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Self-Reported Symptoms on Farmers Health and Commonly Used Pesticides Related to Exposure in Kura, Kano State, Nigeria

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Abstract

Background: As many types of rapid toxicity or explicit evidence and platforms provide useful information on the symptoms of human risk and pesticide self-poisoning accounts, which over the promise of aiding decision-making in a variety of areas, including the regulatory management of chemicals, product, environmental assessment and emergencies.

Objective: The aim of the present study was to assess commonly used pesticides application and frequency of farmer's self-reported symptoms in Kano State, Nigeria.

Methods: A comprehensive questionnaire was established that focuses on sociodemographic characteristics, education and experience on the adverse health effects associated with the use of the pesticide, description of job practices and a list of used pesticides on the farms in the study area. Of the 400 copies of the administered questionnaires, 392 copies were retrieved and found useable, which represents 98% of the administered questionnaires.

Results: A total of 89.5% of the farmers make use of pesticides; of the 351 farmers that made use of pesticides, 31.3% use Apron plus, 12.0% use Atrazine, 33.6% use [Cypermethrin] while 9.7%, 8.5%, 4.8%, 31.3% and 12.0% of the respondents use Sevin, Thiodan, Fusilade, Primextra and others respectively, of the farmers 46.2% had been using the pesticide for 1 years to 5 years, 48.1% had used it for 10 to 15, regularity of these symptoms reveals that the majority of the respondents experienced these symptoms on a regular basis (56.1% for headache, 53.8% for stomach cramps, 56.5% for muscles weakness, 56.8% for vomiting, 58.3% for dizziness, 40.7% for shortness of breath, 45.5% for blurred vision and 66.7% for eye irritation.

Conclusion: It is therefore imperative to structured interventions to lessen health risks exposure, as well as training, labeling improvements, and measures to decrease the cost of barriers in the implementation of safety behaviors and promotion of administrative control measures. Likewise, the use of Integrated Pest Management (IPM) strategies in emerging countries such as Nigeria should be encouraged and made possible by a wide variety of public initiatives and amendments need to be considered to tighten pesticides management.

Keywords: Environmental media; Health risk concerns; Regulatory management; Biomonitoring

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Abbreviations

IPM: Integrated pest management; WHO: World Health Organization; APP: Acute Pesticides Poisoning; PPE: Personal Protective Equipment

Introduction

Interestingly, over the past 30 to 40 years, concerns about environmental pollutants have increased public concern about their own exposure to "problem pesticides", which began to gain momentum around the early 2000s. However, although agricultural productivity has increased, the use of agrochemicals, which has a significant adverse impact on aquatic systems and soil with related biotic and abiotic, including the farmers health and community that consumes food that are chemically grown. In addition, the increasing world population and the requirement to regulate pests, including the factors influencing the use of agrochemicals to shield and improve production in agricultural areas. Either way, these substances are harmful to the environment, for example, this pesticide can pollute water reservoirs and act on unwanted organisms. Today, the

study of pesticides is an important area of research on environmental pollution and several questions remain unanswered about the safety and toxicity of these products to human health and the environment. It is based on the above problem that this research sought to explore commonly used pesticides application and frequency of clinical symptoms of farmers on selected agricultural farmland in Kano State, Nigeria. The purpose of this research is to identify the pesticides most commonly used by farmers in Kano State and to identify the impact of pesticides on health of farmers' through monitoring the prevalence of self-reported symptoms in Kano State. The focus on farmers is significant since from the season's beginning to harvest, farmers are often exposed to large amounts of pesticides, which has potential to induce DNA damage and pose a great risk to the exposed populations raising human health concerns. These health problems can affect health outcomes in years later. The knowledge, attitude and application of commonly used pesticides and the health indicators of many farmers in Kano State are essential to their health, well being and future development. Thus, awareness helps to modify attitudes and behavior towards the pesticides. While significant research into understanding the health burden of chemical pesticide in Kano State has not been undertaken, a literature review revealed an absence in the research. The current study aims at contributing to the extant literature in this regard.

Materials and Methods

Research design

The study adopted a descriptive survey research design. The descriptive survey design according to Gift and Obindah et al. [1] is a kind of research design in which the researcher collects data from a cross section of the study population in respect of variables. This design was considered appropriate for the study since it solicits information from a target group. The design involves collection and analyzing data gathered. Funmilayo et al. [2] described descriptive survey design as a type of design to be employed when a study involves the use of questionnaire to seek the opinion of the respondents [2]. Funmilayo et al. [2] added that the descriptive survey type of design is the most convenient way to obtain real facts and figures in which the results of the analyses will be used for decision making or generalization. This research design is considered suitable for this study considering the fact that this study's primary objective centers on the assessment of commonly used pesticides application and frequency of farmers' self-reported health symptoms from selected agricultural farmland in Kano State, Nigeria. The choice of a descriptive survey design was premised on its value and facility in addressing the research problem raised in the study.

The study area

Kano State is located between latitude 13°N and 11°N and longitude 8°W and 10°E (Figure 1). It is approximately 840 kilometers away from the Sahara Desert. Kano has a mean height of around 472.45 m above sea level. Kano State has 44 provinces: "Ajingi, Albasu, Bagwai, Bebeji, Bichi, Bunkure, Dala, Dambatta, Dawakin Kudu, Dawakin Tofa, Doguwa, Gabasawa, Garko, Garun Mallam, Gaya, Gezawa, Gwale, Gwarzo, Kabo, Karaye, Kibiya, Kiru, Kumbotso, Kura, Kunchi, Madobi, Makoda, Minjibir, Kano Municipal, Nassarawa, RiminGado, Rogo, Shanono, Sumaila, Takai, Tarauni, Tsanyawa, Tudun Wada, Tofa, Warawa and Wudil".

