Entomology

Knowledge, attitude and practices of cereal grain sellers towards the use of synthetic and plants-based insecticides for the control of stored maize pests

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Abstract

Knowledge of indigenous plants with promising insecticidal activities, which are eco-friendly, biodegradable, non-persistent and cost-effective is important for the successful pest management strategy. A cross-sectional study on knowledge, attitudes and practices (KAP) regarding the use of synthetic and plant-based insecticides for the control of stored maize pests was conducted in the five states in the South Eastern region of Nigeria, namely; Enugu, Abia, Imo, Anambra and Ebonyi between January and March 2021. A well-structured pre-tested questionnaire was used to obtain information on demographics and KAP of 250 cereal grain sellers respondents. Data were summarized with descriptive statistics while Chi-squared test was used to evaluate the association between demographic characteristics, level of education and KAP of respondents. Level of significance were kept at 0.1% confidence interval (p<0.001). The result showed that the number of males 165 (66%) is higher than those of the females 85(34%) and greater preponderance of the respondents were between the age range of 25-49years 145(58%) with majority of respondents' level of education being primary school189 (75.6%). Respondents' source information on the type of pesticide to use majorly from agro shops with greater numbers in Ebonyi State (60%) receiving such information from the market. 98% of respondents in Enugu knows about pesticide and use while all the respondents in Abia (100%), Imo (100%), Anambra (100%) and Ebonyi (100%) knows and makes use of synthetic pesticide as crop protectants. Phos toxin and commando belonging to 1A (extremely hazardous) and 1B (highly hazardous) respectively according to WHO classification are commonly used as grain protectants. Health problems associated with pesticide use included headaches, nausea, weakness, dizziness, watery eyes, and vomiting. Among the demographic information of the respondents (gender, age, marital status and educational status), educational status has significant (<0.001) association between knowledge, attitude and practices of cereal sellers as respondents who attended tertiary institution has good knowledge score, attitude and practices towards the use of synthetic insecticides and plant-based botanicals more than those respondents that attended secondary and primary school level. 83 (33.2%) and 167(66.8%) has good and poor knowledge on the use of synthetic insecticide and plant-based botanicals respectively. 88(35.2%) and 162(88%) respondents possess positive and negative attitude respectively. In addition, 57(22.8%) of respondents has good practice whereas 193(77.2%) has poor practice scores towards the use of synthetic insecticides and plant-based botanicals. Organizing health education campaigns directed to maize grain sellers in order to increase their awareness on the pesticide usage, hazards, storage, safety use and also consider the use of plant-based insecticides as a control option in pest management is recommended with immediate implementation.

Keywords: maize grain sellers, pesticides, botanicals, pesticides residues, KAPs

Introduction

Cereals are the most important food grains and the chief sources of food for the majority of the world's population. They are grown in greater quantities and provide more food energy worldwide than any other type of crops (IDRC, 2019) [12]. Maize for instance, occupies about 17% of the world's cropped area and contributes 35% of the staple food grown in Africa (Pingail, 2014) [16]. They provide about 60% of calories and 50% of proteins to the human race (Riaz *et al*., 2015) [20]. The economies of Nigeria like many other countries depend directly on increased production of cereals.

Traditionally, farmers have depended on the use of synthetic pesticides for pest control and organophosphate (OP) pesticides insecticides, are highly effective in that regard. They are diverse group of organic chemicals used for domestic, agricultural and industrial purposes. They are one of the most extensively applied insecticides in the field of agriculture, such that around 40% of all the pesticides that are produced and used commercially belong to this category (Kaushal *et al*., 2021) [13]. However, misuse of highly toxic insecticides, coupled with a weak or totally absent legislative framework in the use of pesticides, is one of the major reasons for high incidence of OP pesticide poisoning in developing countries including Nigeria. Pesticides generally are among the leading cause of death by self-poisoning particularly in low- and middle-income countries. More than 80% of the reported toxic exposures to pesticides are attributable to OP insecticides (Eze *et al*., 2018) [10]. In addition to agricultural and horticultural workers subjected to persistent moderate OP exposures over their professional lifetime, those that sell those produce is also at risk. The most popular source of OP insecticide in Nigeria is the locally made variety called '*Otapiapia*' whose active ingredient is dichlorvos or 2, 2-dichlorovinyl dimethyl phosphate (DDVP), with most containing between 5-10% w/v

and are readily available for purchase over the counter (Eze *et al*., 2018) [10]. They act as both contact and systemic insecticides that are not as persistent as organochlorines, but tend to be more toxic to applicators and wildlife.

