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Pesticides related knowledge, attitude and safety practices among small-scale vegetable farmers in lagoon wetlands, Lagos, Nigeria

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Abstract : The unsafe and indiscriminate use of pesticides in wetlands for agriculture represents a major risk to the environment and human health globally. The risk of exposure is due to lack of knowledge regarding its safe use, proper pesticides handling and practices. The aim of this study was to evaluate vegetable farmers' knowledge, and practices during pesticides preparation and application in their crop production. A total of 81 small-scale vegetable farms identified in these wetlands during survey were used for this study. Four declined because they are organic farmers. In all, 77 vegetable farms and farmers were analysed for this study using a structured questionnaire. Data obtained were subjected to descriptive statistics. The results indicate high risks of exposure of the vegetable farmers to toxicity and health hazards to pesticides. 71.4% of the farmers agreed that pesticide use poses some potential risk to human health while 63.6% agreed that it poses risk also to the environment. The majority of the farmers (48.1%) stored their pesticides in the open field. Some respondents also stored their pesticides in open shed meant just for pesticides (18.2%), and locked chemical stores designated only for pesticides (14.3%). A worrying 6.5% of the farmers reported storing pesticides within their living area. Over 67% of the farmers indicated using one personal protective equipment (PPE) at least during handling and spraying of pesticides. Among respondents who reported using PPE, 11% wore all the recommended six key PPE items (coveralls, protective boots, glasses/goggles, gloves, respirator, and hat). A substantial number of respondents reported not wearing respirators/nose mask (84.6%), coveralls (59.6%), or glasses/goggles (46.1%) at all. The PPE most often used were protective gloves (71.2%), hats (44.2%), and booths (42.3%). No or partial use of PPE by farmers during pesticides application increases the potential risk

of pesticide exposure, with serious health implications. These results point out a general lack of training and knowledge regarding the safe use of pesticides among small-scale farmers. Also there is a high risk of pesticides exposure. Urgent need for regular and updated training of farmers on the safe use of pesticides is crucial to ensure safe pesticides use and environmental safety.

Keywords: Pesticides, safety practices, wetlands, vegetable farmers

Introduction

Vegetables are important edible crops and are essential parts of the human diet (Adedokun et al., 2016; Zhou et al., 2016). The utilization of leafy vegetable is part of Africa's cultural heritage and they play important roles in the customs, traditions and food culture of the African household (Mensah *et al*., 2008; Adedokun *et al*., 2017). Vegetable production in the tropics relies on many chemicals such as fertilizers, pesticides and crop preservatives to produce and preserve an abundance of high-quality yields. Pesticides are substances used for preventing, destroying, repelling, or mitigating any pest (insects, mites, nematodes, weeds, rats, etc.), including insecticide, herbicide, fungicide, and various other substances used to control pests (USEPA, 2006; Njoku *et al*., 2017). Traditionally, Nigerian farmers have been relying heavily on pesticides for the control of various weeds, insect pests and diseases, leading to the high importation of these products (Desalu *et al*., 2014).

The target pest groups of commonly used pesticides include herbicides, insecticides, fungicides, fumigants and rodenticides (Sharma *et al*., 2012). Each pesticide or pesticide class comes with a specific set of environmental concerns because of their toxicity and persistence in the environment (Lamberth *et al*., 2013). Such undesirable effects have led many pesticides to be banned, while regulations have limited and/or reduced the use of others (Sharma *et al*., 2012). Organochlorine causes egg shell thinning in raptorial birds, thyroid disruption in rodents, birds, amphibians and fishes, and also acute mortality attributed (Fleischli *et al*., 2004; Rattner, 2009). Organophosphate and carbamate also cause thyroid disruption in rodents, birds, amphibians and fishes (Rattner, 2009); impaired metabolic functions such as thermoregulation, water and/or food intake and behavior, impaired development, reduced reproduction and hatching success in vertebrates (Story and Cox, 2001). They also cause oxidative damage by interacting with vertebrate immune systems and modulation of their signal transduction pathways (Galloway and Handy, 2003). The extensive use of pesticides have led to an accumulation of a huge amount of residues in the environment, thereby causing a substantial environmental health hazard due to uptake and accumulation of these toxic compounds in the food chain and drinking water (Adesuyi *et al*., 2015; Adesuyi *et al*., 2016; Njoku *et al*., 2017). Many