Kano State has an overall land area of 20,760 sq kilometers with 9,383,682 populations of inhabitants (2006 provisional result) [3]. Kano temperature is always between 33°C and 15.8°C even though it occasionally reaches 10°C during Harmattan season. Kano has two seasons, including 4 to 5 months of rain and a prolong dry spell usually from the month of October through April. The air masses movement from South-West maritime, extending out of the Atlantic Ocean with the impact of the rainy season, starting from May to September. The start and duration of the rainy season varied between the northern and southern parts of Kano State. In the southern State of Kano, Riruwai last six (6) months beginning early May through late September. Northern parts of Kano State go from the month of June to early September [1]. Average precipitation ranges from 63.3 mm + 48.2 mm in May and 133.4 mm + 59 mm during the month of August. Air masses from the tropical maritime move from South-West to North, which regulates the weather of Kano State all through the rainy season. Moisture from the Atlantic Ocean is being transported through the air masses. This humidity is absorbed once it's forced to increase by means of convection or over a barrier of highland's or a mass of air; and it came like rain. Peak period happens when the sun sets across West Africa amongst March through June. The dry spell begins in the month of October then lasts until April of next year. Low temperatures are usually experience around this time as the sun faces Southern Hemisphere as the desiccating continental mass of air movement which extends through the Sahara, while blowing through the Northeast and carry the Harmattan dust with it. Implying the period of harvest [3].

Population and sample size

The study population comprised farmers in Kura local government area of Kano State, North-West, Nigeria. Available statistics, based on the 2006 population census, showed that Kura has a total population of 143,094 people and 80% of them were farmers [3]. Hence, the population of the farmers was estimated to be 114,475. The population of the study was projected in 2018 using population growth rate of 2.47% as provided by the Nigeria population commission [4]. The projected population was obtained using the following equation:

Equation 1:

$$P_t = P_0(1+r)^t$$

Where, P_t is the projected population, Po was the population in 2006 (114,475), r is the population growth rate (2.47% = 0.0247), and t is the number of years (12).

$$P_t = P_0(1+r)^t = 114475\left(1+\frac{2.47}{100}\right)^{12} = 114475(1+0.0247)^{12}$$

$=114475(1+0.0247)^{12} = 114475(1.0247)^{12} = 114475(1.3402) = 153417$

Hence, the projected population of 153,417 farmers in Kura of Kano State was estimated.

Sample size

A sample size of 399 farmers in Kura was estimated using an equation described by Yamane [5]. Sample size was estimated as:

Equation 2: $N = \frac{N}{1+N(e)^2}$

Where, n is the sample size to be determined, e is the level of significance, and N is the population size.

$$N = \frac{N}{1+N(e)^2}, N = 153417, e = 0.05$$

$$N = \frac{153417}{1+153417(0.05)^2}$$

$$N = \frac{153417}{1+153417(0.0025)} = \frac{153417}{1+383.5425} = \frac{153417}{384.5425} = 398.9$$

n=399

Sampling techniques

The study adopted a multi-stage random sampling technique in the sample selection process. In the first stage of the sampling, random sampling was used to sample 10 villages out of the total of 26 villages in Kura local government area. Randomization was done through balloting. The selected villages were Sarkin Kura, Gamadan, Azore, Kadani, Guraza, Imawa and Godar Ali. During the second stage of sampling, a random sample was selected to select farmers from 10 villages. To give each of the selected villages a uniform number of farmers, the sample size were divided equally across the 10 selected villages and a sample of 40 farmers were selected from each of the villages.

Instruments for data collection

Researchers developed a questionnaire entitled "Self-Reported Symptoms on Farmers Health and Commonly Used Pesticides Questionnaire" that was used in data collection. It was comprised of 25 sections which focus on different demographics including sex, marital status, and age, educational qualification, farming experience, farm size, land ownership status, use of pesticides, commonly used pesticides, effect of pesticides, health problem associated with the exposure to pesticide use and the effect of the pesticide's application on the environment. The study also assesses the safety measures farmers' use to control pesticides and the behaviors when using pesticides.

Validity of instrument

The research questionnaire was presented to experts for validation. Copies of the questionnaire were presented to three experts, two from Environmental Health Science, Kwara State University and one expert in research and statistics (statistician). These experts were required to examine the validity of the research instrument (questionnaire) in terms of language, clarity and content in line with the purpose of the study, research questions and the hypotheses it would measure.

Method of data collection

To facilitate data collection, the researchers employed four research assistants. Two of the research assistants helped in the administration of the data. The research assistants were properly briefed on how to administer the questionnaire. The questionnaire was administered within a four-week periods. Each of the research assistant covered two communities while the researcher also covered two communities. Of the 400 copies of the administered instruments, 392 copies were retrieved and found useable, representing 98% of the administered questionnaire.

Methods of data analysis

Entered questionnaires information was rechecked for quality assurance in an Excel sheet before analysis was done. All submission requests from the semi-structured and comprehensive questions were summarized from all respondents using statistics that are analyzed descriptively such as simple percentages and frequency distribution were used to analyze the demographics of the respondents and to answer the research questions. Also, some vital results of the analysis were presented using pictorial representation like bar chart, cluster bar charts and other forms of pictorial representation. To enhance data analysis and computation of results, version 20.0 of the SPSS was used.

