

ANALYSIS OF CONSUMERS' PERCEPTION OF INSECTICIDAL PRESERVATIVES AND ITS RESIDUES IN RICE AND WHEAT FROM SELECTED MARKETS IN PORT HARCOURT

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Article History

Received: 18.01.2025

Accepted: 11.02.2025

Published: 23.03.2025

Abstract: A market survey involving 100 grain consumers who were randomly selected in two markets, was conducted to examine their awareness of chemical preservatives in the study. The respondents in the two markets, Choba and Wokem in Port Harcourt was interviewed to examine their awareness of chemical preservatives in pulse crops, addressing growing concerns about food safety and health implications. The study utilized primary data which was collected through the use of questionnaire from the respondents and personal observation by the researchers. A semi structured standardized questionnaire was administered to the respondents to gather information about their socio demographic characteristics, knowledge, and attitude of the traders/consumers on nutrition and food preservation. Data were analyzed using ANOVA and descriptive statistics such as frequency distributions, percentages, mean score and correlation coefficient. However, questionnaires administered to farmers revealed that above 40% regularly employed chemical pesticides, notably Methylbromide and Phostoxin, with a preference for metal containers in grain storage and the seller/consumers above 36 years old consumes more of the grains. Only 65% of respondents are aware that grains bought are usually preserved with banned chemicals (gammalin 20, carbide etc) and health risks associated with consuming the treated grains. Binary logistic regression of factors results shows that the only significant factor in this model is education status ($p = 0.028$), which shows that respondents with higher education are significantly more likely to be aware of health risks associated with consuming treated goods ($B = 1.402$). With the global rise in agricultural pesticide use to maximize crop yield, consumers and regulatory bodies have raised alarms over potential health risks mainly cancer from pesticide accumulation in food. These results highlight the need for stricter pesticide application guidelines and regular monitoring to ensure consumer safety and food quality.

Keywords: Survey, Consumers, pesticides, residues, markets, grains.

Cite this article:

Azeez, O. M., and Amadi, J. S., (2025). ANALYSIS OF CONSUMERS' PERCEPTION OF INSECTICIDAL PRESERVATIVES AND ITS RESIDUES IN RICE AND WHEAT FROM SELECTED MARKETS IN PORT HARCOURT. *ISAR Journal of Agriculture and Biology*, 3(3), 8-18.

Introduction

Pesticide usage over the years has grown steadily and has now reached 3.5 billion kg of active ingredient per year of which 70% is used by China, Argentina and USA. Farmers in high- and higher-middle-income countries are known to use more than farmers from lower-middle and low-income countries both in total amounts and in amounts to be able to reach the same yield per ha (Pretty and Bharucha (2015). Due to the high usage of pesticides, they are now a crucial part of modern life and are used to preserve food storage facilities, agricultural land, flower gardens, as well as to get rid of pests that spread infectious diseases that are dangerous to humans (Asiegbu *et al.*, 2022; Hussain *et al.*, 2021a; Isah, *et al.*,

2020). Pesticides are thought to cost roughly \$38 billion worldwide each year (Pan-Germany, 2012). They are used on fruits, vegetables, wheat, rice, olives, canola pressed into oil and on non-food crops such as cotton, grass and flowers (Njoku *et al.*, 2017).

Pesticides due to mankind food shortage has been used to reduce post-harvest losses in food production such as rice and wheat. Nevertheless, the use of pesticides on food crops has left the challenge of food safety and health hazard (Carvalho, 2016). The continual usage of pesticides can lead to excess accumulation in soils and consequently their uptake by the plant under favorable conditions. The use of pesticides food production has also been linked to acute poison on an estimated three million farmers in developing countries and 18,000 of these aforementioned farmers

have been reported to die from the continual usage. Several researchers in previous study reported that some specific pesticides such as organochlorines, organophosphates or carbamates insecticides or herbicides can cause parkinson's disease, cancer, sterility in males and neurological disorders (Vergucht *et al.*, 2006; Wallig *et al.*, 2002)). Furthermore, pesticides can contaminate soil and water resources, negatively affect aquatic and terrestrial organisms, disrupt food chains, and lead to biodiversity loss. Additionally, the increased application of pesticides can contribute to the development of pesticide-resistant pests, further exacerbating their environmental impacts. (Muvesaier, 2021).