of the adverse effects of pesticides on the environment depend on the interactions between the physicochemical properties (vapour pressure, stability, solubility, pK_a) of the pesticide, soil adsorption and soil persistence, the soil factors (pH, organic components, inorganic surfaces, soil moisture, soil microflora, soil fauna), the plant species, and the climatic variation (Damalas and Eleftherohorinos, 2011).

Farmers directly involved in the handling are at a high risk of exposure to pesticides through contact with pesticide residues on treated crops, unsafe handling, storage and disposal practices (Koureas *et al*., 2014; Manyilizi *et al*., 2017). Poor maintenance of spraying equipment and the lack of protective equipment or failure to use it properly are another form of exposures (Matthews, 2008). Pesticide exposure can occur through four routes: Mouth, skin, inhalation into the lungs and the eyes (Desalu *et al*., 2014; Jallow *et al*., 2017). Inhalation exposure can occur while mixing granular and powder forms of pesticides, spraying of the solvent and during the burning of empty containers. Inhalation exposure provides the fastest route of exposure into the bloodstream (Desalu *et al*., 2014).

The use of pesticide in Nigeria has been on the increase ever since its introduction in cocoa production. Asogwa and Dongo (2009) estimated that about 125,000 - 130,000 metric tons of pesticides are applied every year in Nigeria. According to PAN International (2007), there is a global surge in the incidence of pesticide poisoning with an estimate of 1-41 million people suffering health from exposure to pesticides annually. It is estimated that a minimum of 300,000 people die from pesticides poisoning annually, with most of them (99%) from low- and middle – income countries (WHO, 2009). The exposure to pesticides are reported to have effects on thyroid function, cause low sperm count in males, birth defects, increase in testicular cancer, reproductive and immune malfunction/problems, endocrine disruptions, dermatitis, behavioural changes, cancers, immunotoxicity, neurobehavioral and developmental disorders (Hopping *et al*., 2008; Gill and Garg, 2014; Okoffo *et al*., 2016). There are also reports on the effects such as headaches, body aches, coughing, stomach ache, skin and eye irritation, respiratory problems, dizziness, impaired vision and nausea (Okoffo *et al*., 2016; Jallow *et al*., 2017).

The wetlands in Lagos are cultivated with arrays of vegetables. Farmers in this region use pesticides extensively for the control of pests and diseases in order to increase their vegetable yields. In third world, pesticides are used improperly with disregard for recommended safety measures hence exposing farmers to health risks. Unfortunately, there is lack of information on pesticides exposure, safety measures and operational habits of vegetable farmers during pesticides application in this region.

Therefore, the aim of the study was to describe current practices, knowledge and attitudes of smallholder vegetable farmers regarding the safe use of pesticides in relationship to the adoption of PPE to reduce occupational pesticide exposure, operational habits that lead to exposure and toxicity symptoms.

Materials and Methods

Study Area

The study was carried out in some part of the Lagos lagoon wetlands. Lagos lagoon wetlands in Nigeria is located between longitudes 3°20' and 3°50' W and latitudes 6°24' and 6°36' N.

