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Knowledge and compliance with pesticide safety precautions among stakeholders in Lagos State, southwestern Nigeria

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ABSTRACT

A survey on the knowledge and adherence to pesticide safety precautions amongst Pest Control Officers (PCO), Environmental Health Officers (EHO) and farmers from Western region (WR), Eastern region (ER), Far-eastern region (FER) was conducted in Lagos State, using interview schedule with structured questionnaires consisting of a mixture of open and close ended questions. Highest proportion (67.2% of the 122 participants) was males while the largest proportion (32%) falls between the ages of 26 to 35 years. Highest proportion of the respondents with tertiary level of education was found among the EHOs (76.5%) followed by the PCOs (66.7%) and lastly FW (53.3%). Similarly, the respondents with Primary level of education was highest among the FER (37.5%) followed by WR (6.7%). None of the respondents of PCO, EHO and ER had only primary level of education. All the respondents were aware of personal protective equipment and were aware of the risks associated with pesticide usage. Compliance with the use of (Pesticide Protective Equipment) PPE was highest among the EHO (88%), followed by the PCO (83%) and farmers in the ER (33 %), WR (31%) and FER (30%). Adherence to other safety instructions was significantly ($p=0.05$) higher amongst the professional health officers (PCO and EHO) than the farmers. Training and re-training programs should be organized for all stakeholders handling pesticides and more emphasis should be laid on consistent PPE usage and other control strategies to minimize exposure and the risk of intoxication.

Key words: Pesticides, protective equipment, safety instructions, pesticide users

INTRODUCTION

Pesticides are chemical or biological agents commonly used against pests such as insects, weeds, fungi and nematodes (FAO, 2002). They may include any substances or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease. Moreover, pesticides include any substances that

prevent, destroy or control unwanted species of plants or animals that cause harm during or otherwise interfere with the production, processing, storage, transport or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs (FAO, 2002). Pesticides also include substances intended for use as a plant growth regulator, defoliant, desiccant or agent for

thinning fruit or preventing the premature fall of fruit (FAO, 2002).

Use of pesticides is the main method of control or management of pests in Nigerian homes and farmlands. The dosage used is at an increase as pests become resistant to them. Increased pesticide use as the main method of pest control in homes and in areas with intensive agriculture could have adverse effects on growers and pest controllers, as they may use excessive amounts without adequate protective measures (Palis *et al.*, 2006). Even farmers who are aware of the harmful effects of pesticides often times do not translate this awareness into their practices (Damalas *et al.*, 2006). The adverse health effects of pesticides on humans range from simple irritation of the skin and eyes, to more severe effects, such as affecting the nervous system (seizures), reproductive system and cancer (Collotta *et al.*, 2013).

Pesticide usage is particularly common among farmers, Pest Control Officers (PCO), Environmental Health Officers (EHO) and other individuals in combating pests. The knowledge and adherence to pesticide safety precautions is necessary when working with agrochemicals in order to reduce the risk of poisoning as well as the severity of farm work related injuries or illnesses. Studies about the types of chemicals, personal protective equipment, and exposure to pesticide poisoning indicate that personal protective equipment is effective in reducing farmers' exposure to pesticides (Fenske *et al.*, 1990; Gomes *et al.*, 1999). However, personal safety during agrochemical use has been one of the primary concerns of many international organizations (IPCS, 1991). The objectives of this study were to investigate the level of Personal

Protective Equipment (PPE) usage, and compliance to safety precautions among farmers, pest control officers and health officers in Lagos State, southwestern Nigeria.

MATERIALS AND METHODS

Study Area

The study was carried out in Lagos State, located in southwestern Nigeria. Lagos State lies between latitude 6° 24' N to 6° 39' N and longitude 3° 14' E to 3° 27' E and occupies a geographical area of about 3475 km² of which about 22% is water (786 km²). The State was divided into three senatorial regions which are Western, Eastern and Far Eastern regions.

Research instrument and design

The research instrument and design for this study was one that permits gathering of primary data on pesticide usage and safety precaution adherence from pesticide users within the State. Semi-structured interviews, guided by questionnaires were used to collect the data. The study was conducted with the approval of the President of Pest control Association of Nigeria (PECAN) for pest control officers, Coordinator of Lagos State, Agricultural development programme (ADP) for farmers and from president of Environmental Health Officers Registration Council of Nigeria (EHORECON) for health officers in Lagos State.