Health hazards of pesticides are a matter of global concern today. Pesticides are taken for granted and the hazards associated with their use are being neglected. Careless handling and needless exposure associated with the use of pesticides ranges from asphyxia, tissue and organ damage, burns, poisoning or even cancer, thus cereal grain sellers need to be conscientized and protected from the hazards associated with the use of pesticides (Allender and Spradly, 2011) [4]. The world Health Organisation (WHO) and the United Nations Environmental Programmed (UNEP) estimated that one to five million cases of pesticide poisoning occur in poor developing among agricultural workers each year, with about 20,000 fatalities (Conway and Pretty, 2006) [8].

In most of these poor endemic countries, the agricultural system geared towards crop protection is usually maintained and sustained by alternative indigenous practices and often gained popularity for historical and cultural reasons (Adera, 2003; WHO, 2004) [2, 25]. This belief is based on the fact that the use of synthetic insecticides for the control of insect pests has a number of side effects. Further reports have shown that one-fifth of people from the most endemic countries use indigenous herbs for the control pests (Okaiyeto and Oguntibeju, 2021) [17]. Among the herbs that have been used in the past for control included; *Moringa oleifera*, *Azadirachta indica*, *Vernonia amygladina*, *Ocimum spp*, *Capsicum spp* (Adam and Mariam, 2022; Aswalam *et al*., 2008; Asawalam and Hassanali, 2006) [1, 5, 6]. There is also belief that these herbs work better when used in an integrated approach (Hikal *et al*., 2017) [11].

Community perception, awareness, and beliefs about pest destruction of crops and available control options have had significant influence on the efforts geared towards providing a sustainable integrated pest management system (Sinzogan *et al*., 2004) [22]. Also, understanding of the indigenous practices would necessitate prompt implementation of eco-friendly and affordable pest management options.

However, there is paucity of information on the level of knowledge, attitude and practices of cereal grain sellers on the use of synthetic and plant-based pesticides in the South Eastern part of Nigeria, thus, this study was carried out. The findings of the study could provide a platform for organizing educational strategies for maize grain sellers to enlighten them on pesticide related risks and the need to embrace the use of eco-friendly control options.

Aim of the study

To access knowledge, attitude and practices of cereal grain sellers towards the use of synthetic and plant-based insecticides for the control of stored maize pest

2. Materials and methods

Study area

The questionnaire based study was conducted in the South Eastern region of Nigeria. The South East of Nigeria is one of the six geopolitical zones in the country that consists of the following states; Enugu (6.4584^{o}N, 7.5464^{o}E), Abia (5.4527^{o}N, 7.5248^{o}E), Imo (5.5720^{o}N, 7.0588^{o}E) Anambra (6.2209^{o}N, 6.9370^{o}E) and Ebonyi (6.2649^{o}N, 8.0737^{o}E).

Study design

The study was a market-based descriptive cross-sectional study that targeted persons selling maize grains at the major markets of the South East; Ogbette (Enugu), Ariaria (Abia), Okigwe (Imo), Eke Awka (Anambra) and Ebonyi (Abakaliki) at the time of study. Information was obtained using pre-tested structured close-ended questionnaires administered to the markets cereal grain sellers. The questionnaire elicited information on respondents' demographics and their knowledge, attitudes and practices regarding the use of synthetic and plant-based insecticides for the control maize weevil; *Sitophilus zeamais*. The questionnaires were satisfactorily explained to the respondents in their local dialect by the researchers who also guided those that could neither read nor write.

Determination of sample size

The sample size was determined using the formula for determining finite population: e is the margin error (0.05) (Taro Yamane, 1967). Using the projected population of 4,411,100; 3,727,300; 5,408,800; 5,271,800 and 2,800,400 persons for Enugu, Abia, Imo, Anambra and Ebonyi respectively (Edward *et al*., 2019); $n=4,411,100/1+4,411,100,000(0.05)^2$;$3,727,300/1+3,727,300(0.05)^2$;$5,408,800/1+5,408,800(0.05)^2$, $5,271,800/1+5271800(0.05)^2$ and $2,800,400/1+2,800,400(0.05)^2$= 399.9 approximately 400. Out of this number, fifty (50) participants each including male and female (from major markets of the South East) were randomly selected for interviews using standardized questionnaire.

Ethical clearance and informed consent

Informed consent was obtained from the cereal sellers that participated in the study. Advocacy meetings were held with the market leaders to inform them of the research objectives and methodology, which were explained in details. With their cooperation, maize sellers were subsequently sensitized and mobilized for the study.

Questionnaire administration

A total of 250 cereal grain sellers, 50 selected from each major market in each State in the South East were interviewed using well-structured pre-tested questionnaire. The questionnaire was translated into the local language (Igbo) for the respondent who could not read or write English but care was taken to retain their original meanings. The questionnaire was used to obtain information on the knowledge, attitude and practices of maize sellers towards pesticide (both synthetic and plant-based) use and associated health risks.