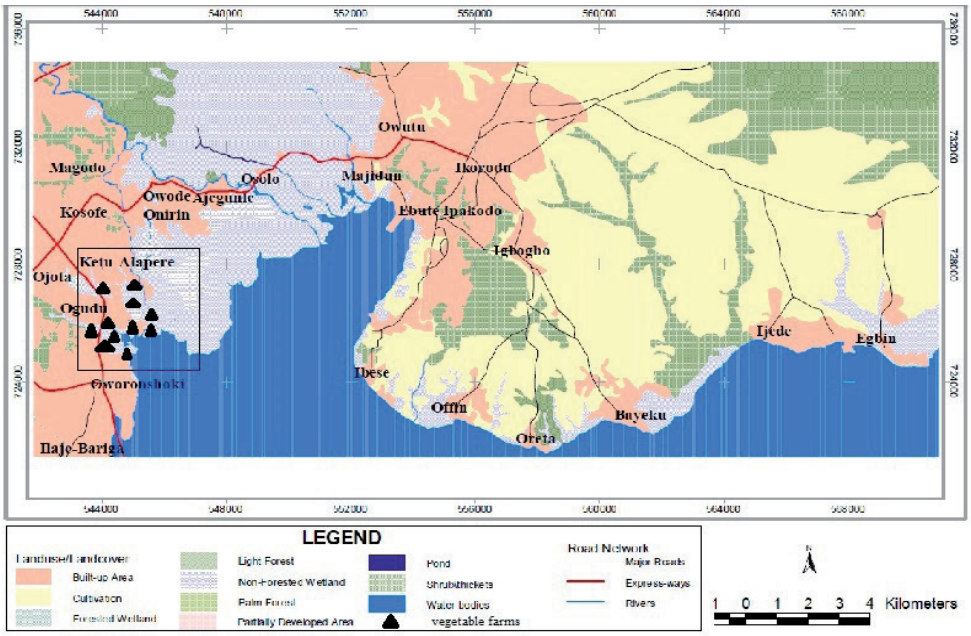

Figure 1 - Map showing the vegetable farms along Lagos lagoon wetlands

Sampling technique and data collection

The study was carried from June to July 2017. The basic information for the analysis was obtained from primary data collected with the aid of a pre-tested semi-structured questionnaire. However, due to the small number of farms, all the total 81 small-scale vegetable farms identified in the wetlands during survey were assessed and used for the study. Four (4) declined the use of pesticides because they are organic farmers. In all, 77 vegetable farms and farmers were sampled for this study in all. The survey covered demographic characteristics of farmers, pesticides use practices, and use of PPE, operational habits exhibited by farmers during and after pesticides applications, and reported symptoms experienced within the last one year. All participants agreed

to participate in the research study by signing informed consent forms.

A questionnaire was designed to include closed and open-ended and was pre-tested by randomly interviewing fifteen farmers. The closed questions were in a multiple choice format so that respondents had to select only the appropriate answer or answers that they thought well described their opinion or attitude on a particular issue. The validated questionnaire contained three main sections. The first section was designed to collect information on personal characteristics of the farmers including age, educational level, and years of farming experience. The second section focused on collecting information on farmers' level of awareness of pesticide laws and regulations, and knowledge and understanding of pesticides with respect to the environmental and human health. In addition, we also collected data on self-reported toxicity symptoms associated with pesticide use, as well as farmers' knowledge about exposure routes. When symptoms were assessed, respondents were asked if within the past year prior to the date of the interview they experienced at-least one health impairment immediately after applying or handling pesticides. If the answer was yes, respondents were asked to specify which symptoms they had experienced. The third section included questions regarding pesticide handling and safety practices including reading and following label instructions, storing and disposing of pesticides and empty containers, and use of PPE and other protective practices during and after pesticide application.

Data Analysis

All data were coded, entered, and then analyzed using SPSS version 20 (SPSS Inc., Chicago, IL, USA) and Microsoft Office Excel 2010 (Microsoft Corporation, Redmond, WA, USA). Descriptive results were expressed as frequencies and percentages.

Result and discussion

Demographic characteristics of the respondents in the study area

The demographic characteristics of respondents in the study area are shown in Table 1. It was evident from this study that males dominated vegetable farming in this wetland, 94.8% were males while 5.2% were females. This could be attributed to the intensive nature hence less attractive to most females. The male to female ratio in this study corroborates earlier report by Ugwu *et al.* (2015) and Adelani *et al.* (2011), that Fadama farming system of vegetable cultivations in wetlands in Nigeria were dominated by males. Additionally, about 50.7% of the farmers had their ages between 35 – 44 years with 31.2% within the range of 25 and 34 years. Only 1.2% of

the farmers were above 55 years. The average age of the farmers was 36 years.

