Published by
NIGERIAN SOCIETY OF PHYSICAL SCIENCES
Available online @ https://asr.nsps.org.ng/index.php/asr

African Scientific Reports 4 (2025) 242

African Scientific Reports

Pesticides survey and identification of common insecticides used for foodstuff storage in Makurdi, Benue State, Nigeria

Qrisstuberg M. Amua[a], Emmanuel K. Ukpoko[b,*]

[a]*Department of Natural Sciences, British Canadian University Obudu, Cross River State, Nigeria*
[b]*Chemistry Department, Joseph Sarwuaan Tarka University Makurdi, Nigeria*

Abstract

Pesticides in foodstuffs have become a daily deal with potential health challenges. Identification of these pesticides would be helpful in precautionary ways of dealing with their consequences on foodstuff and human health. A survey of pesticides was done in five major markets located in different axes of Makurdi town. The survey was achieved with the instrument of questionnaire and interview, anchored and recorded during the interview with pesticide sellers at their respective stores at the markets in Makurdi. At least three pesticide dealers were interviewed from each market on the types of pesticides available (inventory) comprehensively, those used for foodstuff storage, effective types of insecticide for foodstuff storage, the most patronized, and their mode of application. Identification and classification of the pesticides were based on active chemical names, common names, or trade names in Nigeria; the nature of active chemicals; applications on the field; and in-store foodstuff. The average percentage of daily patronage was calculated, and knowledge of the expiration date was uncertain. Interestingly, three active chemicals were considered the most popular and sought-after for aiding food storage: aluminum phosphide, dichlorvos, and permethrin, all under multiple brand names. These chemicals accounted for 37.50%, 33.33%, and 20.83% of the market, respectively, with the remaining insecticides accounting for just 8.33%. The study also revealed that many illegal and outdated pesticides are still in use in Makurdi, often in absurd quantities without a shelf life, endangering the health of everyone who consumes the food products obtained from their usage.

DOI:10.46481/asr.2025.4.1.242

Keywords: High pesticides, Survey, Foodstuff, Storage, Chemicals

Article History :
Received: 13 September 2024
Received in revised form: 23 November 2024
Accepted for publication: 07 February 2025
Published: 12 March 2025

© 2025 The Author(s). Published by the Nigerian Society of Physical Sciences under the terms of the Creative Commons Attribution 4.0 International license. Further distribution of this work must maintain attribution to the author(s) and the published article's title, journal citation, and DOI.

1. Introduction

Pesticides are chemicals capable of destroying pests or controlling their activities, so it is used in agriculture to boost the foodstuff supply by protecting crops against destructive pests, both in the field and in storage. The application of pesticides varies from preparation of seeds, and soil, crop growth on fields and post-harvest treatment of farm harvest [1]. Pesticides are applied to grain foodstuff during storage to prevent pest infestation [2]. Pesticide dealing is very technical and it is very difficult for the individual farmers or extension agent to adopt safe and responsible practices without detailed step-by-step instructions [3]. According to a survey report conducted Pii et al [4], the report offers details on the kinds of pesticides those farmers, marketers, and consumers of agricultural food products that are stored employ. The results was obtained from the following sampling category of 51% respondents

*Corresponding author Tel. No.: +234-703-768-1809.
Email address: ukachiiemma@gmail.com (Emmanuel K. Ukpoko)

were male, with 41% falling within the age range of 30-39, married respondents accounted for 52%, while 48% had household sizes of 1-5, only, 20% of the respondents had no formal education, and 75% were marketers [4]. In a multiple response schedule, The most patronized pesticides were aluminium phosphate tablets which ranked 80% for storage pesticides, while dichlovos was 60% and DDT was 35%. Other pesticides, such as endosulfan, gamalin, carbofuran, carbendazim, and permethrin were ranked between 5-15% according to Pii *et al*. [4]. Another research by Adelaku *et al*. [5] state that the use of synthetic pesticides (insecticides, herbicides, fungicides, and some antimicrobials) is inevitable in fruit and vegetable farming due to the widespread exposure to pests and illnesses. Stinging eyes, blisters, rashes, blindness, nausea, illnesses, diarrhea, and death are examples of acute health impacts [5]. Many concerns have been raised from many quarters in Nigeria about application of pesticides and the risks of pesticides in foodstuffs [6, 7] as most of these pesticides have shown a high degree of toxicity, especially in developing countries [8].