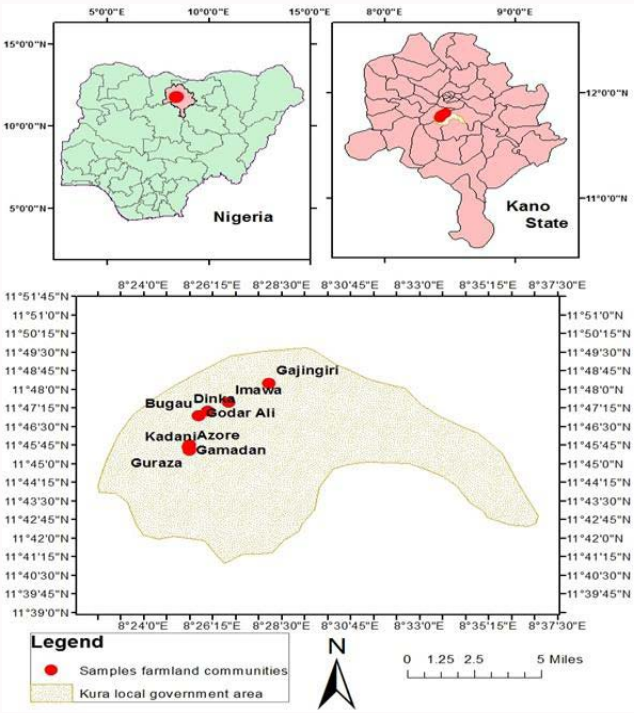

Figure 1: Map of Kano State showing the location of the Study Area in Nigeria.

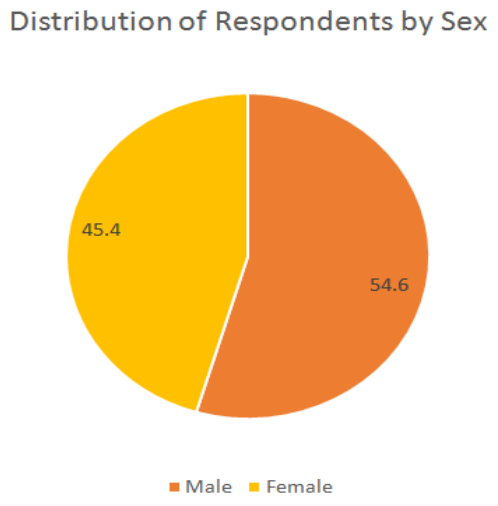

Figure 2: Distribution of Respondents by Sex.
Source: Field Survey, 2019

Results

Figure 1 presents the demographics of the respondents. Result of the distribution of the respondents based on sex reveals that 54.6% of the farmers were male and 45.4% were female. Result also shows that 60.7% were married, 33.9% were single and 5.4% were divorced (Figure 2).

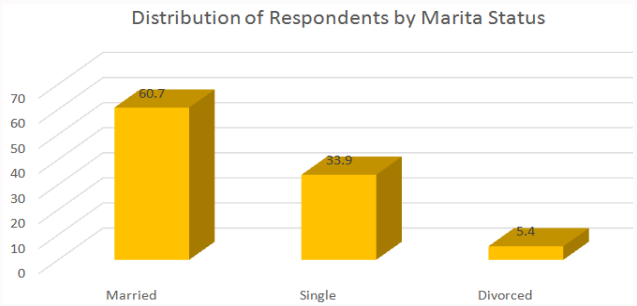

Figure 3: Distribution of Respondents by Marital Status.
Source: Field Survey, 2019

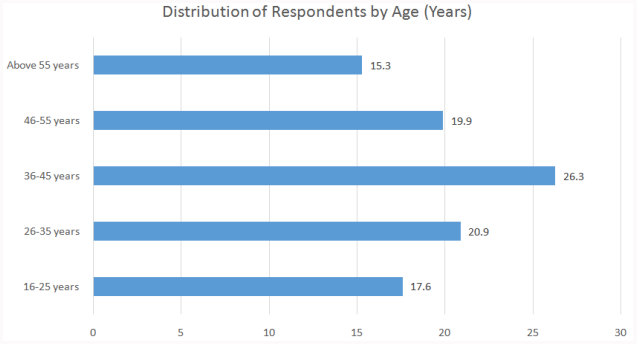

Figure 4: Distribution of Respondents by Age (Years).
Source: Field Survey, 2019

The distributions of the respondents based on age were as follows: 17.6% were between ages 16 to 25 years, 20.9% were between 26 to 35 years, 26.3% were between 36 to 45 years, 19.9% were between 46 to 55 years while the remaining 15.3% of the respondents were above 55 years (Figure 3).

In terms of their educational qualification, 20.2% of the farmers had no formal education, 31.6% had primary education, 36.2% of the farmers had secondary education, 6.4% were OND/NCE holders, and 4.6% were B.Sc/HND holders while 1.0% had postgraduate degrees (Figure 4).

Result also shows that 46.2% of the respondents had 1-10 years of farming experience, 47.7% had 11-20 years of farming experience and 6.1% of the farmers had above 20 years of farming experience (Figure 5).