Majority of the farmers (68.9%) had formal education, mainly primary education (15.6%), secondary education (46.8%) and tertiary education (6.5%), with 31.1% of the farmers with no formal education. The lower level of the farmers can affect their ability to perform some critical tasks (e.g. calibration of sprayers and mixing of pesticides) that required a little bit of higher education. This may affect the farmers' operational habits in relation to chemical usage (Okoffo *et al*., 2016). Ashburner and Friedrich (2001) and Kemobonta *et al*. (2014) also earlier reported that education has a great influence on the overall behavior and the dispositions of individuals towards adoptions of agricultural related innovation. Most of the respondents (46.8%) had 6–10 years of farming experience, with 35.0% having more than 10 years of farming experience. The average number of years of vegetable farming in the study area was 9.8 years. This clearly shows that most of the farmers in the study area have quite adequate experience in vegetable production. It is therefore very likely that their adoption levels of technologies such as pesticide use would be high. Majority of the farmers were farmers with less than 5 hectares per respondent. The vegetable farmers in the study area are growers of eight different vegetables namely; *Corchorus olitotius* (ewedu), *Amarathus hybridus* (tete), *Celosia argentea* (soko) *Abelmoschus esculentus* (okra), *Telferia occidentalis* (Ugu), *Lycopersicon esculentum* (tomato), *Allium fistulosum* (spring onions), *and Capsicum annum* (pepper). However, the most common vegetable grown in these areas are the spring onions and the leafy vegetables (*Corchorus olitorius, Amaranthus hybridus* and *Celosia argentum*).

Farmers knowledge and understanding of pesticides

Farmers' knowledge of pesticides including potential effects on human and environment, awareness of pesticides laws and exposure routes were presented in table 2. 71.4% of the farmers agreed that pesticide use poses some potential risk to human health while 63.6% agreed that it poses risk also to the environment. When farmers were asked to indicate how pesticides enter the human body, oral (79.2%), dermal (50.6%), inhalation (32.5%), and eye contact (19.5%) were stated as the most common routes of exposure to pesticides. About 14.2% of the farmers indicated their lack of knowledge of any route of exposure to pesticides. The majority of the farmers (58%) are aware that some pesticides have been banned or are restricted for use. The gaps identified in this study could be used for knowledge-based training programs for farmers. Training activities and programs can leads to increased levels of knowledge about safety precautions while handling pesticides. It is imperative that proper training programs on pesticide safety and on the hazards of pesticide exposure be developed to address gaps in farmers' knowledge about pesticides (Alam and Wolff, 2016; Jallow *et al*., 2017). The majority (84.4%) of the farmers indicated that pesticides application is essential for high crop yield and productivity. It is important

Table 1 - Demographic Characteristics and Profile of the Farmers

Variable	Description	Freq (N)	Percentage (%)
Sex of Farmers	Male	73	94.8
	Female	04	5.2
Age of Farmers	15 – 24	06	7.8
	25 – 34	24	31.2
	35 – 44	39	50.7
	45 – 54	07	9.1
	Above 55	01	1.2
Educational Level	No formal education	24	31.1
	Primary	12	15.6
	Secondary	36	46.8
	Tertiary	05	6.5
Farmers years of experience in vegetable cultivation	1 – 5	14	18.2
	6 – 10	36	46.8
	11 – 15	19	24.7
	16 – 20	08	10.3

to enlighten farmers on the use of alternate cropping system and organic farming that are not dependent on pesticides use. Also, integrated pest management practices should be promoted to these vegetable farmers.