For instance, European countries, wherever a high level of pesticides in foodstuff has been discovered, the European Union did place a ban on some agricultural commodities from those areas for some time now. Food items banned by European countries since June 2016 include beans, sesame seeds, melon seeds, dried fish and meat, peanut chips and palm oil [9]. Beans banned by the European Food Safety Authority were found to contain dichlorvos concentrations exceeding 0.03 mg/kg, whereas the acceptable maximum residue limit is 0.01 mg/kg [9, 10].

Pesticides are formulated to stop pest organisms from the destruction of crops and foodstuff, but they also generate some residual contaminants and risks within foodstuff [11, 12]. Human health is now threatened by the presence of pesticides residues in crops and foodstuff [11, 12]. Examples of these pesticides of concern include cypermethrin (α-cyano-3- phenoxybenzyl-2,2-dimethyl-3-(2,2 dichloro vinyl) cyclopropanecarboylate), butachlor, aldrin, dieldrin, pendimethalin, propanil, alpha HCH, etc. [9].

In Nigeria the National Agency for Food and Drug Administration and Control (NAFDAC) banned 30 pesticides and other chemicals in Nigeria on 2nd January 2022 [8]. According to Ref. [8], Nigeria was a signatory to several international treaties and conventions that banned chemicals and pesticides such as the Rotterdam Convention, an international treaty designed to facilitate informed decision-making by countries regarding trade in hazardous chemicals and pesticides. Its added that, in the last four years, NAFDAC has reviewed its regulations, and guidelines and strengthened collaboration with government agencies and stakeholders to ensure effective regulations and such collaborative effort has been recorded in agrochemicals regulation and other areas [8].

The objective of this study was to survey the available and common pesticides used in the storage of agricultural produce within Makurdi, Nigeria and to test the level of the farmers and marketers on these chemicals banned by NAFDAC. Using structured questionnaires to gather coherent information on the prevalent pesticide patronage and application among harvested/stored produce by food dealers, this survey was conducted to improve up to date knowledge of the current brands of pesticides used in Benue, existence levels of pesticides applications. This is to unveil the current increased awareness on food safety and quality control on residual pesticide concentrations in/on harvested/stored produce in Benue state. This study was build on the ropors by Dugje *et al*. [3] and Pii *et al*. [4] to ascertained the additional increased of pesticides brands and application as technology improved with time in Benue state as the food basket of the nation.

2. Methodology

2.1. Study area

Sample areas were the main markets of Makurdi Town in Benue State. Benue State is in the North Central region of Nigeria. The state accounts for over 70% of Nigeria's Cereal crop production. Makurdi is a Town at latitude 7.732152, and longitude 8.539144, on Nigeria GPS coordinates of 7° 45′ 55.7472″ N and 8° 32′ 20.9184″ E at 91.237 meters altitude [13]. Makurdi is the political headquarters of Benue State with a population estimate of 454,419 as at the year 2023; where the domestic and commercial cereal foodstuff are massively kept in storage to enhance market value and also mitigate glut in the supply chain.

A survey of pesticides was done in the five main markets from different axes as shown in Figure 1, Map of Makurdi Town in Benue State, Nigeria. These markets are the High-level Market, Moden Market, North Bank Market, Wadata Market and Wurukum Market.

2.2. Survey of pesticides In Makurdi town

A survey of pesticides was done in five major markets located on different axes of Makurdi town as described on the map of Makurdi town (Figure 1). Pesticides dealers with the surplus pesticide were contacted from each of the five markets and were acquainted with the essence of the research questionnaire, those who obliged were engaged. The survey was conducted with the instrument of a questionnaire and oral interview. Structured questionnaires were anchored and recorded during the interview with pesticide sellers at their respective stores at the markets in Makurdi town. The Questions were as follows: Q1, What are you selling, (a) Pesticides, (b) Fertilizers (c) General Agrochemicals (to tick the choice), Q2, How long are you into this Business? (a) 1 year (b) 5 years (c) 10 years and above (to tick the choice), Q3a. What are the brands of Pesticide available? (to be listed in reccod), Q3b, From the Pesticides you shown/ mentions, which brands are used for food stuff storage? (to list), Q4a, Please recommend at least five effective brands of pesticides for storage of my Beans and corns for at least one year. (To tick from Q3b, listed above or add to list), Q4b, Which of these pesticides your customers patronized mostly? (To tick from Q3b above or add to list), Q4c, How do I apply