Data collection

Data were collected using questionnaire based on the following parameters: Demographic characteristics of respondents (gender, age, marital status and educational background), knowledge, attitude and practices towards the use of synthetic insecticides and plant-based botanicals as cereal protectants.

Data analysis

Quantitative data from completed structured questionnaires were checked manually by the researchers for consistency, completeness and appropriate responses before coding the data. Data were analysed using SPSS Version 22.0 for Windows (SPSS Inc, Chicago, ILL, USA) and means separated using Friedman Test for *p*-value at 0.001 level of confidence. Descriptive results were expressed with frequencies and percentages in bar charts.

Results

The results of the present investigation show that the number of males 165 (66%) who participated in the study was higher than those of the females 85(34%). A good number of the respondents were found between the age ranges of 25-49 years while 206 (82.4%) respondents make up married persons that participated in the study and most with primary majority level of education 189 (75.6%) (Table 1).

Table 1: Personal information of cereal sellers

Demography	Enugu	Abia	Imo	Anambra	Ebonyi	Total
Gender						
Male	35	31	30	33	36	165 (66%)
Female	15	19	20	17	14	85 (34%)
Age range						
20-24	16	12	6	14	8	56 (22.4%)
25-49	23	30	33	23	36	145 (58%)
50+	11	8	11	13	6	49 (19.6%)
Marital status						
Single	8	4	8	4	7	31 (12.4%)
Married	39	40	40	44	43	206 (82.4%)
Divorce	3	6	2	2	0	13 (5.2%)
Educational status						
Primary	35	36	43	37	38	189 (75.6%)
Secondary	12	10	4	9	5	40 (16%)
Tertiary	3	4	3	4	7	21 (8.4%)
Total	50	50	50	50	50	250

The responses of respondents on the source of information regarding the pesticides to use as grain protectants are represented in Fig. 1 below. Across the South East, majority of sellers gathered information on the type of pesticide to use from agro shops with fewer numbers in Ebonyi State, however, Abia State recorded the highest of respondents (96%) that source information on the type of pesticide to use from agro shops while 24% of them were from Ebonyi State. More of the respondents obtain information from agro shops. More of the respondent from Ebonyi State (16%) obtains information from government agencies than other states whereas 60% of them obtain information from the markets compared to (2%) from Enugu and Abia States respectively.

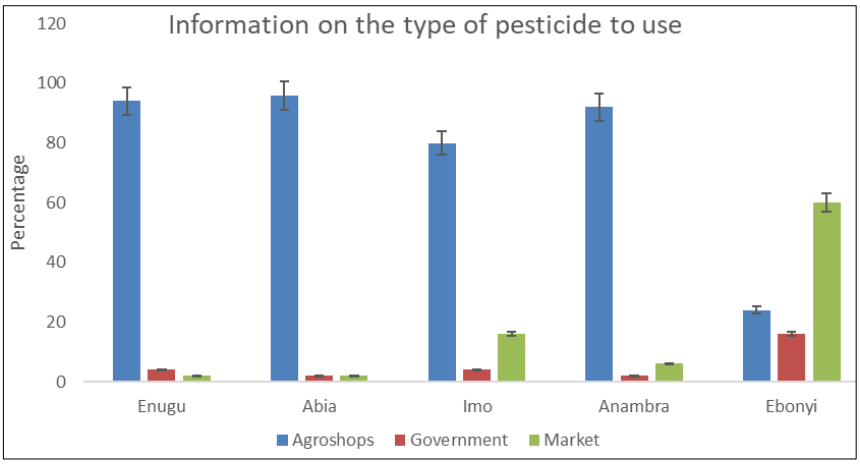

Fig 1: Source of information on the type of pesticide to use as grain protectant

The study also shows that the most commonly used pesticides are phostoxin and commando, a group of 'extremely hazardous' and 'highly hazardous' organophosphate pesticide respectively based on WHO classification (WHO, 2005) [24]. The detail of pesticide used by cereal sellers is represented in Table 2.

Table 2: Chemicals used by cereal sellers as cereal protectants in across the South East

Trade Name	WHO classification	Active ingredients	Chemical family
Phostoxin	1A (Extremely hazardous)	Aluminium phosphide	Organophosphate
Commando	1B (Highly hazardous)	Zinc phosphide	Organophosphate

Generally, information regarding respondents' source of cereal shows that cereals are sourced mostly from markets. The highest number of respondents that sourced cereals from the markets is recorded in Enugu State (96%) and the lowest recorded among Ebonyi State (88%). The highest and lowest number of respondents that sourced for cereals from friends are recorded in Ebonyi (14%) and Enugu State (4%) respectively (See Fig 2 below).

