

(RESEARCH ARTICLE)



Evaluation of the impact of effective management practices in mitigating the toxicity symptoms of pesticides preparation and storage in Kebbi State, Nigeria

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Abstract

The study Evaluated the Impact of Effective Management Practices in Mitigating the Toxicity Symptoms of Pesticides Preparation, Storage and Application in Kebbi State, Nigeria. Structured Questionnaires were used to obtained information from the respondents. Descriptive statistics comprising frequency distribution tables and percentages and were used for Data Analysis. Likert scale was used to determine farmer's perception on the toxicity symptoms of pesticides of pesticides preparation, storage and application employed by farmers when handling pesticides. The result of the study showed that majority of the respondents (90%) were male while female formed the minority in pesticide usage with only (10%). The study also showed that all the respondents (100%) were married and engaged in agricultural activities. The study further revealed that all the respondents never had any formal training on the use of pesticide from either governmental or non -governmental organizations. The research study also found out that all (100%) of the respondents were not aware of the toxicity of pesticides during preparation, storage and application. Likert Scale Analysis showed a negative perception by farmers on awareness of pesticide toxicity during preparation, storage and application. On perception of the respondents on the toxicity of pesticides during preparation, storage and application, the study revealed that Nausea, Dizziness, Diarrhea, Respiratory Difficulty, Skin Irritation, Rashes, Fever, Peeling of the Skin, Vomiting, and Headache were the serious toxicity effects of pesticide. It is concluded that respondents had negative perception on pesticide management of toxicity of pesticides during preparation, storage and application. It is therefore recommended that appropriate authorities should enforce the use of protective clothing, appropriate equipment and correct handling practices when using pesticides. Existing pesticide regulations and monitoring policies should be enforced. Government should also intensify efforts at registering and controlling distribution of pesticides and banning hazardous ones. It should also enforce the making of less toxic pesticides available to farmers.

Keywords: Impact; Effective Management Practices; Mitigating the Toxicity Symptoms; Pesticides Preparation; Storage and Application

1. Introduction

Exposure to insecticides is one of the most important occupational risks among farmers in developing countries. In some situation exposure to insecticides can occur from accidental spills of chemical leakages of faulty spraying equipment (4) The exposure of farmers increases in the case of not paying attention to the instructions on how to use the insecticides and particularly when they ignore basic safety equipments (3).

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Pesticides are chemicals usually synthetic sometime biologically used to kill or contain the activities of pests (11) Crop damage from pest infestation often result in serious consequences, warranting the need to use pesticide. However, despites their benefits, pesticide are potentially hazardous to man and the environment when inappropriately handled (3). Factors such as balanced use, optimum dosing, correct application method and timing helps in ensuring improved agricultural productivity (10). Use of agrochemicals has led to increased food production. However, exposure to other organisms during their application including human, is poorly controlled (11). Their use has significantly increased the concentration of toxic materials in food and the environment, with negative effects on plant and animal health. (4) The world health organization (1) has estimated that more than three million farmers in developing countries are poisoned by agrochemicals each year (4)

Agriculture is one of the most dangerous occupations although it is the second largest sector in the world as a source of work force. A large number of agricultural workers and farmers suffer from work accidents and diseases every year (7). Each and all individuals are faced with some types of pesticide exposure, but farmers and farming workers are particularly at high risk of pesticide exposure due to added risk of occupational exposure (6). Crop protection products particularly the use of pesticides against pests is one of several factors that are contributing to the huge growth in agricultural production. Pesticides are major inputs of the modern agricultural production, and due to their high capability and trustworthiness for crop protection against pests and warranty of high crop yields (6). To protect human health against vector-borne diseases, for example, malaria, dengue, Zika fever, Chikungunya fever (10), and to protect home sites, storages, lawns from weeds, pathogens and both insect and mammal pests pesticides are also used (9).