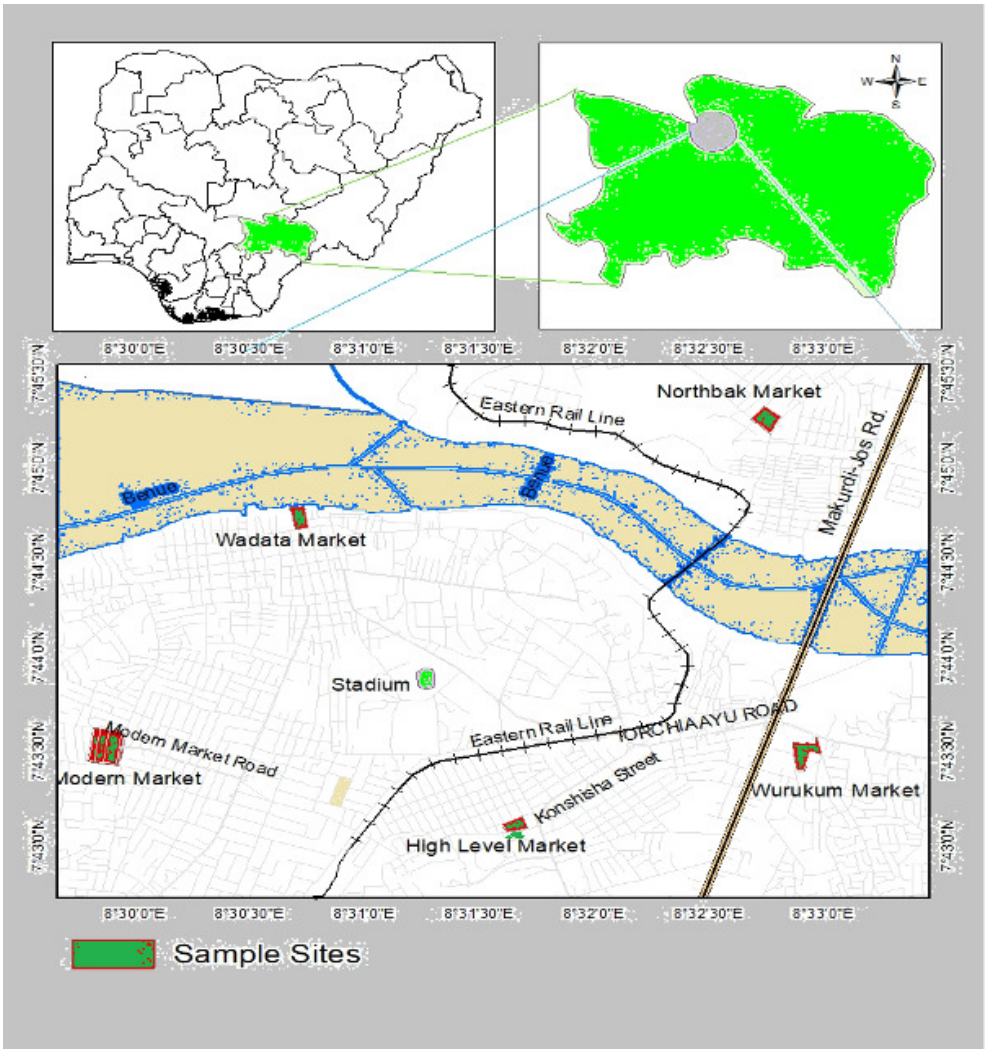


Figure 1: Map of Makurdi town in Benue State, Nigeria showing the markets samples areas.

these brands of pesticides or insecticide and stored my foodstuff of Beans and Corn stuffs? (To tick from a-d) (a) Direct contact (b) indirect contact (c) close environment (d) On silos / containers, and Q5, Do you know when these pesticides expired while in your stored. At least three pesticide dealers in the same market were interviewed from each market.