Also, over 77% of the farmers did not read or follow the instructions on pesticides label, 69.5% of them stating that they can't read and understand the label instructions while 31.5% stated that the labels were written in English language. As a result, there is difficulty in their ability to read and understand pesticide labels regarding the correct and safe use of pesticides, or written communication about how to avoid the risks of exposure. This is a cause for concern, and an indication of general ignorance of the importance of pesticide labels in reducing exposure risk. Educated and enlightened farmers are more knowledgeable about pesticide safety, having better ability to read, understand and follow hazard warnings on labels, and conceptualized the consequences of poor pesticide usage practices (Jallow *et al.*, 2017). Just 22% of the farmers were able to read, understand, and follow pesticide label instructions correctly. Among farmers who are aware that some pesticides have been banned or restricted for use, the high toxicity of the pesticides (89.4%), not effective (61.7%) and expensive (76.6%) were cited as major reasons for the ban or restriction. A considerable number of the respondents in this study had no and limited formal training or technical support in pesticide safety. Therefore, pesticide retailers should

be trained, increasing their knowledge of pesticide safety and risk because they serve as technical advisers to farmers and other end-users. Promoting safe pesticide use will also require educating farmers on the safe use of pesticides risk and exposure. Training farmers and pesticides retailers alone will not be sufficient if there is no proper national pesticide regulatory framework and enforcement. Higher priority must be given to enforcing existing pesticide laws and regulations at the retailing and at the farm level, through monitoring and auditing activities.

Table 2 - Farmers knowledge, understanding and view about pesticides (n=77)

Question	Variable	Freq (N)	Percentage (%)
Do you think that pesticides harm the environment?	Strongly agree	29	37.7
	Agree	20	25.9
	Disagree	18	23.4
	Strongly disagree	10	13.0
Do you think that pesticides affect human health?	Strongly agree	40	51.9
	Agree	15	19.5
	Disagree	18	23.4
	Strongly disagree	04	5.2
How do pesticides enter the human body? [x]	Dermal	39	50.6
	Oral	61	79.2
	Eye contact	15	19.5
	Inhalation	25	32.5
	Don't know	11	14.2
Do you think pesticides are essential for high crop yield and productivity?	Strongly agree	51	66.2
	Agree	14	18.2
	Disagree	09	11.7
	Strongly disagree	03	3.9
Do you read and follow pesticides labels?	Yes	17	22.1
	No	60	77.9
Do you know any banned or restricted pesticides?	Yes	47	61.0
	No	30	39.0
Do you know the reason pesticides are banned or restricted? [x,y]	Highly Toxic	42	89.4
	Not effective	29	61.7
	Expensive	36	76.6
	Don't know	18	38.3

[x] Multiple responses allowed; [y] percentage of respondents who knew that pesticides are banned or restricted for use (n=47)

Farmers Practices on storage and disposal of pesticides

Farmer's ways of storing of pesticides and disposal of pesticide residue solutions, old expired stocks, and empty pesticide containers are shown in Table 3. The majority of the farmers (48.1%) stored their pesticides in the open field. Some respondents also stored their pesticides in open shed meant just for pesticides (18.2%), and locked chemical stores designated only for pesticides (14.3%). A worrying 6.5% of the farmers reported storing pesticides within their living area. When asked what they do with leftover pesticide solutions, 22.1% of respondents reported storing in containers to be reused, 11.7% disposed on the field, 7.8% applied the leftover solution on the crops and 5.2% wash off. About 53.2% of respondents reported mixing only the amount of pesticides needed for the application at hand. Disposal of old pesticide stocks is often on open field (13.0%) and adding to the other to be reused (3.9%). Over 83% of the farmers indicated that they buy only the amount of pesticides they needed. The most common ways of disposing empty pesticide containers were placing in waste collection bins (36.3%), discarding them on farms (6.5%), burning them on the farms (2.6%) and burying the containers within the farms (1.3%). Alarmingly, 53.3% of the farmers reported re-using empty pesticide containers for other purposes like watering, storing seeds and grains etc. with the perception that once these containers are thoroughly washed with soap and water they pose no danger to their health. Education and farming experience had a negative relationship with disposal of pesticide containers after use, the reuse of pesticides containers and burning of used pesticides containers. This implies that as farmers gain more experience in farming with their education level, they are less likely to throw empty pesticide containers on the ground outside the farm, reuse or burn used pesticide containers. The re-use of pesticide containers represents a route of serious non-occupational human exposure, as several traces of pesticides could still be found in the containers even after washing and rinsing. Similar widespread reuse of pesticide containers for other household activities has been reported in other studies (Afari-Sefa *et al*., 2015; Okoffo *et al*., 2016).