The distribution of the farmers based on farm size reveals that 43.4% of the respondents had 0.5 to 2.0 hectares of land, 38.5% had 2.5 to 4.0 hectares of land and only 18.1% of the farmers had above 4 hectares of land (Figure 6).

In terms of land ownership status, 52.3% of the farmers acquired their land through inheritance while 47.7% of the farmers acquired their lands through leasing (Figure 7).

In Table 1 are the World Health Organization (WHO) classifications of the pesticides presented. The pesticides most commonly used (mainly pyrethroids, phenylamide and s-metolachlor compounds) by small scale farmers in Kura are categorized by WHO as moderately hazardous and slightly hazardous [6]. The classification of the pesticides shows that insecticides and herbicides are mostly used group, followed by fungicides (31.2%). However, 12% of the other (unidentified), pesticides were used multi-purposely. The insecticides

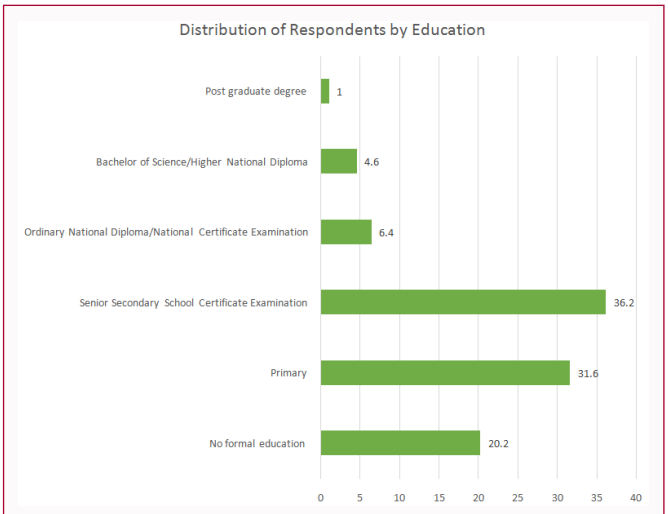

Figure 5: Distribution of Respondents by Education.
Source: Field Survey, 2019

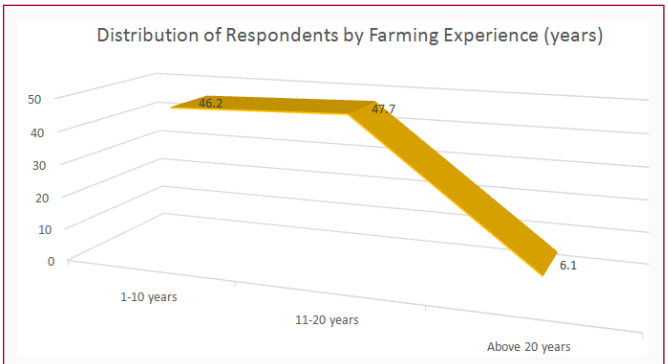

Figure 6: Distribution of Respondents by Farming Experience (years).
Source: Field Survey, 2019

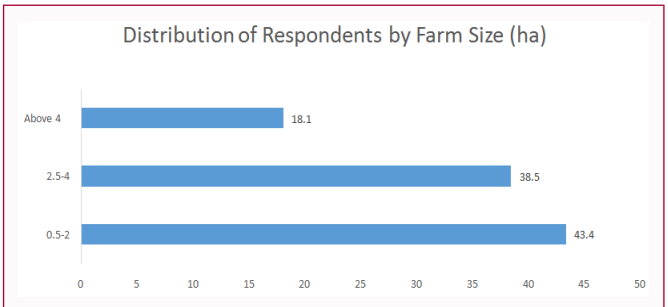

Figure 7: Distribution of Respondents by Farm Size (ha).
Source: Field Survey, 2019

used belonged to the chemical groups of pyrethroids, carbamates and organochlorines. The herbicides belonged to the groups of triazines, aryloxyphenoxypropionate and chloroacetanilide.

Answering of objective questions

Table 2 presents the use of pesticides among farmers in Kura of Kano State. The result reveals that 89.5% of the farmers make use of pesticide while only 10.5% of the respondents do not use pesticides. Of the 351 farmers that use pesticides, 31.3% use Apron plus, 12.0% use Atrazine, 33.6% use Cypermethrin while 9.7%, 8.5%, 4.8%, 31.3% and 12.0% of the respondents use Sevin, Thiodan, Fusilade, Primextra and others (unidentified) respectively. The results showed that 46.2% of the farmers had been using the pesticide for 1 to 5 years, 48.1% had

Table 1: Products reported as used by farmers in Kura.

Type of pesticide used (trade name)	Active ingredient	Main use	Chemical Hazardous Class (WHO)
Apron Plus	Metalaxyl (phenylamide)	Fungicide	II
Atrazine	Triazines	Herbicides	III
Polythrine	Cypermethrin (pyrethroids)	Insecticides	II
Sevin	Carbaryl (carbamate)	Insecticides	II
Thiodan	Endosulfan (organochlorine)	Insecticide	II
Fusilade	Fluazifop-p-βutyl (aryloxyphenoxypropionate)	Herbicides	III
Primextra	S-Metolachlor (chloroacetanilide)	Herbicides	Has no known WHO hazard classification
Others/unidentified			

Note: I: Extremely hazardous; II: Moderately hazardous; III: Slightly hazardous; IV: Unlikely to present acute hazards under normal use condition [6]