The information gather from interview and inspection exercise with these questions were sort with the following order: Types of pesticides available, (that is comprehensively inventory), those that are generally used for foodstuff storage, the effective types of insecticide for foodstuff storage, the most patronized and their mode of application, identification and classification of the pesticides were based on active chemical names, common names or trade names in Nigeria, the nature of active chemicals and applications on the field or in-store foodstuff.

$$\text{Percentage average daily patronage (\%)} = \frac{\text{Day minimum and maximum range of persons patronage for a particular pesticide across the markets}}{2} \times 100. \quad (1)$$

3. Results

The classification of the surveyed pesticides available in Makurdi, Benue State, Nigeria, is shown in Table 1, presented with chemical names, trade names in Nigeria, the nature of the active chemical, the target organisms, and the mode of application. The results in Table 2 show the daily patronage of common and effective insecticides for the storage of foodstuff in Makurdi, Benue State, Nigeria.

Table 1: Daily patronage of insecticides for storage of foodstuff in Makurdi, Benue State, Nigeria.

S/N	Chemical Names	Trade Names in Nigeria	Nature of Active Chemical	Target Organisms	Applications / Cautions
1	Actellic	Actellic 25 EC	Organophosphorus (Synthetic)	Insects	Not to consume or sell the grains mixed and stored with Actellic until after 3 months (short-term) or 6 months (long-term).
2	Aluminium phosphide (AlP)	Justoxin, Phostoxin, Fumitoxin, Fostox, Celphos, Pestphos, Talunex, etc.	Phosphates (Inorganic Synthetic)	Insects	Systemic insecticide for many cereal crops.
3	Apron or Aspirin	Apron Star 42WS, Mefenoxam	2-Acetoxybenzoic acid (Synthetic)	Fungi	Pre-plant seed coat treatment. Apply as slurry or dust and plant after treatment.
4	Atrazine	Atrazine, Atrataf, Atraforce, Delzine, Xtrazine	Organochlorine (Synthetic)	Grass	For the control of grass weeds in cereal crop fields.
5	Alachlor	Lasso, Alachlor, etc.	Organochlorine (Synthetic)	Grass seeds	For pre-emergence weed control in maize and some leguminous crops.
6	Butachlor	Butachlor, Butacrop, Butastar, Cleweed, Teer, etc.	Organochlorine (Synthetic)	Grass and Broadleaf	For the control of broadleaf and grass weeds in rice and leguminous crops.
7	Carbofuran	Bay, Diafuran 3G, Furadan, Curater, Furacarb, Yaltox, etc.	Benzofuran amine	Insects and nematodes	Controls foliar and soil insects and nematodes in vegetables, maize, groundnut, soybean, potatoes, etc.
8	Cypermethrin	Best, Cypermethrin, Superthrin, Cymbush, Cypercot, etc.	Organochlorine	Insects	Contact insecticide for many crop pests.

S/N	Chemical Names	Trade Names in Nigeria	Nature of Active Chemical	Target Organisms	Applications / Cautions
9	Dimethoate	Perfekthion 2.5 EC	Organophosphate	Insects	Contact and systemic action. Controls plant-sucking insects in cotton, cowpea, cereals, etc.
10	Dichlovos	Nuvan, Pestoff, Dash, Sniper, Delvap, etc.	Organophosphate (Chlorinated)	Insects	Contact insecticide used to protect grains in storage and in houses. Often combined with Actellic.
11	2,4-D Amine	Aminoforce, Delmin-forte, 2,4-D Select, etc.	Organochlorine (Synthetic)	General weeds	For pre- and post-emergence control of broadleaf weeds.
12	Glyphosate	Roundup, Glycel, Bushfire, Touchdown forte, etc.	Organophosphate (Synthetic)	Herbicide	Systemic herbicide for general weed control before land preparation.
13	Lambda-cyhalothrin	Karate, Laraforce, Attack, Zap, etc.	Organochlorofluoride (Synthetic)	Insects	Systemic insecticide for many crop insect pests.
14	Mancozeb	Mancozeb, Mycotrin, Z-force, Hi-shield, etc.	Carbamate of Sulfur amide (Non-synthetic)	Fungi	Contact fungicide for disease control in many crops.
15	Oxidiazolone	Ronstar, Riceforce, Unicrown	Organochlorine	Grass	For pre-emergence weed control in rice fields.
16	Paraquat	Dragon, Gramoxone, Paraforce, Weedcrusher, etc.	Organochlorine (Synthetic)	General weeds	Contact herbicide for weed control in all crop fields.
17	Pendimethalin	Stomp, Pendilin	Dinitroaniline (Synthetic)	General weeds	For pre-emergence weed control in rice, maize, and leguminous crops.
18	Permethrin	Rambo Nix, Ride, Elimite, etc.	Organochlorine	Insects	Applied on cloths, silos, nets. Used for scabies, lice, or mixed with grains in storage.