Considering the growing concerns, more comprehensive research is needed on the monitoring and assessment of pesticide especially in its use in rice and wheat farming in Port Harcourt, Rivers State, Nigeria. This knowledge gap hinders the development and implementation of effective and sustainable pest management strategies, evidence-based policies, and regulations aimed at mitigating the negative impacts of pesticide use on the environment and human health. In the light of this, this study brings to the fore, the monitoring and assessment of pesticides in rice and wheat from two selected markets in Port Harcourt.

The objectives of the study is to monitor the pesticide residues in wheat and rice and evaluate consumer awareness of the pesticide

Materials and Methods

Description of the study area

This study was carried out in Rivers State, Nigeria. Rivers states lies between Latitude 4°30'N and 5°45'N approximately longitude 6°30'E of the Greenwich meridian with a total area of 11,077 km² with a mean annual rainfall which ranges from 4,700 mm on the coast to about 1,700 mm (National Bureau Statistics, 2006). The state occupies lowland area of Niger Delta with dense and thick tropical rainforest vegetation. It is characterized by high atmospheric (ambient) temperature that ranges between 25°C to 38°C

Research Instrument

The study utilizes primary data which was collected through the use of questionnaire from the respondents and personal observation

by the researchers. A semi structured standard questionnaire was administered to the respondents to gather information about their socio demographic characteristics, knowledge, and attitude of the students on nutrition. Respondents were informed about the study and provided consent, mostly verbal but sometimes signed, before interviews were conducted.

A semi-structured self-developed questionnaire was used as the survey instrument. The questionnaire included the socio-demographic characteristics, knowledge about the nutritional status and assessment of associated factors.

Statistical Analysis

All data were subjected to Analysis of variance (ANOVA). A descriptive statistics of Mean, standard deviation, standard error and graph representation were used to analyze the results obtained with SAS version 9.2 software (SAS, Institute, 2003).

Results

Demographic Characteristics of pesticides sellers

Table 1 shows the demographic characteristics assessment of pesticide residue in wheat and rice from two selected markets in Port Harcourt. The result obtained for the socio demographic grain sellers in the area had male (55%) are more involved compared to female (45%). The result also shows that 45% of those involved in grain sales are between the age ranges of 36-45 with 35% of them had no formal education while the least of them (7.5%) has primary education. The last result obtained under the socio demographic table shows that 52.5% of those sellers are into trading.

In terms of sex, religion and Age brackets the result shows that there is a little difference between the male and female consumers (45%, 55%) based on the result of assessment of pesticide residue under study. Based on marital status, that single (40%), and married (50 %) while the least frequency rate was obtained for widowed (10%). Based on occupation, Trading (52.5%) recorded the highest rate followed by Farming (37.5%) and Artisan (10%). However, most of the respondents are illiterate (35%) and those educated among them were through Adult Education (27.5%) others ranged between 7.5 – 15% primary and tertiary education.

Table 1: Demographic Characteristics

Characteristics	Categories	Frequency (N = 40)	Percentage
Sex	Male	22	55.0
	Female	18	45.0
Age	25-35 years	17	42.5
	36-45 years	18	45.0
	46-55 years	5	12.5
Religion	Christian	22	55.0
	Muslim	18	45.0

Marital status	Single	16	40.0
	Married	20	50.0
	Widowed	4	10.0
Educational status	No formal education	14	35.0
	Adult education	11	27.5
	Primary education	3	7.5
	Secondary education	6	15.0
	Tertiary education	6	15.0
Occupation	Trading	21	52.5
	Farming	15	37.5
	Artisan	4	10.0

Insect Infestation and Damage

The result on table 2a show the result obtained for Insect Infestation and Damage. The result shows that 95% of these grain sellers attested that they have noticed the presence of insect in grains sold while 5% respondents claimed ignorance. However only 42.5% of the grain sellers have seen holes in the grain sold while 17.5% noticed powders form on their grains, 27.5% changes in colors and 12.5 moldiness on stored grains. This observation is in tandem with experience acquired by the respondents over the years

Prevention Methods

Prevention methods engaged in by the grain sellers is presented in table 2 b. The result shows that 45% of them are engaged in the traditional method prevention forms compared to 40% who used chemicals while the least was obtained for cleanliness of grain (15%). Types of chemical used by the traders result obtained showed to be last resort for the majority (72.5%) though some respondents mentioned other chemicals not listed in this questionnaire while 12.5% claimed they used gammalin20 and 10% claimed they used methylbromide with majority (30%) claiming they used ½ tablet as the quantity they applied. The final result obtained from the table show that 60% of these grain sellers attested to the fact that 25-50% are the percentage of insect damage before the use of chemical.