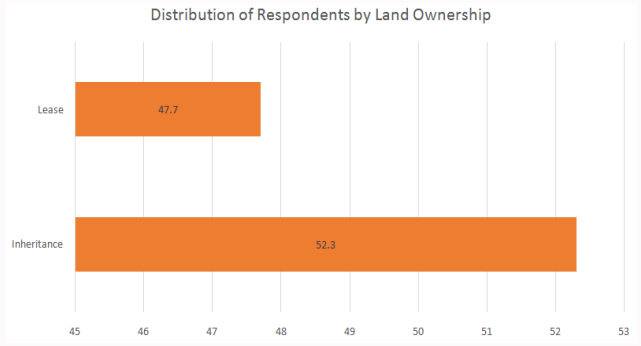

Figure 8: Distribution of Respondents by Land Ownership.
Source: Field Survey, 2019

use it for 10 to 15, 2.3% had use it for 16 to 20 years and 3.4% of the respondents had use pesticide for more than 20 years. A total of 158 respondents (45%) knew about the use of pesticide through retailers, 36.8% heard about it from co-farmers and 18.2% of the respondents heard about pesticide use through consultancies. One hundred and nine (109) respondents representing 31.1% of the respondents stated that their main purpose of using pesticide was for weed control, 14.5%, 14.5% and 39.9% of the respondents said that their main purpose of using pesticides was for pest control, rodent control and fungi control, respectively. The most common pesticides used by farmers in Kura are presented using a bar chart shown in Figure 2.

Table 3 shows that 41.4% of the respondents who complained of pesticides related problems had headache, 39.4% had stomach cramps, 46.5% complained of muscle weakness, 37.4% complained of vomiting, 36.4% complained of dizziness, 27.3% complained of shortness of breath, 11.1% complained of blurred vision while 54.5% complained of eye irritation. Results of the analysis of the regularity of these symptoms reveals that the majority of the respondents experienced these symptoms on a regular basis: 56.1% for headache, 53.8% for stomach cramps, 56.5% for muscles weakness, 56.8% for vomiting, 58.3% for dizziness, 40.7% for shortness of breath, 45.5% for blurred vision and 66.7% for eye irritation.

Discussion

Most commonly used pesticides by farmers in Kano State

Globally pesticides are an important and growing component of the 21st century, which is widely used for pests' control, weeds, diseases and other pathogens of plant, to decrease or eradicate crop losses and to sustain high quality product. Even if pesticides are considered poisonous and a high risk to farmers who are exposed, pesticide use among farmers in Kano is relatively high and farmers in

Table 2: Pesticide use among farmers in Kura.

Questions	No. of respondents	Percentage (%)
Do you use pesticides		
Yes	351	89.5
No	41	10.5
If yes, what type of pesticide do you use?		
Apron Plus (phenylamide)	110	31.3
Atrazine (triazines)	42	12
Cypermethrin (polythrine)	118	33.6
Sevin (carbamate)	34	9.7
Thiodan (organochlorine)	30	8.5
Fusilade(aryloxyphenoxypropionate)	17	4.8
Primextra(chloroacetanilide)	110	31.3
Others	42	12
Years of pesticides use		
1 years to 5 years	162	46.2
10 years to 15 years	169	48.1
16 years to 20 years	8	2.3
Above 20 years	12	3.4
How do you know about pesticides usage		
Retailers	158	45
Co-farmers	129	36.8
Consultancies	64	18.2
What is your main purpose of using pesticides		
Weed control	109	31.1
Pest control	51	14.5
Rodent control	51	14.5
Fungi control	140	39.9

Source: Field survey (2019)

Kano practice farming involving both subsistence and commercial, while using huge pesticides quantities. It was notice that the most commonly used pesticide Cypermethrin (33.6%) was applied often in Kano, followed by Apron plus (31.3%) and Primextra (31.3%), Atrazine (12.0), Sevin (9.7%), Thiodan (8.5%), Fusilade (4.8%) and Other (unidentified) (12.0%). Unexpectedly, in some parts of Kano State, it was observed that people consumed pesticide-treated seedlings copiously knowing that these seedlings could be harmful to their health. This view was contrary to a study conducted by Abubakar et al. [7] who found that the pesticides mostly used by agricultural farmers were known as Apron Plus (93.8%), followed by Sevin used

Table 3: Symptoms and frequency of symptoms among farmers who use pesticides and experience some effects.

	Frequency of self-reported symptoms			
Health related self- reported symptoms	**Regularly n (%)**	**Occasionally n (%)**	**Rarely n (%)**	**Total**
Headache	23 (56.1)	13 (31.7)	5 (12.2)	41 (41.4)
Stomach cramps	21 (53.8)	14 (35.9)	4 (10.3)	39 (39.4)
Muscles weakness	26 (56.5)	15 (32.6)	5 (10.9)	46 (46.5)
Vomiting	21 (56.8)	12 (32.4)	4 (10.8)	37 (37.4)
Dizziness	21 (58.3)	13 (36.1)	2 (5.6)	36 (36.4)
Shortness of breath	11 (40.7)	11 (40.7)	5 (18.5)	27 (27.3)
Blurred vision	5 (45.5)	2 (18.2)	4 (36.4)	11 (11.1)
Eye irritation	36 (66.7)	13 (24.1)	5 (9.3)	54 (54.5)