The aforementioned leaders agreed with the objectives, methods and usefulness of the results from this study and they helped in gaining confidence and cooperation from the respondents. Voluntary acceptance of each respondent to do the survey was fundamental in obtaining a result that reflected the attitude of the entire population of pesticide users within

the State; therefore, sincere answers were sought, each being used as aggregates, with no individual reference of any kind. Most of the farmers lived within their farm vicinity but the questionnaire administration was however limited to only individuals within the age of 18 years and above.

In all, one hundred and twenty two (122) responses from PECAN members (18), Environmental health officers (17) and farmers (87) in Lagos State were used for this study. The farmers were randomly selected from Odogunyan, Imota, both in Ikorodu Local Government Area (LGA), Ojo, Badagry and Epe, representing the western, eastern and far-eastern geographical regions of the State respectively

Data Collection

The primary data for this study was obtained through interview schedule using questionnaires consisting of a mixture of open and close ended questions as well as face to face interview methods. The questionnaires used were divided into four sections: the first section, being the demographic section, contained questions about the respondents' age, gender, religion, marital status and educational background. The second section consisted of questions related to pesticide usage, such as the duration of pesticide usage, type and effectiveness of the pesticide used.

On first visit, observations were made to ascertain if there was a need for the questionnaires to be administered in native language and if an interpreter would be required. All the pest control officers and the farmers were found to be basically educated, so there was no need for an interpreter. Data from the questionnaire administration were edited

and incomplete responses were treated as invalid and excluded from the analysis. The designed questionnaires were pre-tested on ten farmers at Odogunyan in Ikorodu to eliminate ambiguous questions. Some modifications were made on the questionnaires as a result of the pretest before it was administered to the respondents. Data obtained from the questionnaire administration were analyzed quantitatively and the responses from open ended questions were grouped into classes that expressed similar ideas. Percentages based on valid responses only were calculated from close ended questions

Statistical analysis

All the data gathered during this survey were analyzed using descriptive and inferential statistics of the Statistical Package for Social Sciences (SPSS) program, version 20.

RESULTS

Effect of gender distribution, age and educational level on usage of Pesticide Protection Equipment

A significant proportion of the respondents were males (67.21%) as shown in Table 1. However, the distribution of gender among the different groups of respondent such as the Pest control officers (PCOs), Environmental Health Officers (EHOs), Farmers from Western region (WR), Eastern region (ER), Far-eastern region (FER) varied widely. Results of gender distribution showed that there more males among the PCOs (94.5%), than ER(72.5%), WR(60%), EHOs (58%) and FER (53.1%) (Table 1).

The age distribution of the respondents varied as presented in Table 2. The highest proportion (32%) of respondents were between the ages of 26 – 35 years while

the least (9%) were between ages of 18 – 25 years (Table 2). The distribution of the educational levels of the respondents is presented in Table 3. Fairly large percent (44.26) of the respondents attended secondary school. Highest proportion (76.5%) of the respondents with tertiary level of education was found among the EHOs while none was observed among farmers from the FER.

All the respondents were literate as 10.7 44.3, 39.3 of the entire population had, primary secondary and tertiary education respectively while 5.7% had undergone other forms of education (Table 3). In general, all the members of the Pest Control offices (PCOs) and Environmental Health Officers (EHOs) attained highest (tertiary) educational levels than the farmers.

Table 1: Gender distribution of respondents

GENDER	PCO	EHO	WR	ER	FER	TOTAL
Male	94.45	58.82	60.00	72.50	53.12	67.21
Female	5.56	41.18	40.00	27.50	46.88	32.79
TOTAL	100.00	100.00	100.00	100.00	100.0	100.00

F= Frequency, %= Percentage, PC= Pest Control Officers, EHO= Environmental health officers, WR= Western region, ER= Eastern region, FER= Far-eastern region

Table 2: Age distribution of respondents

AGE (Years)	FREQUENCY	PERCENTAGE (%)
18 – 25	11	9.02
26 – 35	39	31.97
36 – 45	31	25.41
46 – 55	21	17.21
56 – 65	20	16.39
TOTAL	122	100.00

Table 3: Educational Level of Respondents on Usage of Pesticide Protection Equipment