In Nigeria, agricultural sector is the major supplier of food, raw materials and 70% of Nigeria's population largely depend on this sector for survival (Olakunle, 2016). Due to the country's drive to increase agricultural production and the upsurge of different species of pest that damage and ravage agricultural products` in field and storage, farmers have resorted to the use of agrochemicals as an important control strategy (12). An estimated 125,500, 130,000 metric tons of pesticides are used annually (Asogwa, 2013). According to (1), 7% of rice and yam farmers apply pesticides, and 41% of farmers apply pesticides to at least one food crop in Nigeria. The application of pesticides is often imprecise, with unintended worker exposures.(5) on problems associated with pesticide usage and application in cocoa production in southern Nigeria found the use of pesticides for insect pest control has generated public health problems and environmental pollution in Nigeria.

Despite the fact that several pesticides are banned and restricted or unregistered in many countries despite them been listed as hazardous by (11);(3), Stated that many of them are still widely promoted and applied especially in developing countries where weak controls and dangerous work condition make their impact even more devastating. In view of the adverse environmental effects from the usage of insecticide, lack of awareness of health consequences by some farmers, it therefore becomes imperative to identify farmers and pest management practices in their farming activities by investigating farmer's awareness and perception about the effect of pesticides used in the environment.

1.1. Statement of the Research Problem

People have been using pesticides in various activities such as farming and domestic application for insects such as mosquitos, flies, cockroaches etc. However, most of the users are not aware of the safety measures or precautions when applying pesticides. Most of the pesticides applied may affect non-target organism, contaminates soil and water.

Despite the contribution of pesticides to agricultural production many of them are not biodegradable as such bioaccumulation can enter into the food chain and be detrimental to human health and the ecosystem. This has over the years constituted many health hazards. Excessive application of insecticide has posed serious risks to human health, and cause acute diseases like stinging eyes, rashes, blindness, nausea, dizziness, diarrheal and death.

Objectives of the Study

The General objective of the study is to evaluate of the Impact of Effective Management Practices in Mitigating the Toxicity Symptoms of Pesticides Preparation, Storage and Application in Kebbi State, Nigeria. The specific objectives are:-

- Describe the socio- economic characteristics of the respondent in study area.
- Assess the level of farmer's awareness on toxicity symptoms of pesticides in the study area.
- Analyse the methods employed by farmers in storing pesticides before and after usage.

Significance of the Study

This study would add to the existing knowledge on the Effective Management Practices in Mitigating the Toxicity Symptoms of Pesticides Preparation, Storage and Application in Kebbi State, Nigeria and will provide empirical information to policy makers in the formulation of appropriate polices that would enlighten or educate farmers on how to protect themselves when handling and spraying pesticides. It would also serve as a source of baseline information to researchers wishing to conduct research in this area. The study is also likely going to guide practicing and prospective farmers on ways to mitigate the toxicity effects of pesticides during preparation, storage and application. It would as well also serve as reference material for future researchers.

Scope and Limitations of the Study

The research focused on the Evaluation of the Impact of Effective Management Practices in Mitigating the Toxicity Symptoms of Pesticides Preparation, Storage and Application in Kebbi State, Nigeria because of time factor, financial constraints and language barrier. The study was conducted in seven Local Government areas of kebbi State. The limitations encountered during the course of this research were transportation related, financial issues and the time for administration of questionnaires for both the interviewer and interviewee was limited.

2. Methodology

2.1. Study Area

The study was conducted in Kebbi State, Nigeria situated between latitudes 10° 8'N and 13° 15'N and longitudes 3° 30'E and 6° 02' E. The State is adjoined by Sokoto and Zamfara States to the East, Niger State to the South, Benin Republic to the West and Niger Republic to the North. The State has an estimated population of about 3,238,628 for which males account for 1, 617, and 498 (49.9%), while females are 1, 621, and 130 (50%) [6]. The State is made up of 21 Local Government Areas with an area of about 37, 690 square kilometers out of which 36.46% is made up of farmland. Majority of the inhabitants of Kebbi State are peasant farmers who reside in rural areas. The Northern part of State is located in the semi-arid sudano-sahelian ecological zone and experiences serious moisture deficiency in greater part of the. However, the Southern portion of the State falls within Northern Guinea Savannah ecological zone. The highest rainfall is recorded in July and August, which ranges from 400 to 850 mm. This increases both in amount and intensity within the State from the north to the south. The annual temperature varies from 21°C to 38°C.