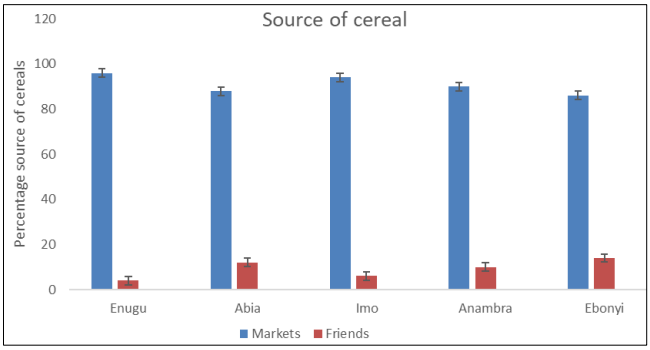

Fig 2: Source of cereals by grain sellers

The result of the frequency of application of pesticides to avert losses by insect pests reveals that most cereal sellers used synthetic pesticides most times in the control of insect pests in their stored commodities. The study showed that 100% of Abia, Imo, Anambra and Ebonyi State respondents respectively and 98% of Enugu State frequently used pesticides for pest control whereas 2% from Enugu State rarely use pesticides as a control option (Fig 3 below).

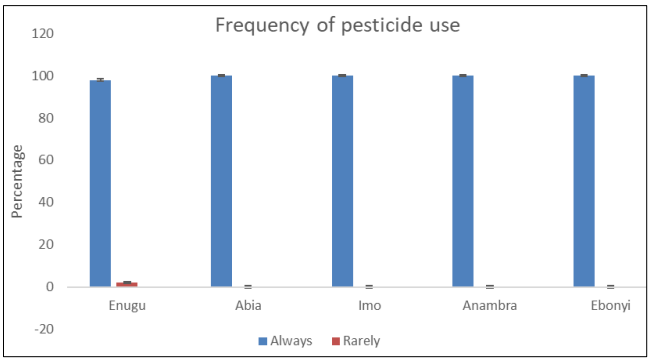

Fig 3: Frequency of pesticide use as grain protectants

The type of protective equipment worn during pesticide application is indicated in a bar chart below (Fig.4). Generally, the number of respondents that makes use of personal protective equipment during spraying of pesticide is low. The result showed that 10% of Enugu State use all the items listed (nose masks, overcoats, gloves and boots) with the lowest number (4%) recorded among Anambra and Ebonyi State. The highest and lowest number of respondents that makes use of nose masks during pesticide application was recorded in Enugu respondents (12%) and Anambra (6%) respectively. However, 16% of Anambra respondents affirm that they wear overcoats whereas 6% from Enugu and Ebonyi States respectively make use of overcoat. Anambra State (18%) have the highest number that makes use of gloves, and Ebonyi respondents (2%) being the least. The highest number of respondents that put on boots as a precautionary measure during spraying exercise is highest among Imo State (8%), with the least found among Abia State (2%). However, 76% of Ebonyi State do not make use of any of the personal protective equipment with Imo State recording 40% (Fig.4).

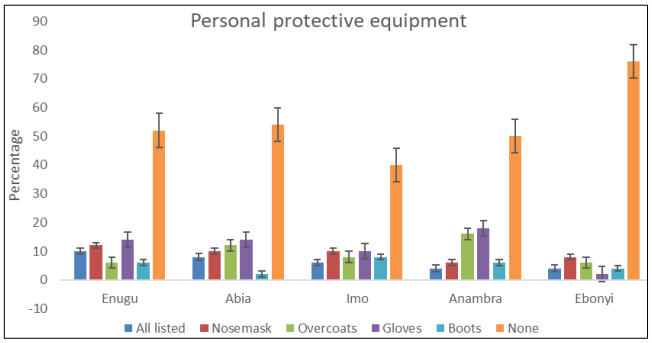

Fig 4: Personal protective equipment worn during pesticide application

Data gathered on the route of exposure to pesticides from respondents is indicated in Fig 5. The result showed that 70% of Imo State respondents get exposed to pesticides through swallowing while lowest number (36%) was recorded among Abia State respondents. Route of exposure through inhalation is highest in Abia State (30%) but lowest among Ebonyi State respondents (8%). Skin as a route through which one can get exposed to pesticides was higher in Anambra State (24%) but lower in Imo State (2%). Highest number of grain sellers from Anambra State (16%) gets exposed to pesticide through the eye but lowest number was recorded in Imo State (4%). Number of respondents, who affirmed that swallowing, inhalation, skin and eye are the routes of exposure was highest in Imo State (14%) but lowest in Enugu State respondents (2%).