Table 2a: Insect Infestation and Damage

Varieties	Categories	Frequency (N = 40)	Percentage
Have you noticed presence of insect in goods sold?	Yes	38	95.0
	No	2	5.0
Nature of damaged caused by insect	Hole	17	42.5
	Powder	7	17.5
	Change in colour	11	27.5
	Mouldiness	5	12.5

Table 2b: Prevention Methods

Varieties	Categories	Frequency (N = 40)	Percentage
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How do you prevent your goods from insect damage?	Chemical application	16	40.0
	Cleanliness	6	15.0
	Traditional method	18	45.0
Types of chemical used	No response	2	5.0
	Gammalin 20	5	12.5
	Methylbromide	4	10.0
	Others	29	72.5
What quantity is being used for goods?	No response	3	7.5
	½ tablet	12	30.0
	¼ tablet	5	12.5
	¾ tablet	6	15.0
	Litres liquid per bag	2	5.0
	Others	12	30.0
What is the percentage of insect damage before the use of chemical?	< 25%	13	32.5
	25-50%	24	60.0
	50-75%	3	7.5

Table 2c: Storage Methods

Varieties	Categories	Frequency (N = 40)	Percentage
How long do you store your goods?	No response	1	2.5
	Less than a week	14	35.0
	1-2 weeks	8	20.0
	More than 2 weeks	17	42.5
Method of goods storage	Sacks	30	75.0
	Jute bags	4	10.0
	Polythene bags	3	7.5
	Metal/iron container	3	7.5
Do you obtain storage prevention history from the farmer or seller?	Yes	29	72.5
	No	11	27.5
What is the source of chemical for prevention/storage?	No response	1	2.5
	Retail shop	20	50.0
	Hawkers	11	27.5
	Chemical dealer	6	15.0
	Others	2	5.0

Storage Methods of grains by the sellers in the study area.

Table 3 presents the result obtained for Storage Methods of grains by the sellers in the study area. The results shows that 42.5% of

these sellers stored their good for more than 2 weeks while 35% store less than 1 -2 week with 75% of these sellers claiming they make use of sacks bags as their methods of good storage while 10% make use of jute bags with the least (7.5%) obtained for polythene bags and metal iron container respectively. Furthermore, the result shows that 72.5% claimed that they obtained storage prevention history from the farmer or seller while 27.5% are to the contrary. The result also showed that 50% of these sellers attested that their source of chemical for prevention/storage is obtained from retail shop while least said their own source of chemical for prevention/storage is from other sources, Hawkers (27.5%).

Awareness and Health Risks

Table 4 presents the result obtained for Awareness and Health Risks. The result shows that 97.5% of the grain sellers noticed signs of spoilage or mould on their grains while 60% said they are not aware some chemical are on the approved list, while 70% are not aware that some chemicals are on the banned list. Only 67.5% respondents are aware of the health risk associated with consuming treated grains. Similarly 67.5% are not aware of inherent health hazards consumers eating treated grains are exposed to while 75% are aware of terminal diseases from consuming treated grains.

Table 3: Awareness and Health Risks

Variables	Categories	Frequency (N = 40)	Percentage
Do you notice signs of spoilage or mould on your goods?	Yes	39	97.5
	No	1	2.5
Are you aware some chemical are on the approved list?	Yes	16	40.0
	No	24	60.0
Are you aware that some chemicals are on the banned list?	Yes	12	30.0
	No	28	70.0
If yes, how did you know?	No response	33	82.5
	1	7	17.5
Are you aware of the health risk associated with consuming treated goods?	Yes	27	67.5
	No	13	32.5
Are you aware of inherent health hazards consumers eating treated goods are expose to?	Yes	13	32.5
	No	27	67.5
Are you aware of terminal diseases from consuming treated goods?	Yes	30	75.0
	No	10	25.0

Binary Logistic Regression of Factors affecting Respondent's Awareness of Health Risk from Consumption of Treated Goods

The only significant factor in this model is education status ($p = 0.028$), which shows that respondents with higher education are significantly more likely to be aware of health risks associated with

consuming treated grains ($B = 1.402$). Other variables, such as sex, age, marital status, and religion, did not show statistically significant effects, though age (0.056) and years of business experience (0.099) approached significance. This indicates that potential influence of age and years of business experience influencing respondent's awareness with higher age group and higher years of business experience more likely to be aware.