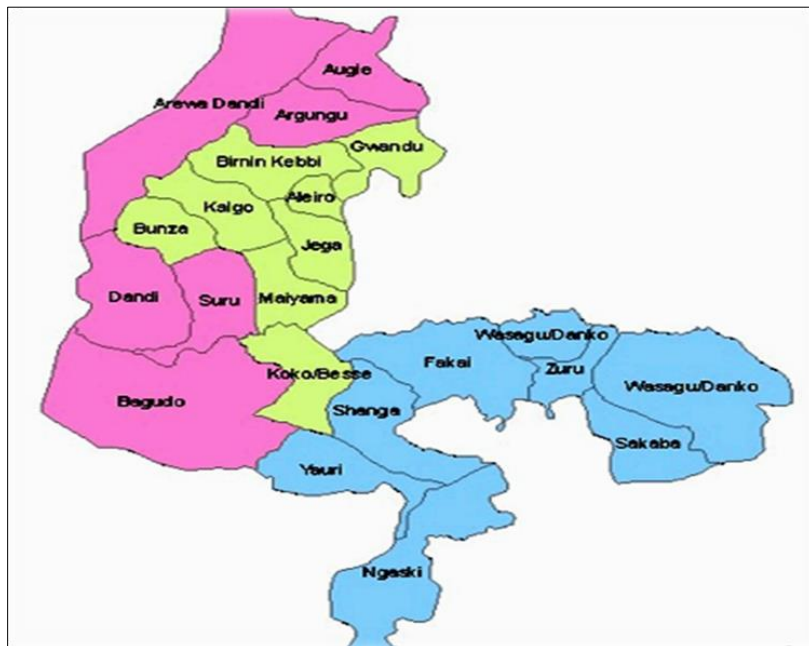


Figure 1 Map of the Study Area. Source: Google map

2.2. Sampling Procedure and Sample Size

The focused population of this research work was the farmers that uses pesticides on their farms in Kebbi State. In line with ecological characteristics, cultural practices and level of technology used in pesticides preparation, storage and application. In order to obtain a representative sample in achieving the stated objectives, multistage and simple random sampling procedures were adopted to select the sample size for the study. At stage I, seven local government areas were purposively selected based on their dominant involvement in pesticides preparation, storage and application. The seven LGAs are Zuru, Sakaba, Danko Wasagu, Fakai, Shanga, Yauri and Ngaski. At stage II, two dominant villages were purposively selected from each of the seven local government areas based on the large number of farmers that uses pesticides on their farms in the study area making a total of 14 villages. In stage III, in each of the 14 villages, 15 farmers were randomly selected in each of the villages given a sample size of 210 farmers that used pesticides.

2.3. Instruments for Data Collection

The basic instruments used for data collection for this research study was structured questionnaire. A structure questionnaire containing both open and close ended questions, was used to collect primary data from the respondents. Oral interview was used to collect primary data from those who cannot read and write that is those who do not have formal education in the study area, while secondary data were sourced from test books, journals conference papers, magazine and websites.

2.4. Methods of Data Analysis

The data collected from the administered questionnaires were analyzed using descriptive. Descriptive statistic such as frequency distribution tables, percentages and mean were used to analyze objectives 1, 3. Likert scale was used to analyze objective 2.

2.5. Likert Model Specification

Likert scale is psychometric scale for measuring attitude in a research where questionnaire are used. So it can be used to examine perception.