S/N	Chemical Names	Trade Names in Nigeria	Nature of Active Chemical	Target Organisms	Applications / Cautions
19	Propanil	Orizo, Propanil, Propacare, Rhonil, etc.	Organochlorinamide (Synthetic)	General weeds	For post-emergence weed control in rice.

Table 2: Daily patronage of insecticides for storage of foodstuff in Makurdi, Benue State, Nigeria.

S/No.	Pesticides	Daily number of persons patronage	Average persons patronage	Percentage average daily patronage (%)	Applications	Expired awareness
1	Aluminium phosphide	4–7	4.5	37.50	Indirect/direct contact	Unknown
2	Dichlovos	3–5	4	33.33	Direct/indirect contact	Unknown
3	Permethrin	2–3	2.5	20.83	Direct contact	Unknown
4	Others	0–2	1	8.33	Direct/indirect contact	Unknown
5	Total	9–17	12	99.99		

4. Discussion

4.1. Pesticides survey

The result of pesticides surveyed has shown the extensively used of pesticides in Benue State Nigeria, the survey also review much about less considerations for regulation, evaluation, supervision, which remains a great challenge for awareness. The pesticides dealers also hint that, most of the customers do buy it in bulk quantity for retails out of markurdi town and some are hawking around on the streets of Benue towns. The dealers also hinted that, many local users do not care of the labels but solely depends on the oral advertisements by hawker with intent to lure local users for the anticipated results. Monitoring on occasionally or seasonal activities to combat pesticides is highly worrisome due to unauthorized channels of distribution and applications. Broad utilization of both banned and the unbanned pesticide recorded on Table 1 from the survey excised is worrisome. Some of the banned pesticides are rebranded without records of the actual active chemical composition and excipients for massive sales. Also the buyers used without prior knowledge of the real chemical composition and its affect on human heath than effect on insect or pest. The surveyed reviewed nineteen (19) different active chemical species which were identify in over fifty three (53) marketing brand names of pesticides, and are in the markets in Makurdi Town which is more than thirteen (13) reported by Dugje *et al*. [3] in Bornu state. Comparing the results in Bornu State 2008 and of Benue State 2024, it is clear that there is an increase in pesticide application in Nigeria. The reviewed nineteen (19) different active chemical species belong to organochlorins, organophosphate, carbamates and pyrethroids class of insecticides respectively. From the nineteen active chemical seen in the surveyed inventory, nine of these active chemicals were; Atrazine, Alachlor, Butachlor, Gglyphosate, Oxidiaxone, paraquat, Pendimenthalin and Propanil are used on field for the control of glasses in crops and other weed pest in different brands name respectively. The rest ten of pesticides were; Actellic, Aluminium phosphide, Apron or Aspirin, Carbofuran, Cypermethrin, Dimethoate, Dichlorvos, Lamdacyhalothrin, Mancozeb, and Permethrin are use for insect pest control for postharvest losses of crops on fields, in stored foodstuffs, indoors as well as domestic places to repelled pest. Furthermore, the study also revealed the presences of many restricted and outdate pesticides that are still in some stores within this state without certainty of expiry dates awareness by dealers, and in outrageous quantities which could posed health challenge to consumers of the food products it may applied to.

The survey result of this research shows that, three active chemicals of Aluminium phosphide, dichlorvos, and permethrin in different brands names emerged the top demanded or patronized insecticides for foodstuffs storage applications at 37.5%, 33.3%, 20.8% respectively as shown on Table 2, and the rest insecticides shared in 8.33% only. This is similar to a survey report by Pii *et al*. [4] in which most patronized pesticides were aluminium phosphate tablets which ranked 80% for storage pesticides, while dichlovos was 60% and DDT was 35% on a separate note.

This percentage patronage is directly proportional to volume of application of these insecticides by farmers and foodstuff dealers and storage merchants alike, in Benue State, because thy are not buying for fun sake but for prevention of post harvest loss.