Table 4: Binary Logistic Regression of Factors affecting Respondent's Awareness of Health Risk from Consumption of Treated Goods

Independent Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)
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							Lower	Upper
Sex(Female)	-0.892	1.087	0.673	1	0.412	0.410	0.049	3.452
Age	-2.089	1.095	3.641	1	0.056	0.124	0.014	1.058
Religion(Muslim)	-1.862	1.249	2.222	1	0.136	0.155	0.013	1.797
Marital Status(Married)	1.962	1.439	1.858	1	0.173	7.111	0.424	119.353
Marital status(Widowed)	-0.723	1.629	0.197	1	0.657	0.485	0.020	11.816
Education status	1.402	0.637	4.842	1	0.028*	4.063	1.166	14.162
Years of business experience	1.341	0.814	2.714	1	0.099	3.823	0.775	18.844
Constant	-0.996	2.492	0.160	1	0.689	0.369		

*Significant at p<0.05

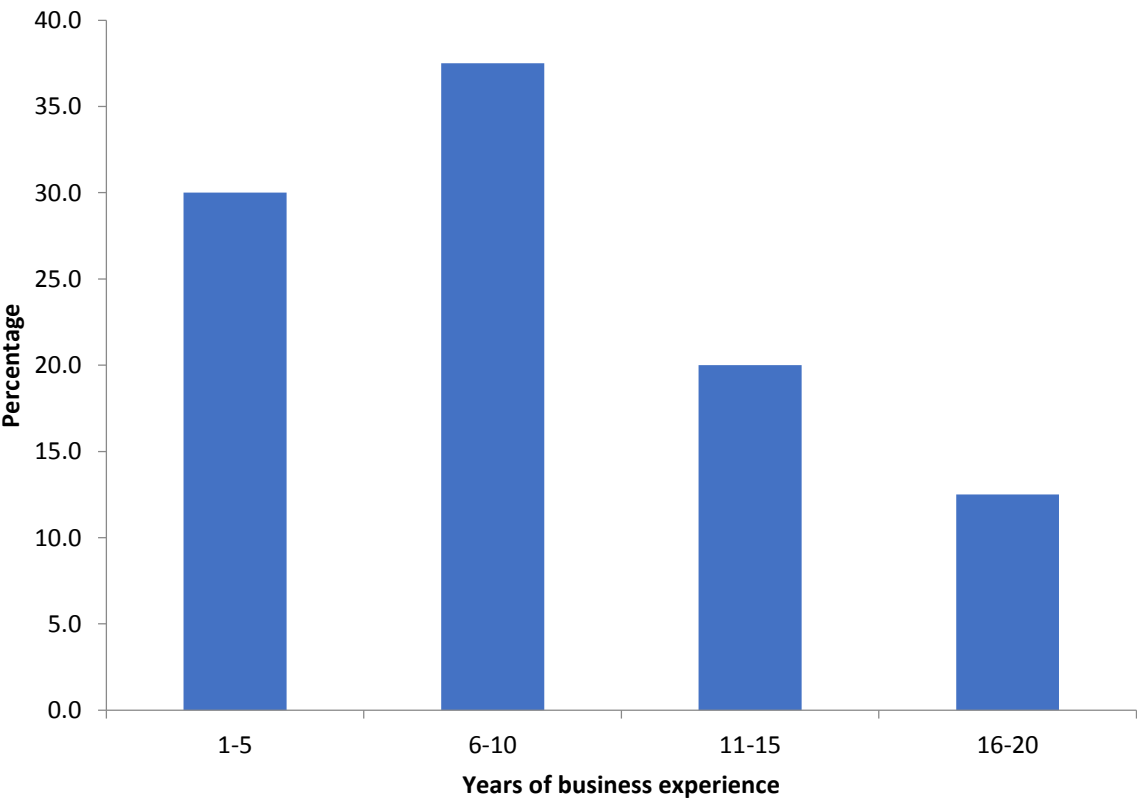


Fig 3a Years of Business Experience of Participants

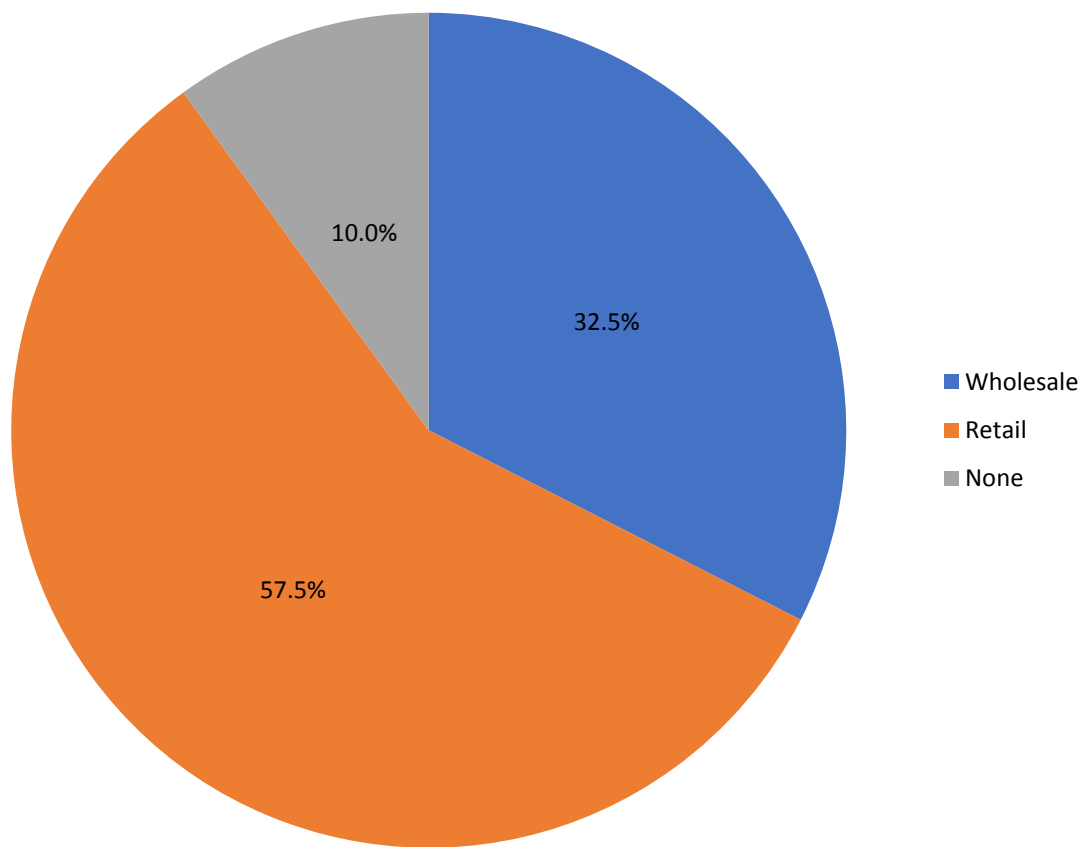


Fig. 43b : Distribution of Sale Type amongst Participants

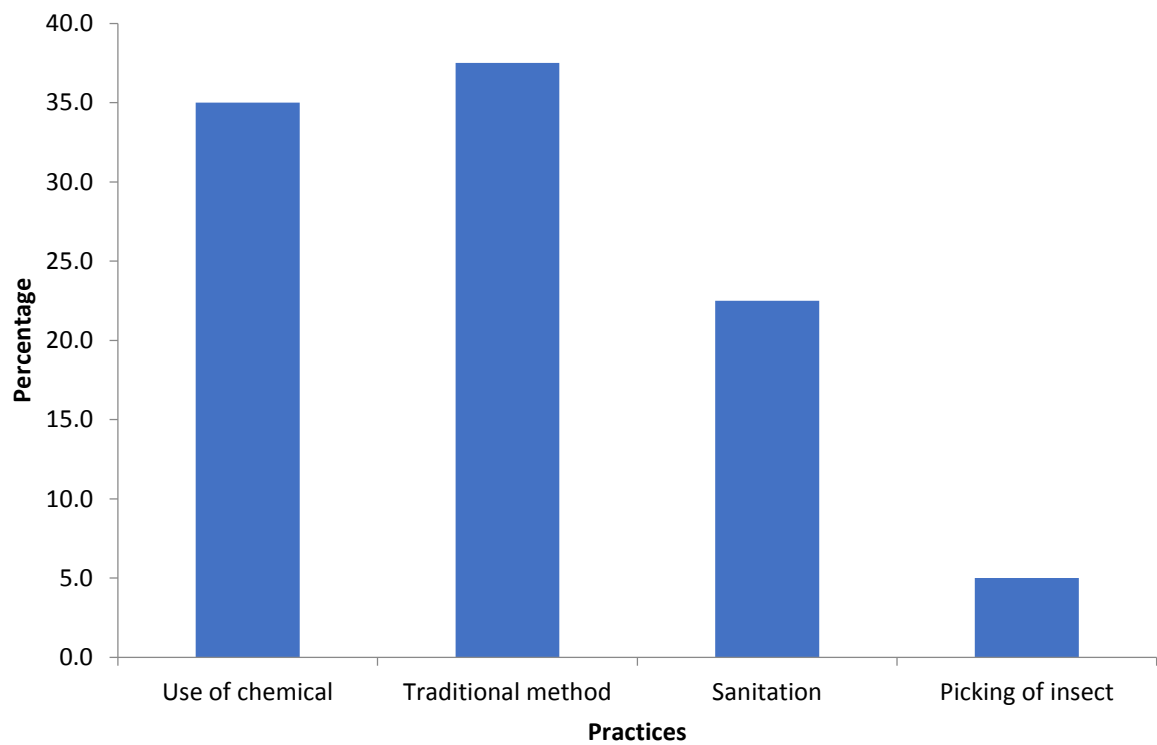


Fig. 3c: Management Practices of Damaged Goods by Respondents

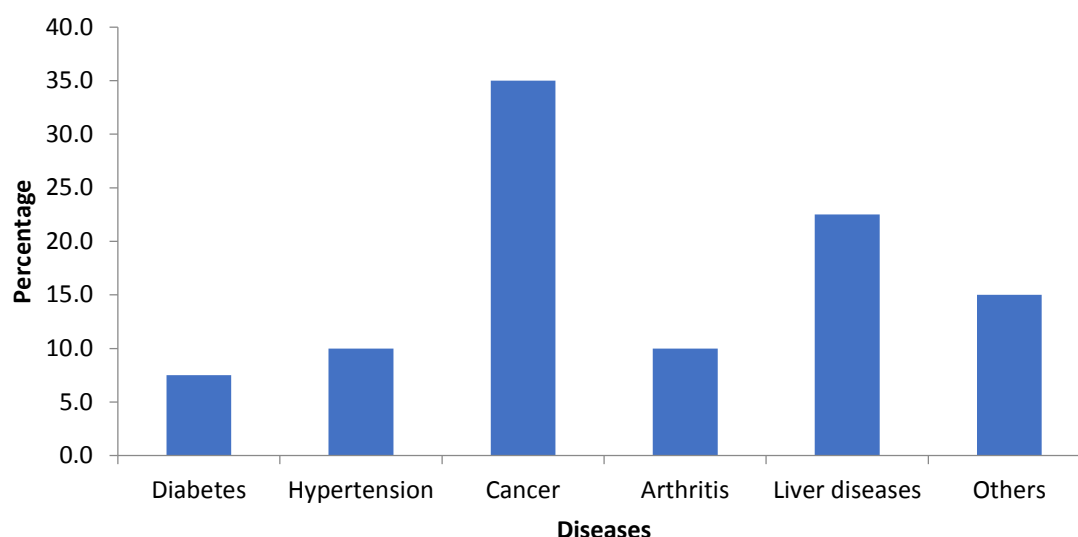


Fig. 3d: Terminal Diseases Caused by Consumption of Treated Goods as identified by Respondents

Discussion

Positive correlation was established between the preserved grain samples and variety of chemical used in the markets under study. The concentration of pesticides in grain sample is largely determined by the merchant, the type, quantity, and frequency of pesticide applied to grain during storage. The factors are directly related to the attitude and knowledge of the merchants towards grain preservation (Gesese *et al.*, 2016). This study agrees with the study of Yusuf *et al.* (2019) who stated that approximately one hundred and thirty-seven (36.5%) of the respondents that use pesticides indicated that they used an organophosphate pesticide on their grains for storage.