For perception scale under positive statement scores assigned are: -

Strongly Agreed_____5
 Agreed_____4
 Undecided_____3
 Disagreed_____2
 Strongly disagreed_____1

For negative statement the score assigned are

Strongly agreed-----1
 Agreed-----2
 Undecided-----3
 Disagreed-----4
 Strongly disagreed-----5

Where

$$\text{average mean score} = \frac{\text{Total sum of attitude score}}{\text{Total number of respondents}}$$

$$\text{The mean score} = \sum \frac{f_{xi}}{N} = \frac{5 + 4 + 3 + 2 + 1}{5}$$

3. Results

Table 1 Socioeconomic Characteristic of the Farmers (n=120)

Variables	Frequency	%
Gender		
Male	108	90
Female	12	10
Total	120	100
Age		
7-20	0	0
20-34	24	20
35-50	96	80
Total	120	100
Education		
Illiterate	2	2
Primary	36	30
Secondary	17	14
Tertiary	19	16
Non Formal Education	46	38
Total	120	100
Marital Status		
Married	120	100
Single	0	0
Total	120	100
Secondary Occupation		
Civil servants	43	36
Trading	29	24
Only farming	48	40
Total	120	100
Experience		
1-9 years	22	18
10-19years	26	22
20years and above	72	60
Total	120	100
Crops Grown		
Guinea corn	62	52
Maize	19	16
Rice	19	16
Pepper	10	8
Beans	10	8
Total	120	100
Training on Pesticides		
Yes	0	0
No	120	100
Total	120	100

Farm Size (ha)		
0-1 (ha)	10	8
1-2 (ha)	48	40
2-3 (ha)	34	28
Above 4(ha)	29	24
Total	120	100

Source: Field Survey, 2021

Table 2 Toxicity Symptoms reported by farmers after mixing or spraying pesticides (n = 120)

Symptoms	Frequency	%
Headache	60	78
Dizziness	31	40
Skin irritation	100	83.3
Vomiting	08	10
Nausea	10	13
Itchy eyes	48	62
Coughing	15	19
Stomach ache	06	8
Poor vision	09	12
Shortness of breath	07	9
Excessive sweating	14	18
Fatigue	42	55
No health effect	17	22

Source: Field survey, 2021 * Multiple responses recorded

Table 3 Farmers Management Practices on Storage and Disposal of Pesticides

Pesticides Storage	Variable	Frequency	(%)
Storage of pesticides	Open shed just for pesticides In the open field	14	18.2
		37	48.1
	Locked chemical store	11	14.3
	Living Area	05	6.5
	Don't store pesticides	10	12.9
How unused leftover (mixed, diluted) pesticides are used	Disposed on the field	09	11.7
	Mix only needed pesticides Apply on other crops	41	53.2
		06	7.8
	Wash off	04	5.2
	Stored in container to be reused	17	22.1
How old pesticides stocks are been used	Buy what is needed Dispose on the field	64	83.1
		10	13.0
	Add with new to reuse	03	3.9
Usefulness of empty pesticide containers	Discard on-farm Bury on- farm	05	6.5
		01	1.3
	Burn on farm		

		02	2.6
	Waste collection bins	28	36.3
	Reuse for other purposes	41	53.3

Source: Field survey, 2021 * Multiple Responses were Recorded

Table 4 Likert Type Scale Showing Positive and negative Statement (n=120)

S/N	Awareness/Perception	SA	A	UD	DA	SD	Total Sum of Awareness	Average Mean Score
I	Pesticide increases output	106	14	0	0	0	24	4.9(positive)
ii	Pesticides are harmful to man	120	0	0	0	0	250	5.0 (positive)
iii	Pesticide are harmful to the environment	24	24	36	24	12	160	3.2 (Positive)
iv	Pesticide should be handled with care	96	12	2	5	5	229	4.6(positive)
V	Ensure safety during application	120	0	0	0	0	250	5.0 (positive)
Vi	Pesticide should not be handled by children	43	48	15	10	7	196	3.92 (positive)
Vii	Pesticide are used to control pest at home and on farm	62	53	5	0	0	224	4.48 (positive)
Viii	Don't apply pesticide during windy period	48	50	19	2	0	210	4.2(positive)
Ix	Always read and follow manufactures instruction	0	62	0	58	0	152	3.04 (positive)
X	Pesticide can cause soil erosion	43	43	16	10	7	201	3.9 (Positive)
Xi	Pesticide can cause depletion of soil nutrients	19	16	16	43	24	135	2.7 (Negative)