Educational Level	PCO		EHO		FARMERS						TOTAL	
					WR		ER		FER			
	F	%	F	%	F	%	F	%	F	%	F	%
Primary	0	0	0	0	1	6.67	0	0	12	37.5	13	10.66
Secondary	3	16.67	1	5.88	5	33.33	25	62.5	20	62.5	54	44.26
Tertiary	12	66.66	13	76.47	8	53.33	15	37.5	0	0	48	39.34
Others	3	16.67	3	17.65	1	6.67	0	0	0	0	7	5.74
TOTAL	18	100.0	17	100.0	15	100.0	40	100.00	32	100.00	122	100.0

F= Frequency, %= Percentage, PCO= Pest Control Officers, EHO= Environmental health officers, WR= Western region, ER= Eastern region, FER= Far-eastern region

Identification of most commonly used pesticides among PCOs, EHOs and famers

Period of pesticide usage varied from 0 – 5 years and 21years and above. Highest proportion (29%) of respondents was recorded among those who have used it for 6 to 10 years while the least (10%) were those who have used it for 16 to 20

years (Fig. 1). A total of eight pesticides were found to be commonly used by the respondents in the area under study. These include Cypermethrin (21%), Round up (19%), Paraquat (15%), DDVP (16%), Termicide (10%), Dragon (9%) and Sherpa Plus (4%). Of these, the most frequently used insecticide whether for domestic or crop pest control was Cypermethrin (21%) while least used was SherpaPlus (4%) (Fig. 2).

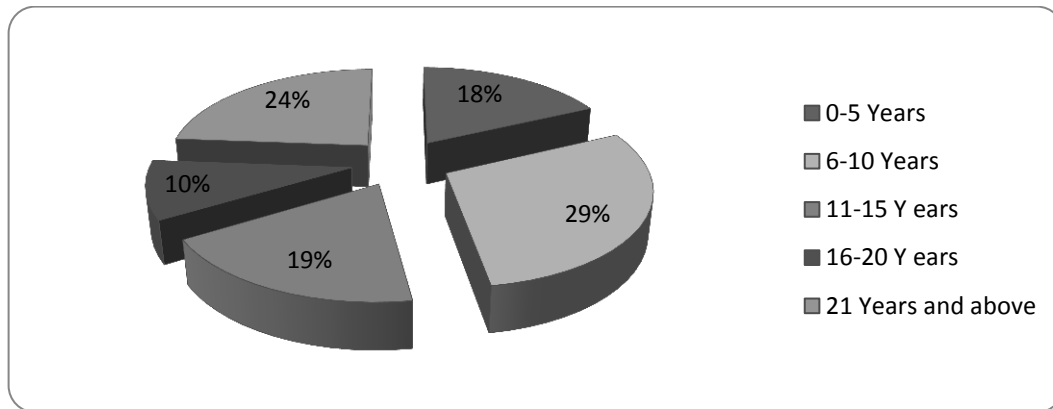


Figure 1: Period of Pesticide Usage by Respondents

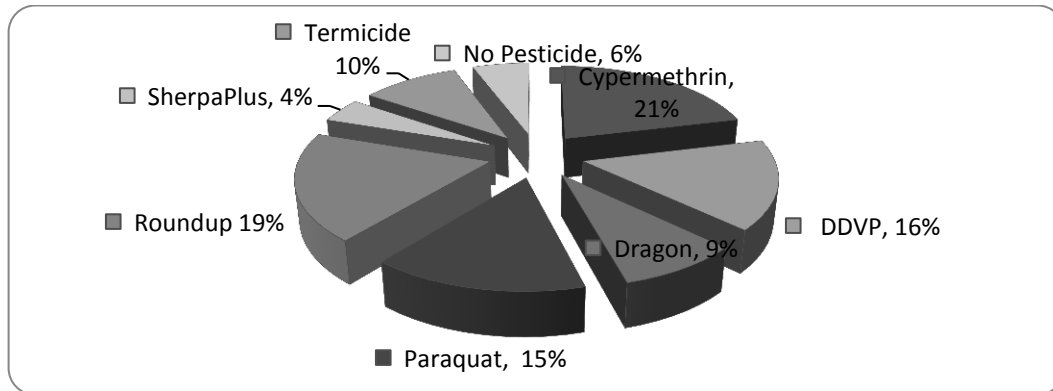


Fig 2: Pesticides commonly used by Respondents (%)

Influence of Pesticide Application training on the selection and use of pesticides among PCOs, EHOs and Farmers in Lagos State

A large proportion of the respondents have received training on pesticide application (Fig. 3). The PCOs and EHOs

obtained direct training from senior colleagues and online while farmers were educated on the use of pesticides forth nightly by farm/village extension workers that were assigned to specific locations by the Lagos State Ministry of Agriculture.