Health implication of this pesticides is are of short terms and long term affect, ranging from simple irritation of the skin and eyes to more severe effects such as affecting the nervous system, hearing, mimicking hormones causing reproductive problems, and also causing cancer [14, 15].

The availability, applications and climate conditions determines affect of pesticide on human health and it differs from region to countries, hence Codex Alimentarius Commission Joint FAO/WHO Food Standards Programme, occasionally calling Governments and interested international organizations wishing to submit comments on draft and proposed draft of pesticides maximum residues limits (MRLs) in foods, including the implications they may have for their economic interest, should do so in writing and in conformity with the Procedures for the Elaboration of Codex Standards and Related Texts (*Codex Alimentarius Procedural Manual*) [10] to harmonised on pesticides regulation timely.

Going by this occasional call from Codex Alimentarius Commission Joint FAO/WHO Food Standards Programme, this unacceptably high concentration of pesticides application in environment and in foodstuff, requires an urgent high level intervention by government regulatory authorities. Benue State legislators and all the relevant organs are call for the establishment of Benue State Agency for Agrochemicals, Food and Drug Administration Control (BSAAFDAC). This agency will be charge with all possible considerations for challenges of regulations, evaluation, supervision, awareness about Agrochemicals, Food and Drug Administration Control, since pesticides application is on high increased in Benue State. BSAAFDAC should ensure precautionary measures required to face out the following challenges.

4.2. Naming pesticides

Numerous pesticides have challenging names that correspond to their molecular makeup. In order to make them easier to recognize, they are frequently given a shorter name, known as a common name. The names of the pesticide's active ingredients are frequently the basis for these colloquial names [3, 4]. For instance, glyphosate has the chemical formula N-(phosphono methyl) glycine, while carbaryl is the popular name for 1-naphthyl methyl carbamate. The substance employed to suppress the hazardous organism is known as the active ingredient. Its use for this purpose is permitted through a registration process, and its capacity to eradicate, damage, or discourage a specific pest or disease has been demonstrated and anything contrary shall not be tolerated. It is important for farmers and extension agents to keep in mind that different businesses manufacture pesticides with the same active ingredient [3]. Most at time a banned active chemicals is use with a label of the permitted and register active chemical.

4.3. Pesticides types

Pesticides can be categorized based on the kind of affect or pest they work well against. For further information, Certain insecticides only work against a single type of disease or pest. Many pesticides are either non-specific or have low levels of selectivity or specificity [10]. When employed, these non-selective insecticides can damage or kill a variety of insects, microorganisms, animals, and plant species.

Pesticides can also be categorized based on how they function. Contact or systemic activity could be the cause of this. For contact insecticides to work, they must come into direct contact with the dangerous organisms. The spray mist's ability to penetrate the crop and kill pests by touch improves with its fineness. After adhering to and penetrating the plant's surface, systemic insecticides spread throughout the entire plant. Systemic pesticides are also those that remain in the soil for a while before penetrating through contact with roots. To select the best pesticide product to use, farmers must be aware of the types of chemicals that are suited for a certain circumstance.

4.4. Pesticides formulations

Understanding the sort of chemical to be used, the pest issue at hand, and the recommendations of manufacturers and researchers are all necessary when using chemicals for pest management under control guideline. In order to select the right sprayer and time for their spraying operations, farmers must also be aware of the characteristics of pesticide formulations. Wet formulations, dry formulations, and fumigants are among the several kinds of Pesticide formulations [3, 4, 10].

Because wet formulations are easier to prepare and measure out precisely, they are utilized more frequently than dry formulations. During preparation, there is no risk of the powder being carried away by the wind. Because of their tiny size, the containers are convenient to store and carry. It is difficult for wet formulations to sink to the spray tank's bottom. These are the challenges to be address under a control agency.

4.5. Precautions when dealing with pesticides

Only recommended pesticides should be in circulation for farmers and dealers to purchased, and it should carefully inspect the packages to ensure that the original labels and tamper-evident seals have not been broken or what is labeled is the actual contents. It is to ensure no purchase or acceptance of any pesticides that have passed their expiration dates, and ask the dealer to show dates of expiration. Avoid purchasing pesticides in unidentifiable repackaging bottles. All these should the challenges to be address under a control agency.