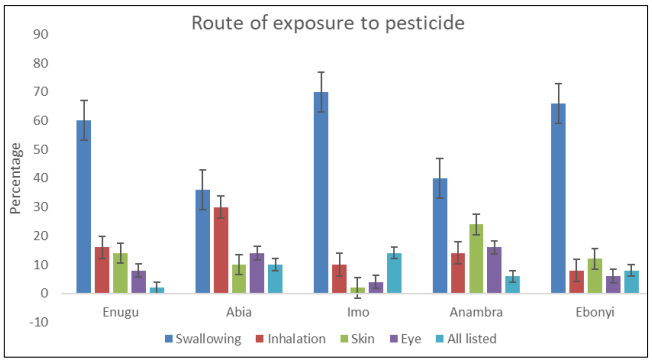

Fig 5: Route of pesticide exposure

Data obtained from respondents pertaining standard method of disposal of pesticide containers is represented in Fig 6 below. From the result, the most common method of disposal of pesticide containers is by throwing them indiscriminately. The highest number of respondents that dispose pesticide containers by burying after use was recorded among Anambra State (10%) and lowest observed among Abia and Ebonyi States (2%). Abia State have the highest number of respondents (82%) that dispose pesticide container indiscriminately by throwing and the lowest from Anambra State (64%). Ebonyi State (18%) recorded the highest number of respondents that reuses pesticide containers for other purposes and the lowest was reported from Imo respondents (6%). Burning of pesticide containers as a means of pesticide containers as a way of

disposal was found to be common among Anambra cereal sellers (16%) with the lowest seen among Ebonyi State respondents (1%) (Fig. 6).

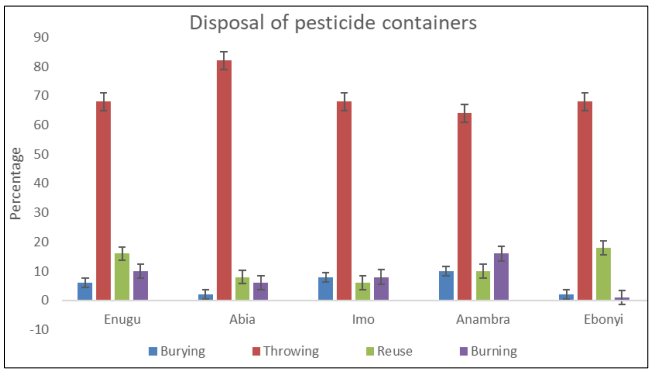

Fig 6: Disposal of pesticide container

Regarding the level of adherence to instructions of pesticide label before use, the study shows that there was low level of adherence by the respondents across the South East. Comparing the level of adherence across the South East, Abia State recorded the highest number of respondents (36%) that adheres to the instructions on the pesticide label while the lowest number of respondents was observed in Imo State (22%). Ebonyi State recorded the highest number of respondents (80%) that do not obey strictly instructions on the of label before pesticide application with the lowest recorded among Abia State respondents (64%) (Fig. 7).

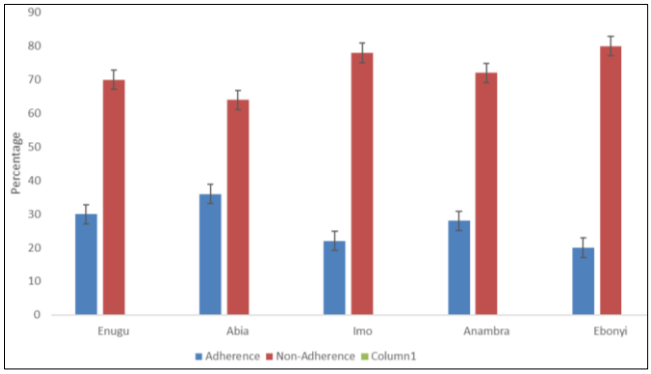

Fig 7: Instruction on the pesticide label before use

The study showed that all the respondents agreed that pesticide have effects on their health ranging from nausea, headache, vomiting, weakness, watery eyes and dizziness. The most commonly health effect experienced due to exposure to pesticide across South East was nausea. Nausea was most commonly experienced among respondents in Enugu State (60%) compared to other states with Ebonyi State the least (52%). The number of respondents suffering from headache was found in Ebonyi (16%) with the lowest found among Anambra State respondents (8%). The number of respondents experiencing vomiting was higher among Anambra State respondent (18%) and the lowest was found among Abia State respondents (6%). Respondents from Enugu and Abia States respectively have equal rate (6%) in the level of weakness with the lowest number recorded among Imo State respondents (4%). Respondents experiencing watery eyes following exposure to pesticide were highest among Imo (10%) respondents but lowest (4%) among Abia and Ebonyi State respondents respectively. Those experiencing dizziness was highest in Abia (12%) but lowest in Enugu State (4 %) (See Fig. 8 below).