Farmers use of personal protective equipment (PPE) to prevent occupational pesticides exposure

The use of appropriate PPE and the adoption of other safe protective measures and attitude during preparation and application of pesticides are important to reduce occupational exposure to pesticides. Over 67% of the farmers indicated using at least one PPE during handling and spraying of pesticides. Among respondents who reported using PPE, 11% wore all the recommended six key PPE items (coveralls, protective boots, glasses/goggles, gloves, respirator, and hat). A substantial number

Table 3 - Farmers practices on storage and disposal of pesticides

Question	Variable	Freq (N)	Percentage (%)
Where do you store pesticides?	Open shed just for pesticides	14	18.2
	In the open field	37	48.1
	Locked chemical store	11	14.3
	Living Area	05	6.5
	Don't store pesticides	10	12.9
What do you do with the unused leftover (mixed, diluted) pesticides?	Disposed on the field	09	11.7
	Mix only needed pesticides	41	53.2
	Apply on other crops	06	7.8
	Wash off	04	5.2
	Stored in container to be reused	17	22.1
What do you do with old pesticides stocks?	Buy what is needed	64	83.1
	Dispose on the field	10	13.0
	Add with new to reuse	03	3.9
What do you do with empty pesticide containers?	Discard on-farm	05	6.5
	Bury on-farm	01	1.3
	Burn on farm	02	2.6
	Waste collection bins	28	36.3
	Reuse for other purposes	41	53.3

of respondents reported not wearing respirators/nose mask (84.6%), coveralls (59.6%), or glasses/goggles (46.1%) at all. The PPE most often used were protective gloves (71.2%), hats (44.2%), and booths (42.3%). According to Matthews (2008), an increase in the use of protective measures decreases the probability of poisoning by 44% to 80%. In this study, there are low levels of adoption of PPE to reduce occupational exposure to pesticides because about 32% of the farmers indicated their non-usage of PPE during handling, preparation and spraying of pesticides. The reasons are; too expensive (45%), not comfortable in the tropic climate (85%), not available when needed (30%), it make work slower (18%) and no health challenges from using pesticides are some of the cited reasons. The use of PPE in our study was much higher when compared to a study in Tanzania that reported 13% use of at least one of the 6 types of PPE in the past 3 months (Manyilizu *et al.*, 2017.). However, it was lower when compared to findings from a study carried out in Ethiopia that reported PPE use was twice as high among pesticides applicators as among re-entry workers (13 versus 7); while none of the small-scale farm workers used PPE in the study (Negatu *et al.*, 2016). This none use and partial usage of PPE by farmers during

pesticides application increases the potential risk of pesticide exposure, with serious health implications. This indicates that farmers may be more willing to risk exposure to pesticides than to use PPE under such climatic conditions. The use of PPE to prevent exposure to pesticides were found to be associated with at least a high school education among migrant farm workers in USA (Hwang *et al*., 2000), farmers in Kuwait (Jallow *et al*., 2017), farmers in Mexico (Blanco-Munoz and Lacasana, 2011), farmers in Ghana (Okoffo *et al*., 2016) and farmers in Oyo state, Nigeria (Ugwu *et al*., 2015). However, according to Jallow *et al*. (2017) education status and training in pesticide use and safety are strong determinants for the appropriate use of PPE among farmers using pesticides.