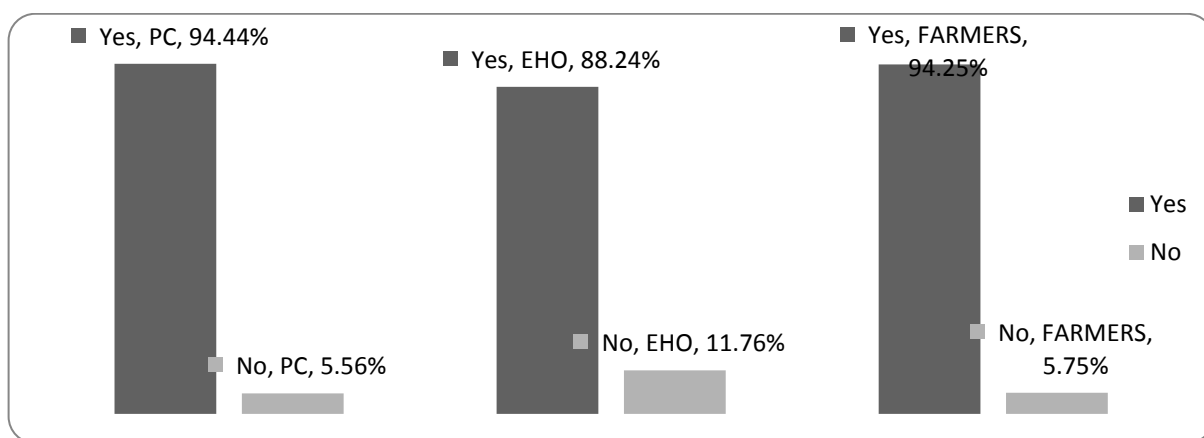


Fig 3: Respondents who received training on Safe Pesticide Usage

The use of different forms of PPE and the influence of training in pesticide application on the extent of usage varied as presented in Table 4. Generally, the PPE commonly used were cover-all (83%), Rubber hand gloves (82.7%) and

boots (88.5%) for protection against direct contact with pesticides. Nose masks (Respirators) (82.7%), Ear muffs (17.2%) and goggles (47.5%) were used to prevent contact of pesticides through the nose, ears and eyes respectively.

Table 4: PPE Usage Among PCOs, EHOs and famers

RESPONSES	PERSONAL PROTECTION EQUIPMENT (PPE)											
	Coverall		Rubber Hand gloves		Rubber boots		Nose mask		Goggles		Ear muffs	
	F	%	F	%	F	%	F	%	F	%	F	%
YES	83	68.03	101	82.79	108	88.52	101	82.79	58	47.54	21	17.21
NO	39	31.97	21	17.21	14	11.48	21	17.21	64	52.46	101	82.79
TOTAL	122	100.00	122	100.00	122	100.00	122	100.00	122	100.00	122	100.00

Compliance to other safety practices among respondents

Generally, most of the respondents (97.5%) were in full compliance with

other safety practices which include the avoidance of food, drinks and cigarette when applying pesticides in domestic or farmlands (Table 5). Environmental

Health Officers demonstrated highest knowledge on the effect of non-compliance (94%) followed by pest control officers (91.4) while the least (3.13%) non-compliance was observed among farmers from the far-eastern region of the State (Table 6).

Table 5: PCOs, EHOs and farmers Who Eat, Drink or Smoke While Using Pesticide

RESPONSES	FREQUENCY	PERCENTAGE (%)
Yes	3	2.46
No	119	97.54
TOTAL	122	100.00

Table 6: PCOs, EHOs and famers who know the Effect of Eating, Drinking or Smoking While Using Pesticide

RESPONSES	PCO		EHO		FARMERS					
					WR		ER		FER	
	F	%	F	%	F	%	F	%	F	%
Yes	16	91.43	16	94.12	10	66.67	30	75.0	1	3.13
No	2	8.57	1	5.88	5	33.33	10	25.0	31	96.87
TOTAL	18	100.00	17	100.00	87	100.00	40	100.0	32	100.0

Key: F= Frequency, %= Percentage, PC= Pest controllers, EHO= Environmental health officers,.

