences (Obida *et al.*, 2012).

The reckless use of pesticides during food storage and processing may lead to the prevalence of pesticide residues in the food at concentrations higher than the maximum residue levels. The Maximum Residue Level (MRL) is the maximum amount of pesticide residue that if found in food substances will not cause any health hazard (Gerken *et al.*, 2001). MRLs encourage food safety by restricting the concentration of a residue permitted on a commodity (FDA, 2005).

Most pesticides are known to be neurotoxic while others have been found to be carcinogenic, teratogenic and/or endocrine disruptors (Hossain *et al.*, 2015; Khan and Law, 2005). The negative health effects induced by the consumption of pesticide residues in food depend, not only on the residue content of food but also on the quantity of contaminated food consumed and the length of time over which the consumption occurs. In addition to chronic toxicity resulting from the consumption of pesticide residues via food, there is a risk of acute and sub-acute toxicity in people who are exposed to high doses through dermal contact, inhalation and accidental ingestion while applying pesticides (Ogar *et al.*, 2012).

Unacceptable levels of highly toxic pesticide residues such as organophosphates, carbamates, fenitrothion and chlorpyrifos have been found in food products by various studies conducted in Nigeria: beans from markets in Northern Nigeria (Otitoju and Chibuikem, 2021; Obida *et al.*, 2012; NAFDAC, 2004), vegetables and fruits from southwest Nigeria (Adeoluwa *et al.*, 2019; Oyeyiola *et al*; 2017), beans and maize from Ibadan markets (Yusuf and Bolaji, 2017) and

fish samples from Lagos Lagoon(Adeyemi *et al.*, 2008).

Table 4: Practices during pesticide application by selected cowpea traders in Abeokuta

Variables	Frequency	
	N	%
Do you eat/drink/smoke when applying pesticides?		
Yes	03	06
No	47	94
What kind of PPE do you use?		
None	30	60
Mask	20	40
Gloves	12	24
Footwear	02	04
How do you apply pesticides?		
Use sprayer/ gloved hands	05	10
Tipping out of the container	18	36
Bare hands	27	54
How long do you store treated cowpea produce before the sale?		
Sell immediately	40	80
< 1 week	08	16
>1 week	02	04
How do you store your pesticides?		
Locked in a store/box	33	66
Left unlocked in a place where children can reach	2	4
Buy and use it immediately	15	30
How do you dispose of pesticide containers?		
Throw in dustbin	22	44
Throw on ground	28	56

N refers to the number of respondents out of a total of 50

Self-Reported Clinical Symptoms following Pesticide Application

Exposure to pesticides can have grave health implications and major clinical symptoms reported by selected traders after pesticide application included skin irritation, vomiting, sneezing, back pain and nausea (Fig 3). Other reported health symptoms include headache, dizziness, tiredness and dry mouth. Similar acute effects were reported by Mutune *et al.* (2018) following exposure to pesticide compounds. The severity of health effects observed by traders depends on how they are managed immediately after clinical presentation. Only 32% of traders interviewed washed their hands after

application while the majority went about their activities without washing their hands. Almost all respondents (>92%) did not take a bath nor do they change clothing after pesticide application (Table 5). Timely treatment of health effects following reactions to pesticide exposure is required to prevent serious injury. In this study, the majority of the traders (90%) saw no reason to go to the hospital after experiencing symptoms of pesticide poisoning. Some of the traders also did not take medication and relied on the symptoms fading with time.

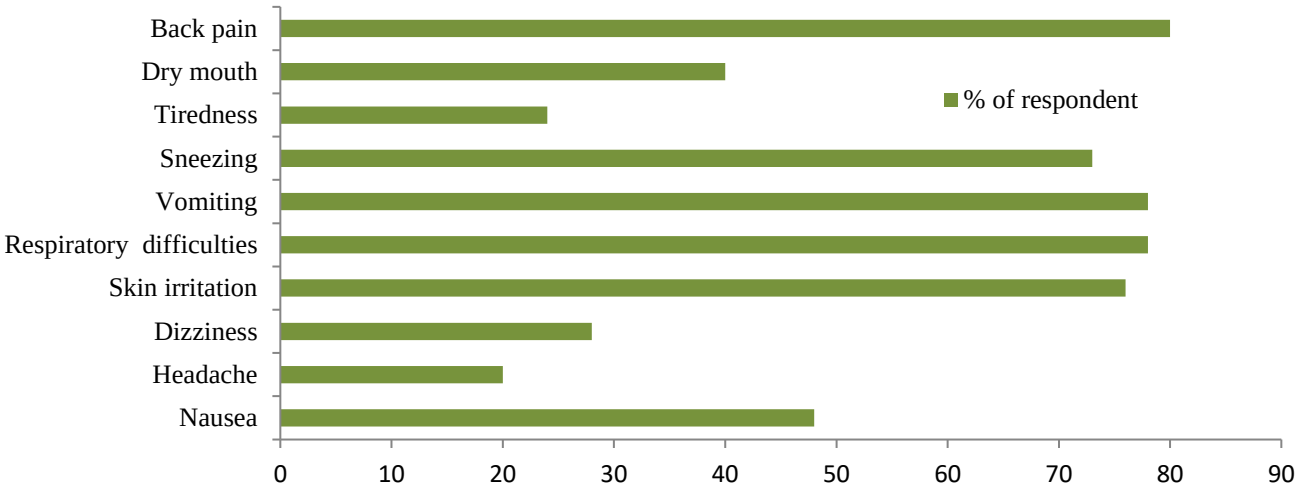


Fig 3: Self-reported clinical symptoms among cowpea traders following pesticide application

Table 5: Post-application practices and management of self-reported clinical symptoms by selected cowpea traders

Variables	Frequency	
	N	%
Do you wash your hands immediately after application?		
Yes	16	32
No	34	68
Do you take a bath immediately after application?		
Yes	04	08
No	46	92
Do you remove clothing/PPE immediately after application?		
Yes	01	02
No	49	98
Do you go to the hospital when experiencing symptoms?		
Yes	05	10
No	45	90
Do you take medication to relieve symptoms?		
Yes	24	48
No	26	52

N refers to the number of respondents out of a total of 50

Conclusion

Pesticides are used by cowpea traders to reduce losses during storage. However, inappropriate use of these chemicals may lead to the presence of elevated levels of pesticide residues in cowpea, poisoning of consumers and possibly death. The majority of the cowpea traders within this study were found to have reasonable knowledge of the toxic nature of the chemicals used. However, as high as 60% of the traders interviewed do not use protective clothing nor do they follow instructions on pesticide labels during pesticide application. Improper use of pesticides as against procedures stipulated in approved guidelines was deduced from trader responses. The reality of poisoning was also deduced from this study although most of the traders take it in a light stride and rarely seek medical attention. The results from this study call for action from relevant authorities involved in the education, administration and control of hazardous chemical compounds. The traders also need to be sensitized on best practices in the use of pesticides with a view to reducing the risk of poisoning and environmental contamination.

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