Table 4 - Farmers use of PPE during preparation and application of pesticides to prevent occupational exposure (n=52) [x]

Protective Equipment	Variable	Freq (N)	Percentage (%)
Coveralls	Always	13	25.0
	Sometimes	08	15.4
	Never	31	59.6
Protective boots	Always	22	42.3
	Sometimes	20	37.5
	Never	10	19.2
Glasses/goggles	Always	16	30.8
	Sometimes	12	23.1
	Never	24	46.1
Gloves	Always	37	71.2
	Sometimes	10	19.2
	Never	05	9.6
Respirator/nose mask	Always	03	5.8
	Sometimes	05	9.6
	Never	44	84.6
Hat/hair dress	Always	23	44.2
	Sometimes	28	53.8
	Never	01	2.0

[x] Number of farmers who wore at least one PPE during preparation and application of pesticides.

Pesticide handling attitude of farmers

Some operational habits exhibited by vegetable farmers in the study area during and after pesticides application are presented in Table 5. The majority of respondents reported not eating (90.9%), smoking (76.6), drinking (71.4), talking (66.2%) or singing water (48.0%) when mixing or applying pesticides. In addition, 13.0% of the respondent reported sometimes stirring or mixing pesticides with hands. These operational practices readily expose farmers to contamination through oral and dermal routes. Similar habits by farmers during pesticides application have been reported in studies by Sosan and Akingbohungbe (2009) and, Ogunjimi and Farinde (2012) in Nigeria.

Over 96% of the respondents reported that they do have their bath after application of pesticides while 100% admitted washing their hands with water and soap after application. This is an indication that there is an awareness of the harmful effects of pesticides exposure on humans. This finding is in line with the study by Lawal *et al*. (2015) who also reported that Cocoa farmers (100%) in Nigeria washed their hands after pesticide application. The survey also revealed that 55.5% of respondents had their bathes along the banks of the lagoon while 44.5% bathed in their houses. Bathing along or within nearby water bodies is a potential threat and risk to aquatic lives and humans due to pesticides contamination.

Over, 35% of the respondents reported that they did not consider wind direction when spraying pesticides. The disregard on wind direction during pesticides application exposes farmers to risk of pesticides intoxication as the wind may blow the chemical towards the body, including the face of the farmer. This might also causes pollution of the environment (soils and nearby water bodies) due to spray drift. Okoffo *et al*. (2016) made similar observations, that poor spraying practice presents great potential to exposure of farmers to chemicals from both dermal contact and inhalation. The survey also revealed that 24.7% of farmers in this study do not wash their used PPE after pesticides application, which further exposes them to health problems such as skin irritation when the used PPE comes in contact with the body. This finding is in line with a study by Ogunjimi and Farinde (2012) on cocoa farmers in Osun and Edo States, Nigeria. The results of pesticides exposures through operational habits exhibited by farmers corroborates the conclusion made by Coronado *et al*. (2004), that exposure to pesticide has been one of the most important occupational hazards among farmers in developing countries. Associations between the unsafe handling and misuse of pesticides and improper use of personal protection, and increased risk for adverse health effects have also been reported in other developing countries, such as Cambodia (Jensen et al., 2011), Armenia (Tadevosyan *et al*., 2013), Uganda (Oesterlund *et al*., 2014), Kenya (Ibrahim, 2015) and Tanzania (Manyilizu *et al*., 2017).

Table 5 - Some operational habits exhibited by respondents during preparation and application of pesticides.

OPERATIONAL HABITS	VARIABLE	FREQ (N)	PERCENTAGE (%)
Talking while mixing or spraying	Always	0	0.0
	Sometimes	26	33.8
	Never	51	66.2
Singing while mixing or spraying	Always	05	6.5
	Sometimes	35	45.5
	Never	37	48.0
Eating while mixing or spraying	Always	0	0.0
	Sometimes	07	9.1
	Never	70	90.9
Drinking water while mixing or spraying	Always	0	0.0
	Sometimes	22	28.6
	Never	55	71.4
Smoking while mixing or spraying	Always	04	5.2
	Sometimes	14	18.2
	Never	59	76.6
Stirring/scoping chemicals with hands	Always	0	0.0
	Sometimes	10	13.0
	Never	67	87.0
Sprayed along the wind direction	Always	09	11.7
	Sometimes	28	36.4
	Never	40	51.9
Washing of PPE before reuse	Always	27	35.1
	Sometimes	31	40.2
	Never	19	24.7
Bathing after application	Always	32	41.6
	Sometimes	42	54.6
	Never	03	3.8