Source: Field Survey, 2021

4. Discussion

Table 1 shows the gender of the respondents. The results indicated that men were the majority in the study with 90% and female form the minority with only 10%. In the study conducted by (Oluwole and Cheke, 2009) to determine the environment and health effect of pesticide use in Nigeria 93.3% of the farmers were male.

The majority of the farmers' who were found to be intensively using pesticides were within age brackets of 35-40 representing 80% and 20% between the ages of 20-34. It means that teenagers were not actively involved in farming activities and young adults were more involved in farming. Age is a socioeconomic factor in farmer's awareness as young adult tend to know more about pesticides than the very young farmers. Older farmers are more aware of pesticide usage due to experience in farming over the years (Tijani and Nurudeen, 2005).

Farmer's level of awareness in using pesticides is related to their educational status as educated farmers can read labels on pesticide containers and also access information from stem sources hence reducing the level of information that should be disseminated by the change agents. In the study, it was determined that 2% of the farmers were illiterate, 46% had finished primary school, 17% had secondary education, and 16% had tertiary education and 19% non -formal education. Most of the farmers could not read and write as found out by this study. Marital status of the farmers was 100% as all the farmers interviewed were married. Secondary occupation of the respondents besides farming were civil service constituting 35%, traders forming 24% and 40% were exclusively involved in farming. Therefore, since greater percentage of farmers were aware of pesticides and used it over the years, it can be said that they were aware of the hazards associated with pesticides. Experience of farmers on farming is an important factor in acquiring skill in farming and effective use of inputs. The famers who participated in the study had been farming for many years of which 18% of

them farmed for 1-9years, 22% 10-19years and 60% above 20years. From the experiences gathered by farmers over the years, it will be easier for them to properly handle pesticides on the farms.

It was found out by the researcher that farmers in this study area mostly cultivates Guinea corn constituting 52%, 16% cultivated maize, 4% cultivated rice and another 4% grew beans and all of which mostly used pesticides on their farms. The use of pesticides by the farmers have increased agricultural productivity and hence increased income and improved standard of living.

All the respondents in the study area who were interviewed testified that they have not received any kind of training on pesticide usage from either governmental or non-governmental organizations. Farmers therefore need regular training on pesticide usage so as to encourage safety practices on pesticide handling and minimize wrong usage. Majority of the had farm size of 1-2 hectares constituting 40% farmers, 28% of the respondents cultivated between 2-3 hectares of farm lands, 24% farmers possessed above 4 hectares of land and only 8% of the respondents had 0-1 hectares. Larger hectareage possession by the respondents means large output in return. The findings of Tijani (2006) supported that the larger the size of the farm the more the need for pesticides usage and the lesser the size of the farm the lesser the need for pesticide usage.

Table 2 shows the toxicity symptoms related to pesticides preparation and application. A total of 60 farmers (78%) self-reported at least one symptom of acute pesticides poisoning during the last one year of pesticides handling and usage, while 17 (22%) of the respondent did not ascribe any significant health effect to pesticides exposure. The most reported symptoms by respondents were headaches (78%), skin irritation (71%), itchy eyes (62), fatigue (55%), dizziness (40%), and coughing (19%). Other symptoms reported by respondents were vomiting, nausea, stomach ache, poor vision, and excessive sweating. These symptoms were similarly reported in studies conducted in Tanzania (Manyilizu, 2017), Cambodia (Jensen *et al.*, 2011) and Bolivia (Jors *et al.*, 2006), that suggested exposure to acute toxic doses of pesticides. The use of personal protective equipment (PPE) as claimed by the vegetable farmers in the study area did not commensurate with the health hazards they reported. For effective protection, PPE should be chosen based on the information given on the pesticide label. Unsafe practices increase the risk of pesticide exposure, thereby increasing the risk of clinical and subclinical adverse health effect (Lekei and Ngowi,