Reading and Adhering to Instructions to Pesticide label by PCOs, EHOs and Farmers in Lagos State

Higher percentage (90%) of all the respondents were aware of safety instructions on the pesticide label as shown in Table 7. However, 83%, and 88% of pest control officers and environmental health officers” always” read safety instructions on the pesticide label (Table 8). On the other hand only

60%, 63% and 72% of the western, eastern, far-eastern regions farmers always read instructions on pesticide label (Tables 8). Though they read the safety instructions on the label, only 38, 11 and 18% of PC, EHO and farmers adhere to priority information on pesticide label. Moreover, only 29% EHO paid attention to active ingredients present on pesticides labels while 55, 29 and 73% of PC, EHO and farmers are mindful of expiry dates on pesticide labels (Table 9).

Table 7: PCOs, EHOs and famers who read safety instructions on the pesticide label

RESPONSES	FREQUENCY	PERCENTAGE (%)
Yes	110	90.16
No	12	9.84
TOTAL	122	100.00

Table 8: PCOs, EHOs and famers who read safety precautions on Pesticide label

SAFETY	PC		EHO		FAMERS						TOTAL	
					WR		ER		FER			
	F	%	F	%	F	%	F	%	F	%	F	%
Always	15	83.33	15	88.24	9	60.00	25	62.5	23	71.87	87	71.31
Sometimes	3	16.67	2	11.76	5	33.33	2	5.00	9	28.13	21	17.21
Rarely	0	0	0	0	1	6.67	9	22.50	0	0	10	8.20
Never	0	0	0	0	0	0	4	10.00	0	0	4	3.28
TOTAL	18	100.0	17	100.0	15	100.0	40	100.0	32	100.0	122	100.0

Key: F= Frequency, %=Percentage, PC= Pest controllers, EHO= Environmental health officers, WR= Western region, ER= Eastern region, FER= Far-eastern region

Table 9: PCOs, EHOs and famers who adhere to priority information on pesticide labels

Priority information	PC		EHO		Farmers	
	F	%	F	%	F	%
Not Bordered	7	38.33	2	11.77	16	18.39
Expiry date	10	55.56	5	29.41	64	73.56
Active ingredients	0	0	5	29.41	0	0
Instruction on usage	1	5.56	5	29.41	7	8.05
TOTAL	18	100.00	17	100.00	87	100.00

Key: F= Frequency, %= Percentage, PC= Pest controllers, EHO= Environmental health officers, WR= Western region, ER= Eastern region, FER= Far-eastern region

Storage and disposal of Pesticide Containers by PCOs, EHOs and famers

Places where pesticide containers are kept/stored include the farm, warehouses, locked-up cupboards, kitchen, roof in the house, room in the house and stores. Highest number of PCOs(43%) and EHO

(29%) store their pesticides in warehouses allocated for it while famers (34%) stored theirs on the farm. (Table 10). Most of them, PC (50%) EHO (35%), and farmers (52%) had no fixed time of storage. Storage period is normally within 1- 12 months (Table 11). The used- up pesticide

containers were kept, sold, or discarded. Most of the respondents discarded their empty pesticide containers (Table 12) in the dustbin, gutters, bury them or via LAWMA. Highest number of PC (22%),

EHO (41%) and farmers (49%) discard their empty containers by burying, via LAWMA and in the dustbin respectively (Table 13)

Table 10: PCOs, EHOs and famers’ storage location

Location	PC		EHO		Farmers	
	F	%	F	%	F	%
Farm	0	0	0	0	30	34.48
Warehouse	15	42.86	5	29.41	6	6.89
Locked-up- cupboard	10	28.57	5	29.41	22	25.29
Kitchen	1	2.86	1	5.88	1	1.15
Roof in the house	0	0	0	0	2	2.29
Room in the house	2	5.71	1	5.89	0	0
Store	7	20.00	5	29.41	26	29.90
TOTAL	35	100.00	17	100.00	87	100.00

Key: F= Frequency, %= Percentage, PC= Pest controllers, EHO= Environmental health officers, WR= Western region, ER= Eastern region, FER= Far-eastern region

Table 11: Duration of pesticide storage by PCOs, EHOs and famers

Duration (months)	PC		EHO		Farmers	
	F	%	F	%	F	%
1-3	9	50	10	58.83	21	24.14
4-6	0	0	1	5.88	14	16.10
7-12	0	0	0	0	6	6.89
No fixed time	9	50	6	35.29	46	52.87
TOTAL	18	100.00	17	100	87	100.00

Key: F= Frequency, %= Percentage, PC= Pest controllers, EHO= Environmental health officers.