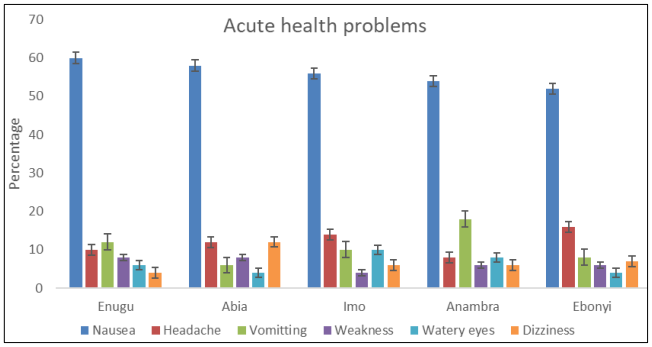

Fig 8: Acute health problems experienced after pesticide application

On the class of people vulnerable to pesticide exposure, the results show that pesticide manufacturers were more vulnerable to pesticide exposure followed by pesticide operators and people selling pesticides. Ebonyi State respondents (84%) recorded that pesticide manufacturers are more vulnerable to pesticide exposure with Abia State bearing the lowest (74%). Abia State respondents bears the highest number of persons (20%) who believed that pesticide operators are vulnerable to pesticide exposure with the lowest being Ebonyi respondent (10%). Imo State respondents (10%) reported that people selling pesticides were more vulnerable to pesticide exposure with their Anambra counterpart (4%) being the lowest (Fig.9 below).

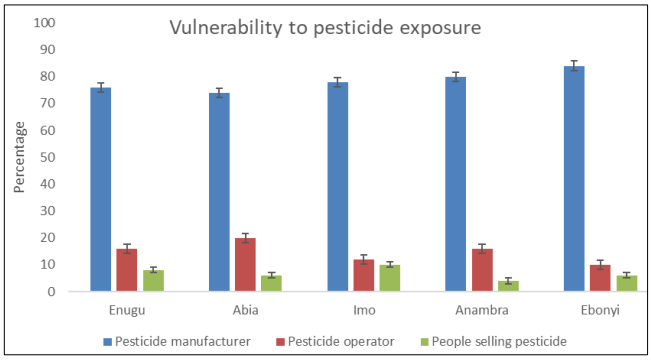

Fig 9: Vulnerability to pesticide exposure

Figure 10 shows measures taken when exposed to pesticide below). The result shows that the number of the number of respondent who meet doctors on exposure to pesticide was highest among respondents in Abia State (8%) but those of Ebonyi State was the lowest (4%). However, Abia and Imo State had equal number of respondents (10%), who meet patent vendor for treatment, whereas an Enugu respondent (2%) was the lowest. The number of respondents who do not receive treatment on exposure to pesticide is highest among Enugu respondents (92%) but lowest among Abia State respondents (82%) compared to other states.

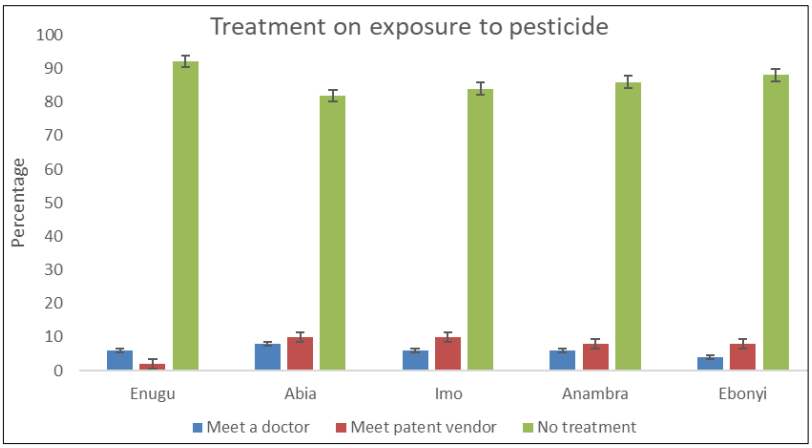

Fig 10: Treatment pesticide on exposure

The number of respondents that never used botanicals as grain protectants was highest in Ebonyi (98%) but lowest in Enugu State (80%). Those that rarely use botanicals was highest among Enugu respondents (20%) but lowest among Ebonyi State respondents (2%) when compared to other states in the South East. (Fig.11).