[x] Multiple responses were allowed

Toxicity symptoms related to pesticides preparation and application

A total of 60 farmers (78%) self reported at least one symptom of acute pesticides poisoning during the last one year of pesticides handling and usage, while 17 (22%) of the respondent did not ascribe any significant health effect to pesticides exposure. The most reported symptoms by respondents were headaches (78%), skin irritation (71%), itchy eyes (62), fatigue (55%), dizziness (40%), and coughing (19%). Other symptoms reported by respondents were vomiting, nausea, stomach ache, poor vision, and excessive sweating. These symptoms were similarly reported in studies conducted in Tanzania (Manyilizu, 2017), Cambodia (Jensen *et al*., 2011) and Bolivia (Jors *et al*., 2006), that suggested exposure to acute toxic doses of pesticides. The use of personal protective equipment (PPE) as claimed by the vegetable farmers in the study area did not commensurate with the health hazards they reported. For effective protection, PPE should be chosen based on the information given on the pesticide label. Unsafe practices increase the risk of pesticide exposure, thereby increasing the risk of clinical and subclinical adverse health effect (Lekei and Ngowi, 2016).

Table 6 - Problems reported by farmers after mixing or spraying pesticides (n = 77) [x]

Symptoms	n [y]	%
Headache	60	78
Dizziness	31	40
Skin irritation	55	71
Vomiting	08	10
Nausea	10	13
Itchy eyes	48	62
Coughing	15	19
Stomach ache	06	8
Poor vision	09	12
Shortness of breath	07	9
Excessive sweating	14	18
Fatigue	42	55
No health effect	17	22

[x] Respondents were asked if they experienced at least one heath impairment immediately after applying or handling pesticides in the last 12 months; [y]Multiple responses allowed.

A limitation of this study is that it is based mainly on self-reported data, relying on the honesty of respondents which is subjected to bias. For example, self-report of PPE use and safe disposal of empty pesticide containers, and the adoption of other safety practices may be influenced by the respondents' desire to indicate that they comply with protective measures against occupational pesticide exposure or wanting to report socially desirable characters. Another limitation relates to the inability to directly link health symptoms experienced by respondents to pesticide exposure. The health symptoms experienced by respondents, such as headaches and fatigue, were not specific, and in some, these symptoms might have been due to causes other than exposure to pesticides, such as long exposure to the sun, especially if no head protection is worn. Nevertheless, that the symptoms reported by respondents occurred immediately after applying or handling pesticides and the frequency of occurrence is a great cause of concern. The subjective interpretation pertaining to the self reported data may lead to a difference with regard to the on-field observation. Finally based on the number of the identified small scale vegetable farmers (81), we cannot claim that it is a representative of all the farmers in Lagos but of the small scale vegetable farmers cultivating the lagoon wetlands. Our intention is not to generalise but to investigate and highlight important health and pesticides safety issues and practices for individual farmers. Creating special awareness and intervention programs about safe usage of pesticide is extremely vital to reduce pesticides exposure and toxicity. It is also important to promote alternative pest control strategies such as the use of biopesticides and integrated pest management (IPM) especially in a threatened ecosystem such as this wetland.

Conclusion

The study provides an overview of pesticide safety knowledge and attitude among small scale vegetable farmers in Lagos lagoon wetlands. The results showed awareness among the farmers on the importance of protecting themselves and the environment from hazards associated with handling pesticides is still very low; especially on the safe use of pesticides and attitudinal practices regarding storage, handling and disposal of pesticides. The adoption of PPE to reduce occupational pesticide exposure, and operational habits is also very low. We hereby recommend urgent need for regular and updated training of farmers on the safe use of pesticides and safe disposal of empty pesticide containers, spray solutions and water used to wash sprayer equipment after spraying as this is crucial to ensure effective management of insect pests and diseases, prevention of environmental pollution and safe pesticides usage.

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