Table 12: Distribution of PCOs, EHOs and famers’ method of treating used pesticide containers

Duration (months)	PC		EHO		Farmers	
	F	%	F	%	F	%
Keep them	3	17.65	1	5.88	4	4.60
Sell them	0	0	0	0	4	4.60
Discard them	15	77.78	16	94.12	79	90.80
TOTAL	18	100.00	17	100.00	87	100.00

Key: F= Frequency, %= Percentage, PC= Pest controllers, EHO= Environmental health officers.

Table 13: Method of discarding empty pesticide containers by PCOs, EHOs and famers

Duration (months)	PC		EHO		Farmers	
	F	%	F	%	F	%
In the dustbin	3	16.67	6	35.29	43	49.43
In gutters	4	22.22	0	0	5	5.75
Burrry them	11	61.11	4	23.53	35	40.23
Via LAWMA	0	0	7	41.18	4	4.59
TOTAL	18	100.00	17	100.00	87	100.00

Key: F= Frequency, %= Percentage, PC= Pest controllers, EHO= Environmental health officers, WR= Western region, ER= Eastern region, FER= Far-eastern region

DISCUSSION

Safety is always an issue when using pesticides, as applicators, bystanders, and the environment can be harmed by exposure to pesticide concentrates or vapor drift. The use of personal protective equipment implies that the worker is expected to operate in a potentially hazardous environment with the protective equipment as one of the key means of preventing exposure.

This study sought to characterize factors related to pesticide safety practices among pest control officers, environmental health officers and farmers in Lagos State. Largest

number of the respondents (32%) was within the ages of 26-35 years. Similar results were found by other researchers in Palestine (Atreya, 2007). Majority of the respondents were males (67%) and this corresponds with the report of Zyoud *et al.*, (2010) and Atreya (2007) in Palestine and Nepal respectively. However, in Brazil, the average age of the studied population was 43.6 years and 17.6% had never been to school (Racena *et al.*, 2006).

Highest proportion of the respondents with tertiary level of education was found among the EHOs. This study showed that the respondents had knowledge of the

importance of PPE usage and owned or used various types of PPEs (Table 4). However, owning PPE did not guarantee usage as 82.79%, 52.46% and 31.97% did not use earmuffs, goggles and coverall respectively. The frequency of PPE usage was used as an indicator of practicing “safety first”. To compare the level/frequency of PPE usage among the respondents, the Pest controllers and Environmental health officers, being regarded as professionals were grouped together as “Health officers” and their practices compared with that of all the farmers. “Always” was considered as the only positive response indicating compliance, it was observed that the officers were more compliant than the farmers in the usage of PPEs. This is expected as the former (officers) are professionals and more literate than the farmers. Rare use of PPE was reported in several studies among farmers in other developing countries such as Sri Lanka (Sivayoganathan *et al.*, 1995), Peru, (Yucra *et al.*, 2006), Nepal (Atreya, 2007) and Filipino (Kedia and Palis, 2008). Moreover, less than 20% used masks, impermeable clothes, or gloves during pesticide application In Brazil (Racena *et al.*, 2006).

Pesticide label provides information on the proper handling of product and personal protection equipment (PPE) requirements during the mixing, loading and application activities; compliance to which brings risk to the barest minimum. There is need to ascertain the extent at which risk is being mitigated in Lagos State, so that necessary remedial intervention measures can be designed.

Most of the respondents stored their pesticide in restricted places locked-up cupboard, and warehouses. Respondents

who disposed empty containers in dustbins/trashcans or by washing and reusing them could expose the general populace to hazardous risks (Zyoud *et al.*, 2010). Such practices were also considered in other studies, to be one of the main problems associated with pesticide use in developing countries (Wesseling *et al.*, 1997).

It is strongly recommended that training and retraining programs should be organized for all stakeholders handling pesticides in one form or the other and more emphasis should be laid on consistent pesticide protective equipment usage and other control strategies to minimize exposure and the risk of intoxication. Reasons behind every safety rule in pesticide usage should also be clarified so that users would better appreciate the essence of compliance.

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