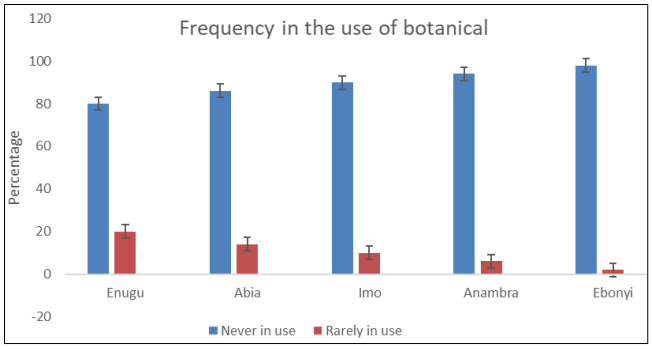

Fig 11: Frequency in the use of botanicals as cereal protectant

Fig 12 shows that respondents were of the opinion that pesticides are effective in controlling weevils than botanicals. In Enugu State, the number of respondents that believed that botanicals are effective in controlling weevils was (12%) while Ebonyi State respondents recorded (2%).

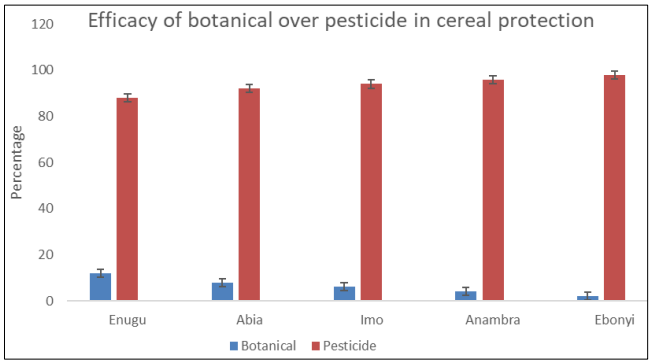

Fig 12: Efficacy of botanicals over pesticide in cereal protection

Knowledge of respondents towards the use of synthetic insecticides and plant-based botanicals

Table 2 shows that only 33.2% of cereal grain sellers demonstrated good knowledge about pesticide use and safety. The majority (66.8%) had poor knowledge levels. This indicates there are significant knowledge gaps among cereal sellers regarding safe pesticide and plant-based botanicals. Their lack of awareness is a major concern.

Table 2: Knowledge levels

Knowledge level	Frequency	Percentage
Good Knowledge	83	33.2%
Poor Knowledge	167	66.8%
Total	250	100%

Attitude of respondents towards the use of synthetic insecticides and plant-based botanicals

From Table 3, just over one-third (35.2%) of sellers had a positive attitude towards safe pesticide practices. However, nearly two-thirds (64.8%) showed a negative attitude, implying they likely do not perceive pesticides as hazardous or feel protective measures are needed. Their poor attitude suggests prevailing myths, misconceptions and lack of concern regarding pesticide risks hence the need to implement botanical use. This poor attitude can lead to unsafe behaviours.

Table 3: Attitude scores

Attitude	Frequency	Percentage
Positive attitude	88	35.2%
Negative attitude	162	64.8%
Total	250	100%

Practice of respondents towards the use of synthetic insecticides and plant-based botanicals

Table 4 shows that only 22.8% of respondents demonstrated good practices related to safe pesticide use like wearing protective gear, following label instructions, hygiene and the use of plant-based botanicals as an alternative. A large majority (77.2%) had poor practices, indicating widespread risky pesticide handling among cereal sellers. Their lack of safety precautions increases pesticide exposure. This presents significant health risks to sellers and consumers of cereals.

Table 4: Practice scores

Practice	Frequency	Percentage
Good Practice	57	22.8%
Poor Practice	193	77.2%
Total	250	100%

Discussion

Cereal sellers across the South East use WHO category 1A and 1B pesticides. These categories of pesticides according to WHO (2005) [24] are extremely and highly hazardous respectively. The use could have negative effects on the environment due to their persistent nature and therefore they should be discouraged from usage. Sellers sometimes mix up different pesticides before applying them on their cereals and such mixtures could result in possibility of causing of synergistic effect as reported by Adeyeye and Osibango (1999) [3]. In an attempt to produce more potent mixtures by preparing pesticides, cereal sellers may end up producing dangerous toxins which could have serious effects and unsafe for human consumption.

Most of the cereals sold in the South East are obtained from the North and a few from markets within the South. It is therefore possible that these cereal products are treated with insecticide in order to preserve them. The result of the study has shown that information on the type of pesticide used by sellers are mostly from agro shops. The present finding disagrees with the findings of Sa'ed *et al*. (2010) [21], who reported that information regarding pesticide use by farmers was obtained from government agencies. Few of the respondents in the present study who reported that government agencies are the source of information were consistent with a study by Nalwanga & Ssempebwa, (2011) [15] in Uganda. The use of pesticides unabated has become the most common practice by cereal sellers while preserving cereals in order to reduce losses by insect pests, without considering the health implications. These findings are in agreement with the findings by Sa'ed *et al*. (2010) [21] who reported that pesticides are commonly used farmers by as crop protectants. Respondents in the present study use one or more of the personal protective clothing during pesticide application, although there still cases of low adherence. The report from this study is not consistent with the findings by Sa'ed *et al*. (2010) [21] where respondents who are well educated with good knowledge use more protective clothing compared with people who are less educated and have knowledge of pesticides.