4.6. On transportation

Pesticides should never be loaded onto a vehicle that is transporting people, pets, food, or animal feed. Avoidance of putting heavy items, pointed things, or anything that protrude, such nails, on or close to pesticides. Use caution when loading and unloading pesticides, and always wash the car before putting anything else in it [10], etc., should the challenges to be address under a control agency.

4.7. Pesticides Storage

The agency should charge to address challenges under her control Like; Do not store pesticides with foodstuff or animal feeds. Never store pesticides in living rooms, kitchen, animal house or toilets. Do not buy pesticides off season in order to prevent prolonged pesticide storage. Ensure that insecticides are always kept under lock and key. Herbicides and other pesticides should be kept apart. Regularly inspect your stored pesticides for leaks or signs of deterioration. Pesticides should always be stored in their original packaging with the labels from the manufacturers.

All pesticides should be kept out of the reach of children and other family members.

Avoid putting pesticides near streams, wells, or sources of drinking water. Discarded or unsalvageable materials and used packages should be burned or buried at certain locations away from humans.

4.8. Pesticides application and precaution

The agency should charge to address challenges of pesticides application and precaution awareness such as; before using any pesticide, always read the label and get advice if you are unsure. Verify the pesticide's suitability for the intended purpose, review the safety measures that need to be followed, choose the dosage rate, and take note of the product label's mixing instructions.

Always adhere to the suggested dilutions and dosing rates. Keep in mind that using larger or smaller amounts is a waste of money. Direct application of pesticide on foodstuff in any way or small quantity is not acceptable.

4.9. Symptoms of pesticide poisoning

The symptoms of pesticide poisoning depends on the type of pesticide and the route of absorption, there are numerous ways that pesticide poisoning might manifest. Other infections or illnesses brought on by too much heat can mimic the signs of pesticide exposure. If Pesticides poison suspected, do immediately seek for medical help if you experience any of the following symptoms [10]:

General: extreme weakness and fatigue; Skin: irritation, burning, excessive sweating or discoloration; Eyes: itching, burning, watering, difficult or blurred vision, narrowed or widened pupils; Digestive system: burning in mouth and throat, extreme salivation, nausea, vomiting, abdominal pain, and diarrhea; Nervous system: reaction such as headaches, dizziness, confusion, restlessness, muscle twitching, staggering gait, blurred speech, fits and unconsciousness, sometimes death.

5. Conclusion

Agrochemicals of pesticides are extensively used in Benue State Nigeria, without appropriate consideration of extant regulation, evaluation and supervision; which poses a significant challenge. This is quite worrisome especially with the broad utilization of both banned and suspected harmful pesticides yet to be banned. Some of the banned pesticides are rebranded for sale while the buyers use them without proper knowledge of the real chemical composition and the effects on human health and environmental toxicity; rather they focus solely on their effect on weeds, insects or other pests.

Intensive training on pesticide composition, the safe use of pesticides, application techniques, mitigation of environmental pollution, human health hazards, export restrictions and the application of pesticide in compliance with extant regulations and specifications on maximum residue limits and Good Agricultural Practices (GAPs) are direly necessary for the farmers in Benue state. In this research, three active pesticides of class insecticide chemicals of Aluminium phosphide, Dichlorvos, and Permethrin in different brand names were found to be the top demanded or patronized insecticides for post-harvest foodstuff storage applications. The insecticides of Aluminium phosphide, Dichlorvos, and Permethrin have major patronage at 37.50%, 33.33% and 20.83% respectively. Other insecticides recorded 8.33% only. This percentage patronage is directly proportional to volume of application of these insecticides by farmers and foodstuff dealers and storage merchants alike, in Benue State, Nigeria. This signifies an unacceptably high concentration of these pesticides in the environment and in foodstuff, thus requires an urgent high level intervention by regulatory and government authorities. We hereby call for a bill for holistic safety regulation of Agrochemicals and Drug Administration in/on food/foodstuff in Benue State. Hence We call on Benue State legislators and the Governor for enactment of relevant legislation for the establishment of Benue State Agency for Agrochemicals, Food and Drug Administration Control (BSAAFDAC). This agency will be charge with all possible considerations for challenges of regulations, evaluation, supervision, and awareness about Agrochemicals, Food and Drug Administration Control in Benue State.

Precautionary measures are required to be taken by consumers before preparation of such foodstuff for consumption to avoid health challenges.