by 80.5% of farmers. The other pesticides include Cypermethrin (73.4%), Fusillade (59.4%), Primextra (51.6%), Atrazine (19.5%), and Thiodan (19.5%). All this suggests pesticides play a remarkable part in the control of pests and growth efficiency. Even though, the pesticides detrimental effects on human health and the environment in the global south have been around for more than a decade, despite the concern that has been expressed. Also, this view is contrary to the study conducted by Denkyirah et al. [8] who found that most (85%) of the participants showed they used chemicals for pests' and diseases control, whereas 15% of the agricultural farmers used other pesticides to control pest, which include Integrated Pest Management (IPM) and integrated crop management. The farmers who depend on pesticides for pests and diseases control (85%); both used pesticides approved and recommended by the Ghana Cocoa Board and pesticides that are not approved by Ghana Cocoa Board. The choice of farmers' unapproved pesticides was founded on its usefulness in pest and disease control (43.1%), market accessibility (25.5%), affordability (18.1%) and fellow famer's suggestions (13.2%) [8]. In addition to the commonly reported pesticides used by farmers in Kura Local Government are due to poisoning (Table 1), many substances were listed as moderately hazardous and slightly hazardous, mostly pyrethroids, phenylamide and s-metolachlor compounds and are frequently used or stockpiled in homes. This shows a consistent relationship between the distribution of pesticide and successive human exposure, and also shows the value of distributed information on pesticide constituents as a potentially useful means of surveillance through an exposure proxy. Notably; at least three (3) commonly agents responsible for poisoning in this research include [cypermethrin (pyrethroids), apron plus (phenylamide), and endosulfan (organochlorine)] were hitherto reported in Tanzania due to pesticide poisoning [9,10]. Likewise, the WHO class I products was not reported as a key source of toxicity in this research, probably since such products are now registered in Nigeria for "restricted use" and therefore were not used by farmers in small scale. Highly toxic pesticides ban has proven to be an effective approach for mortality reduction in Sri Lanka [11]. Reported Endosulfan, in this research, and seen been stored at households, belonging to Persistent Organic Pollutants (POPs) group. It is previously remained restricted in over 56 countries due to its major environmental impact and toxicity [12]. In relations to chronic toxicity, extremely harmful endosulfan is lethal to aquatic life and endosulfan exposure has resulted to lives lost, especially in the global south [13,14]. The Sri Lanka intervention studies, place emphasis on a ban on endosulfan since 1998, deaths due to Acute Pesticide Poisoning (APP) over a 3 year period following the ban that has been reduced by 15 times in designated community hospitals [11]. In relations to acute toxicity, endosulfan is an endocrine disruptor that mimics estrogen with extreme low levels exposure and is present in the breast cancer. It's a neurotoxin and is associated with Parkinson's disease, immune toxicity and birth defects [13]. Endosulfan has been linked with children exposed to increased growths and reproduction effects on environmental plantations on cashew nut in India [11]. Built on this "accumulating evidence base", in 2011, the Review Committee met with the PIC and decided that endosulfan fulfils the inclusion criteria for the PIC treaty (Rotterdam). However, many nations engage in pesticide exportation, like India, have banned its inclusion to the "Prior Informed Consent" (PIC) schedule [14,15]. Even with, India having half of nearly 9,000 tones of endosulfan in its yearly production. The court banned delivery in June 2020 by order of the Supreme Court of India at the request of the "Democratic Youth Federation of India" to quantify the toxic health effects of pesticide [15]. Which is why the study makes available further evidence. To give support to the endosulfan introduction into the list of PIC. Additionally, nations such as "Burkina Faso, Cape Verde, Gambia, Mali, Mauritania, Niger and Senegal" etc. are affiliates that include Sahelian Pesticides Committee (CSP), have banned the use of endosulfan since 2008 ending. This is the final regulatory action to be carried out to guard health of humans and the milieu. This activity is based on the risk appraisals of hazard, taking into considerations, local situational exposure for pesticide operators, including the aquatic ecosystems. These substances were found to pose an unacceptable risk for operators, families inhabiting in or close to cotton fields, including the aquatic ecosystems. The supporting notices credentials indicate precise risks. The risk assessments associated with the Sahelian countries such as hazards assessment to the health of humans (high acute toxicity) and to human contact (occupational exposure), were produce in USA and Australia using examples, taking into consideration the prevailing context in the Sahel (hot climate, inadequate training, lack of PPE). Hence, the assessments meet the risk appraisal criteria [16]. The prevalence of WHO Class II pesticides use (33.6%, 31.3%, 9.7%, and 8.5% respectively) in this research is less than hitherto reported (64% and 76% correspondingly) through a conducted study by Tanzanian farmers' [9]. An earlier conducted research in 1991 to 1993, besides the observed changes that could be due to different conditions in Tanzanian practice of agriculture through the introduction of products that are novel, especially pyrethroids. Cypermethrin is known as a synthetic pyrethroid widely used in agricultural insecticide at large-scale. In soil and plants, it easily degrades. Pyrethroid pesticides have shorter life duration with toxicity that are relatively low. They have easy compounds degradability with risk that is low on the milieu [17]. Though, the pesticides misuse, abuse, or overuse can