The study has shown that respondents get exposed to pesticide through swallowing, inhalation, skin and eye although the commonest source of exposure was through swallowing. The current findings are in consonance with the findings by Sa'ed *et al*., (2010) [21] who reported that agricultural farmers in South India get exposed through swallowing, inhalation, skin and eye. Across the South East of Nigeria, the most method of disposing pesticide containers was by throwing them indiscriminately into the environment. Other methods include burying, burning and reusing for other purpose for which it was not made for. This finding is in agreement with findings by Sa'ed *et al*. (2010) [21] where greater number of poor resource and uneducated agricultural farmers disposes pesticide containers by throwing and reusing. This unsafe disposal of pesticide containers could put general public at higher risk. This unsafe practice of disposing empty pesticide containers as seen in the current study is a major concern serious consequences on the environment, effect on human health and risk to non-target species.

Apart from the issue of unsafe disposal of pesticides, the study has shown that Enugu (70%), Abia (64%), Imo (78%), Anambra (72%) and Ebonyi (80%) of the respondents do not follow instructions on the pesticide labels. This may be directly related to their low level of education, since in the present study only 21(8.4%) had tertiary education. This finding is in agreement with the findings of Atreya, (2007) who found that more than half of farmers in the study do not follow the instructions printed on the pesticide label. This has been linked to pesticide hazards as many cereal sellers including farmers are likely to be exposed to increasing amount of pesticides.

Prevalence of symptoms as a result of pesticide exposure experienced by most respondents was (nausea, headache, dizziness, vomiting, weakness and watery eyes). This shows clearly that pesticide exposure is a health problem. Clarke *et al*. (1997) [7] reported similar incidence of the above symptoms in workers exposed to pesticides. Their perception was that effects of the chemicals on their health are temporary especially at the initial stages of application. This reveals the level of ignorant exhibited by the respondents on the dangers of pesticide application. As such, their claims remain that these health problems do not have any serious effects on them. There is therefore need for health education on the possible acute health impact of pesticides used and ways of minimizing them. Respondents in the present study were of the view that pesticide manufacturer are more vulnerable to pesticide exposure more than others in professionals like farmers, pesticide sellers and operators. The current finding is in discordance with the findings by Wilson and Tisdell (2001) [26] who pointed out that too high exposure to pesticides was common in developing countries where tens of thousands of farmers were affected by pesticides. The present report also disagrees with the finding by Little *et al*. (2003) [14], who reported significant health problems associated with pesticide use as perceived by farmers in Thailand.

Information regarding treatment of persons exposed to pesticides as reported in this study was not encouraging from the present study as greater number of respondents (86.4%) across the South East do not seek for medical attention on exposure to pesticide while (7.6%) and (6%) respectively meet a patent vendors and medical doctors when exposed to pesticides.

Information regarding the consistency in the use of alternative to pesticides especially botanicals shows that cereal sellers rarely make use of botanicals as grain protectants. The only control option of reducing weevil in this study as claimed by the respondents was through the use of synthetic insecticides. This is in contrast to the findings by Renjini (2000) [19], who reported that respondents use botanicals in controlling pests. Based on the response of respondents in this study, it was found that synthetic pesticides were reported to be more effective than botanicals in combating pest problems. This report is not in harmony with report of Regnault-Roger (2005) [18], who indicated that botanical pesticides is a better strategy in reducing current environmental and health concerns. This is because botanical pesticides are generally less persistent and therefore can be applied selectively their effect wear off. Integrated pest management (IPM) also promote the use of botanical to replace the synthetic ones.

Conclusion

The findings of the study indicated that cereal sellers use hazardous pesticides of WHO Class 1A and 1B. However, the present study indicated that cereal sellers lack sufficient

knowledge, attitude and practices of pesticides and plant-based among them so they regularly indulge in risky behaviour when using pesticides. Lack of knowledge, attitude and practices included unabated use of pesticides, no personal protective gadget during spraying operation, indiscriminate disposal of pesticide container, inability to follow instruction on the pesticide label and laxity in treatment when exposed to pesticide poisoning. These may result in danger of acute intoxication and chronic health challenges. Also, the use of plant-based pesticide as protectants on cereal was not considered an effective option to synthetic insecticide according to responses by respondents. To avert this, constant training of cereal sellers on health-related effects of pesticides and the need to embrace the use of botanicals which are eco-friendly, cost-effective and readily available for use should be recommended and implemented.

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Conflict of interest

We declare no conflict of interest.

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