Table 3 is an indication of Farmers Practices on storage and disposal of pesticides. Farmer's ways of storing of pesticides and disposal of pesticide residue solutions, old expired stocks, and empty pesticide containers are shows that the majority of the farmers (48.1%) stored their pesticides in the open field. Some respondents also stored their pesticides in open shed meant just for pesticides (18.2%), and locked chemical stores designated only for pesticides (14.3%). A worrying 6.5% of the farmers reported storing pesticides within their living area. When asked what they do with leftover pesticide solutions, 22.1% of respondents reported storing in containers to be reused, 11.7% disposed on the field, 7.8% applied the leftover solution on the crops and 5.2% wash off. About 53.2% of respondents reported mixing only the amount of pesticides needed for the application at hand. Disposal of old pesticide stocks is often on open field (13.0%) and adding to the other to be reused (3.9%). Over 83% of the farmers indicated that they buy only the amount of pesticides they needed. The most common ways of disposing empty pesticide containers were placing in waste collection bins (36.3%), discarding them on farms (6.5%), burning them on the farms (2.6%) and burying the containers within the farms (1.3%). Alarmingly, 53.3% of the farmers reported re-using empty pesticide containers for other purposes like watering, storing seeds and grains etc. with the perception that once these containers are thoroughly washed with soap and water they pose no danger to their health. Education and farming experience had a negative relationship with disposal of pesticide containers after use, the reuse of pesticides containers and burning of used pesticides containers. This implies that as farmers gain more experience in farming with their education level, they are less likely to throw empty pesticide containers on the ground outside the farm, reuse or burn used pesticide containers. The re-use of pesticide containers represents a route of serious non-occupational human exposure, as several traces of pesticides could still be found in the containers even after washing and rinsing. Similar widespread reuse of pesticide containers for other household activities has been reported in other studies (Afari-Sefa *et al.*, 2015; Okoffo *et al.*, 2016).

5. Conclusion

The study evaluated the Impact of Effective Management Practices in Mitigating the Toxicity Symptoms of Pesticides Preparation, Storage and Application in Kebbi State, Nigeria. The socioeconomic characteristic (Respondents gender age, education, experience and farm size) significantly had negative impact on the toxicity symptoms of pesticides preparation, storage and application as well as the safety practices on pesticides usage in the study area. Generally, respondents had negative awareness on the toxicity of pesticides in the course of preparation storage and application.

Recommendations

Sequel to the findings of this study, the following recommendation were made on ways to improve the situation.

- Government should enforce the making of less toxic pesticides available to farmers
- The manufactures of pesticide should be enforced to fix label (warning) in the language users commonly understand and package chemicals in containers that can hardly be used.
- The Government should ensure that school curriculum in agriculture and science from the elementary schools contain pesticides usage and safety practices
- Farmers need training to encourage appropriate practices for safe use and handling of chemicals and pesticides by educating them about the risk involved in the misuse and abuse of the poisonous materials.
- Local suppliers are the major distributors of pesticides to farmers. They lack training on usage and storage at the shop level on safety practices. Regulatory and adequate monitoring policies are strongly recommended
- Government should intensify efforts at registering and controlling distribution of pesticide and banning hazardous ones.
- Government should provide approval places for disposal of empty pesticide containers and offenders apprehended, to minimize pollution on the environment.

Prices of pesticides should be subsidized so that the very poor farmers can afford it. This is necessary because pesticide usage can boost agricultural output and reduce drudgery associated with farming.

Compliance with ethical standards

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There is no conflict of interest what so ever because all the listed authors have contributed substantially to make the paper publishable.

Statement of ethical approval

The paper complied to ethical standards as required by the journal publishing house.

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