stockpile in the soil and make them harmful to the soil born micro-organisms, even at lower levels. Pyrethroid are a set of pesticides that can cause "diarrhea, headache, convulsion, excessive nasal mucous discharge, sudden swelling of face, vomiting, sweating, eye lids, lips, mouth and throat tissues, hay-fever such as signs and reduced release of brain hormone" [18]. Many of these products are used in export crops [19]. This condition is reflected in the same components in the structure of the substances most frequently considered as poisoning causing. Alternatively, some agricultural farmers can use other methods of pest control like "Integrated Pest Management (IPM)" which decrease their dependence on other chemical pesticides that are toxic. In Tanzania after 1993, IPM control management was presented and comprise of the air tight containers use for storage, botanicals and inert materials like dust, cow dung and ashes to shield maize that are harvested and powdered neem seed, pyrethrum dusts and synergized pyrethrum for universal pests' storage and pheromones use in trapping field insects [14,20,21]. Triazines are also a cluster of chemicals that breaks down the vitamins metabolism that causes skin and eye irritation, vomiting, nausea, diarrhea, salivation and muscular weakness. Its longitudinal effects comprise disturbance in sperm production, liver and kidney damage, adrenal damage, carcinogen, kidney and urinary tract stone formation, lungs and ground water that is contaminated [22]. The results of the analysis revealed that 46.2% of the farmers had been using the pesticide for 1 to 5 years, 48.1% had used it for 10 to 15, 2.3% for 16 to 20 years and 3.4% of the respondents had used pesticide for more than 20 years. This view is contrary to study conducted by Kofod et al. [23]. WHO state that (42.9) of the agricultural farmers indicated they had been using the pesticides for 1 to 10 years, 31% had use it for 11 to 20 years, 11.9% had use it for 21 to 30 years and 14.3% had use it for over 30 years [23]. In the current study, 45% of the farmers knew about the use of pesticide through retailers, 36.8% heard about it from co-farmers and 18.2% of the respondents heard about pesticide use through consultancies. These data were buttressed through a research conducted by Philbert et al. [24] who found that majority (85.7%) of the respondents knew about the use of pesticide through retailer's shop and 14.3% heard about it through other means. During the survey, some farmers were asked on pesticide's information, however, it was noticed that they did not understand the labeling in English, and others are unaware that it was branded in two languages (Swahili and English). A total of 109 farmers, representing 31.1% of the respondents, stated that their main purpose of using pesticide was for weed control, 14.5%, 14.5% and 39.9% of the respondents said that their main purpose of using pesticides was for pest control, rodent control and fungi control, respectively. This view is contrary to the study conducted by Sapbamrer and Nata [25] who found that the majority of frequently used pesticide in rice field remained insecticides (84.6%), followed by herbicides (63.2%), fungicides (7.1%), and acaricides (6.6%), respectively. Insecticides and herbicides, with several trade names, including the most frequently used pesticides in the current study (Table 2).

Effects of pesticides use on farmers' health by monitoring the frequency of self-reported symptoms in Kano

Health is one of the most significant components of the human capital for rural people in emerging countries. The study participants highlighted the potential risks of the use of pesticide and their adverse effects on environment and health. The farmers associate the potential symptoms from the exposure of pesticides linked to the acute poisoning toxicological effects. This could be as a result of majority of them were knowledgeable and several of them had experienced some of these mentioned symptoms. Results of the analysis of the regularity of these symptoms reveals that the majority of the respondents experienced these symptoms on a regular basis: 56.1% for headache, 53.8% for stomach cramps, 56.5% for muscles weakness, 56.8% for vomiting, 58.3% for dizziness, 40.7% for shortness of breath, 45.5% for blurred vision and 66.7% for eye irritation. These results are not in tandem with Bhandari et al. [26] study which showed that nearly all agricultural farmers alleged having symptoms of acute health after using pesticide. In the study, self-reported toxicity is the most often symptoms linked to pesticides, which include headache (73.8%), skin irritation (62.3%), eye irritation (32.8%), weakness (22.4%) and muscle pain (19.1%). His results are in agreement with previous research in Nepal and Vietnam [27,28].

Conversely, this result is not consistent with the research of Maria et al., which shows the majority of common symptoms include cephalea (77 persons or 51.7% of 149 intoxicated patients) trailed by dizziness (48 people) and vomiting (42 people) [29]. Below half of the farm employees identified cephalea (29 people) considered this sign by way of physical appearance of pesticides intoxication (self-examination intoxication). On one hand, over 50% of all people who report diarrhea and those who report dizziness, vomiting and stomach discomfort identified themselves as intoxicated. Further signs identified by the farm employees in their study included blurred vision, loss of appetite, burning face, fatigue, body itching, fever, ringing in the ears and spots on the body. In addition, less than half of the 149 people who identify signs after pesticides use identified themselves highly intoxicated through these products. Cases of self-reported intoxication with higher incidence among younger workers have been reported by Yassin et al. [30] and recommended that this people could express themselves through the interviews better. Some recent studies have showman applicator with illness or symptoms leading to visiting the health care provider which may not be possible to remember this incident than other who ensured not to seek care [31,32]. Symptoms identified in this study include dizziness, cephalea (headache), abdominal pain and vomiting are specific pesticides exposure, such as the organophosphorus and carbamate insecticides [33,34]. Similarly, the findings are not consistent with a study conducted by Gurung and Kunwar [35], which showed 96% of the respondents, knew skin irritation as a poisoning symptom from pesticides use, which is not consistent with the study of Lekki et al. [36], which shows 66% of the respondents had awareness regarding skin irritation [36]. The findings of Gurung and Kunwar [35] showed that 98% and 96% of the respondents knew dizziness and headache as poisoning symptoms of pesticides use in the nervous system. This is contrary to what happened in this current research, as the findings of Lekki et al. [36], is not consistent with the study which shows 49% had awareness regarding dizziness and 66% about headache. 84% of respondents were aware of nausea as poisoning symptoms of pesticides use in gastro-intestinal system which is not consistent with Lekei et al. [36], which shows 34% had awareness regarding nausea. The high frequency of the regularity of self-reported symptoms among farmers in Kano State reveals that the majority of the respondents experienced these symptoms on a regular basis. This is less than what was stated in Kenya, due to the prevalence of episodes of poisoning (61.1% of agricultural workers reported four (4) or more prior poisonings) [37]. These data most probably indicate non-severe condition because they go unidentified in the absence of an Acute Pesticides Poisoning (APP) surveillance program since they do not appear at health center.