Data availability

The data is available and can be released to interested party on request under special terms and conditions.

Acknowledgment

The authors hereby acknowledge and appreciate the cooperation of pesticides dealers in Makurdi, Benue State, Nigeria.

References

[1] A. Orefi & A. Omojo, "Growth and instability in selected cereal crops in Benue State, Nigeria and its implications for food security", Asian Research Journal of Agriculture **5** (2017) 1. https://doi.org/10.9734/ARJA/2017/33100.

[2] D. Pinniger & A. Meyer, *Integrated pest management in cultural heritage*, Archetype Publications, London, United Kingdom, 2015. https://books.google.com/books?id=GH7brQEACAAJ.

[3] I. Y. Dugje, F. Ekeleme, A. Y. Kamara, L. O. A. Omoigui, A. Tegbaru, A. Teli, I. A. Onyibe & J. E. Onyibe, *Guide to safe and effective use of pesticides for crop production: promoting sustainable agriculture in Borno State (PROSAB)*, International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, 2008. https://www.iita.org.

[4] B. T. Pii, R. A. Wuana & S. Nwafor, "Survey of common pesticides used in storage of agricultural produce within Makurdi, Benue State, Nigeria", Asian Journal of Applied Chemistry Research **3** (2019) 302. https://doi.org/10.9734/ajacr/2019/v3i130082.

[5] O. A. Adekalu, S. A. Atanda & I. G. Adarabierin, "Survey on pesticides application practices in leafy vegetables production and public health risk amongst farmers in Lagos and Ogun States, Nigeria", Journal of Agriculture and Veterinary Science (IOSR-JAVS) **13** (2020) 5. https://www.iosrjournals.org/iosr-javs/papers/Vol13-issue5/Series-1/B1305010509.pdf.

[6] P. O. Onuwa, I. S. Eneji, A. U. Itodo & R. Sha'Ato, "Determination of pesticide residues in edible crops and soil from University of Agriculture Makurdi Farm, Nigeria", Asian Journal of Physical and Chemical Sciences **3** (2017) 1. https://doi.org/10.9734/AJOPACS/2017/35001.

[7] S. N. Atsen, G. M. Mafuyai & I. S. Eneji, "Pesticide residue in maize stored in Bassa, Bokkos, Jos-North and Mangu Local Government Area warehouses, Plateau State", African Journal of Agriculture and Food Science **4** (2021) 79. https://www.abjournals.org.

[8] F. Ezeh, *National Agency for Food and Drug Administration and Control (NAFDAC) bans 30 pesticides, other chemicals in Nigeria*, The Nation; The Sun, 2022. https://thesun.ng/nafdac-bans-30-pesticides-other-chemicals-in-nigeria/.

[9] European Commission, Directorate-General for Research and Innovation, Group of Chief Scientific Advisors, *A sustainable food system for the European Union*, Scientific Advice for Policy by European Academies (SAPEA), Berlin, 2020. https://scientificadvice.eu/advice/a-sustainable-food-system-for-the-european-union/.

[10] World Health Organization (WHO), "Pesticide residues in food", Joint FAO/WHO meeting on pesticide residues, Rome, Italy, 15 September 2022. https://doi.org/10.4060/cc4115en.

[11] P. Fantke, R. Friedrich & O. Jolliet, "Health impact and damage cost assessment of pesticides in Europe", Environment International **49** (2012) 9. https://doi.org/10.1016/j.envint.2012.08.001.

[12] P. Duru, *Poisoned food claims 11 lives in Benue*, Vanguard Newspaper, 2022. https://www.vanguardngr.com/2022/11/poisoned-food-claims-11-lives-in-benue/.

[13] Benue State; subdivision, City Population Statistics. Retrieved 5 February 2024. https://www.citypopulation.de/en/nigeria/admin/NGA007__benue/.

[14] A.-C. Johnson & T. C. Morata, *Occupational exposure to chemicals and hearing impairment*, University of Gothenburg, Sahlgrenska Academy, 2010. https://www.dol.gov/sites/dolgov/files/owcp/energy/regs/compliance/advboard/health_risk_chemicals061917.pdf.

[15] United States Environmental Protection Agency (US EPA), *Human health issues related to pesticides*, Washington (DC), US, 2006. https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/human-health-issues-related-pesticides.