This study agrees with other previous report that the pesticides are usually applied to food crops as the first line of action in controlling pests of stored product. The high concentration of many pesticide residues may be attributed to the many rounds of application. Also, the pesticides are mainly applied on a weekly basis or less across the markets. Over the storage period of 1-2 weeks observed in this study, substantial amount of pesticide residues must have accumulated. The notion that pesticides are very effective as observed in this study also aligns with the findings of Alex *et al.* (2018). Overall, this suggests poor knowledge and practice of the usage of pesticides and agricultural practices by the farmers. As Mekonnen and Agonafir (2002) and Tariq *et al.* (2007) showed that 70% of farmers in developing countries encounter difficulties in reading instruction manuals, leading to the misuse of highly toxic pesticides. In a similar study, Li *et al.* (2008) found that, due to lack of pesticide knowledge, most farmers solely focus on the outcome of knock down and timely effect of pesticide used as experienced in this study. They rarely pay attention to the toxic side effects of pesticides on human health. The only significant factor in this Binary regression model is education status ($p = 0.028$), which shows that respondents with higher education are significantly more likely to be aware of health risks associated with consuming treated grains ($B = 1.402$).

From the result obtained in this study, most of the farmers/traders were still in their economic active ages. This is in line with

Nwalieji and Uzuegbunam (2012), that majority of rice producers were still within their middle, active and productive ages. Rice farming was dominated by male in the study area just like this study. The labour intensive nature of rice production could be responsible for male dominance in the study area. The educational level of the respondents reveals that a larger proportion of the respondents had low level of education. This result corroborates the findings of Oluwole and Cheke (2009) that farmers suffered discomforts ranging from skin irritation, headache, vomiting, eye irritation and nausea after using pesticides because of unprotective cover of the body due to low level of education, lack of formal training in pesticide use and poor extension services.

Conclusion

This study assessed the levels of pesticide residues in wheat and rice from two selected markets in Port Harcourt. Therefore contamination may pose a danger to human since diets contamination is the main route of exposure to all group of pesticides. Pesticides are a large and expanding part of the contemporary technology that is widely used in Africa. This study offers an intriguing update of earlier research on substantial pesticide residues. Because they are unaware of the dangers posed by pesticide residues, the recommended dosage levels, or the uniformed standards governing pesticide application, farmers frequently apply pesticides excessively and unreasonably. The result obtained from this study shows that the presence of pesticide residues in the preserved grains, calls for strict measures in the regulation of the use of pesticides for crop protection and yield improvement. Some pesticides are persistent in nature and can bio-accumulate and be biomagnified in the tissues of organisms at the higher trophic level.

Recommendations

Sparingly use of pesticide should be encouraged in insect pest management and more emphasis should be laid on the practice of organic Agriculture. Consequently, further studies for effects on humans should be conducted.

Education, training and information on pesticide safety and management should be strengthened, thus farmers should be sensitized to better pesticide safety practices and the need for continuous pesticide residue monitoring is highly recommended

More emphasis should be laid on the practice of organic agriculture and legislation to control the indiscriminate use of pesticides should be enforced. Proper risk assessment of the consumption of grains exposed to pesticides is suggested here.

There is the need for proper education and enlightenment of farmers on how to use pesticides to avoid problems associated with pesticide poisoning. will aid in guiding their selection of pesticide, as well as the amount and timing of sprays.

It is important to promote, encourage, and reward the use of natural pesticides such dried lime (*Citrus aurantifolia*), dried neem leaves (*Azadirachta indica*), and dry chilli pepper (*Capsicum annum*). This will lessen reliance on and use of synthetic insecticides.

More research funding should be made available and used to investigate plants with insecticidal qualities in order to create natural insecticides.

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