These APP cases are closely monitored by the community on the basis of self-reporting systems. The above re-affirmed pesticides exposure to be one of the main remarkable occupational risks for farmers in the global south and to identify the risks associated with pesticides use and develop pesticides safe methods while handling pesticide. However, most farmers in the study area do not have formal education and without any form of training, so they must be exposed to training and education on the dangers of pesticides usage. This is in tandem with Prince et al. who found that most of the agricultural workers were ignorant, and only an insignificant cluster are educated/literate [38]. It was also shown that 48.9% of the agricultural workers are illiterate and lack knowledge on the appropriate use of agrochemicals, they merely use through learning from their seniors, which possibly will not always be right. Additionally, controlling pesticide usage through regulatory system of proffered is well-known. Studies has shown that residual pesticide are a major concern for consumers that fears frequently when they buy farmed products and community concern around pesticides in their milieu, that their effects on human health is steadily increasing.

Conclusion

It can be said that the use of pesticide in agriculture has been increasing daily to cultivate and produce agricultural products. Kano State Farmers are more likely to use pesticides in their farming, regardless of the duration of their impact, whether they know it or not. Pesticide use knowledge and environmental impact is very significant. A few farmers in this study reported that they had other side effects such as dizziness, headache, blurred vision, skin irritation, vomiting, and problem of eyesight irritation etc. There is evidence that accumulating self-poisoning pesticide are among the most common approaches of suicide globally, nonetheless the snag magnitude and the worldwide deaths distribution is unknown. In conclusion, the results of this study may be useful for different organizations in the design, implementation, and appraisal of ongoing development relating to high extent impute based on agriculture and environment issues in terms of pesticides approaches. However, safety standards can solve many of the problems associated with pesticides use and handling. This comprises sales, storage, application, and disposal. The best way to define these standards is through proper labeling-verbal or pictograms. Labels can help agricultural workers distinguish chemicals and aid accurate and reliable information on suitable usage and disposal. Regulation through verbal labels is ideal for people/societies who can write and read. Pictograms are an alternative for people/societies without writing skills; nevertheless, since this universal knowledge cannot be understood, particularly in the emerging countries such as Nigeria, a multicultural mass communication and education is required. Henceforth, the regulation of label remains effective only if complimentary investments are made towards training agricultural workers to read and interpret them. In the global south, substantially greater resources should be used to analyze and monitor quality of product at the level of the retailer. Regulatory control of dealers, with proper license, training, and supervision, not only advance the compounds efficacy but also monitor human and environmental health. Likewise, application equipment must meet the minimum global standards. This would decrease the peril of unnecessary farmer's exposure to pesticides and good nozzles equipment that is appropriately calibrated promotes effective chemicals use and avoids drift. However, pesticide use is increasing in the global south particularly through advances in agricultural practices. Undoubtedly, this area is considered a critical area of significant public concern, with farmers seriously considering controlling it, and an understanding of the truth about the use of pesticide and regulation will support the farmers make rational decision about their agricultural farming practices. After all, it is essential to improve the balance between the agricultural system and the production of better and healthier food, quantity and quality. The benefits of this global diet and food security must be weighed against the risk of pesticide use. Improved theories established in all of these cases can begin to alleviate the situation.

Also, a crucial pillar in the considerations of pesticides is the "precautionary principle" and ought to be an important guide in policy making regarding pesticides safety. Therefore, the following are recommended:

- Raising Awareness and better knowledge.
- Present list of pesticides permitted for use and prohibited from use in Nigeria need to be reviewed. List of pesticides permitted for use in organic agriculture production need to be issued by Ministry of Agriculture and Rural Development to meet the demand of organic farmers.
- Governments should provide literary education on all level of organic agriculture and in relevant research centers.
- Advocating for community awareness on pesticide safety measures through approaches including the community, legislators, private sector, decision makers and the administrators.
- Endorsement of sound farming practices that is organic and ecological in nature, holistic and suitable for local farming practices that remain undisruptive to the social, economic, gender and cultural considerations.
- Regulating the dependence of agricultural farmers on artificial products like the use of harmful pesticides to the milieu.
- Promoting and supporting agricultural practices that encourage biodiversity preservation and guarantees wholesome food and quality products that are good.
- Provide appropriate risk criteria for evaluation and necessitate that such evaluation be carried out in Nigeria and not overseas.
- Requires that farmers should be represented throughout the boards that are associated with agriculture pesticides.
- Promote agriculture production patterns that have minimal environmental footprints.
- There is need for high demand for bio-pesticides, especially for soil borne diseases control and law enforcement in pesticides trade and use need to be tighten.
- All "problem pesticides" need to be banned and some amendments should be considered in coming years with tendency to tighten pesticide management.

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