KNOWLEDGE, ATTITUDES AND PRACTICES ON PESTICIDE EXPOSURE AND SAFETY AMONG SMALLHOLDER FARMERS OF MITETE PARISH, SEMBABULE DISTRICT

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DECLARATION

I Nakuya Evelyn, registration number 21/U/0451 hereby declare that this dissertation is entirely my original work and has never been submitted to any institution nor anywhere else for any kind of award. I therefore present it to Makerere University School of Public Health in partial fulfilment of the requirements for the award of a Bachelor's degree in Environmental Health Sciences.

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DEDICATION

I dedicate this dissertation to my parents, Mr. Kizza Henry and Mrs. Namale Annet Kizza as a form of accountability for their tireless efforts to ensure I reach this far in my education.

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ACRONYMS AND ABBREVIATIONS

FAO	Food and Agricultural Organization of the United Nations
HHPs	Highly Hazardous Pesticides
IPM	Integrated Pest Management
KI	Key Informant
KII	Key Informant Interview
LC	Local Council
LMIC	Low- and Middle- Income Countries
NGO	Non-Governmental Organizations
PPE	Personal Protective Equipment
SDS	Safety Data Sheet
UNACOH	Uganda National Association of Community and Occupational Health
WHO	World Health Organization

OPERATIONAL DEFINITIONS

Active ingredient refers to the part of the product that provides the pesticidal action.

Exposure to pesticides refers to any contact between a living organism and one or more pesticides.

Integrated Pest Management (IPM) according to Food and Agricultural Organization of the United Nations (FAO) refers to careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human and animal health and the environment.

Pesticide refers to any substance, or mixture of substances of chemical or biological ingredients intended for repelling, destroying or controlling any pest, or regulating plant growth.

Risk is the probability and severity of an adverse health or environmental effect occurring as a function of a hazard and the likelihood plus the extent of exposure to a pesticide(FAO, 1995).

Smallholder farmers are farmers who are capable of producing crops on a small piece of land without necessarily using expensive and advanced technologies.

ABSTRACT

Background

Pesticides are often used in agricultural production to control weeds, diseases and other plant pathogens in an effort to reduce yield losses and maintain high quality products. Occupational pesticide exposure widely occurs in the case of smallholder farmers in open fields and people employed in the industry of pesticides. Pesticide exposure is a serious public health threat due to the risks associated with it in case safety measures are not put in place. There is limited information regarding the knowledge, attitudes and practices on pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district.

Study objective

To assess the knowledge, attitudes and practices on pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district so as to get information that can be used to control this public health challenge.

Methodology

A descriptive study that used a mixed method approach utilizing both quantitative (cross-sectional study) and qualitative methods was used. The quantitative data was collected from 278 smallholder farmers of Mitete parish, Sembabule district using a structured questionnaire that was entered in a mobile Kobo collect tool. Systematic random sampling and simple random sampling methods were used to select the study participants. Qualitative data was collected from key informants including agrochemical retailers, agricultural extension worker, heads of farmers' groups and Local Council 1 Chairpersons using a key informant interview guide. Quantitative data was downloaded into Microsoft Excel for cleaning and exported to STATA, Stata 14 (64-bit) Software for univariable analysis. Thematic analysis was used to analyze qualitative data.

Results

The majority of participants were not aware of the toxicity color codes present on labels 73.7% (205/278). Most participants 86.7% (241/278) had never had any training on how to use pesticides. Most participants 85.0% (216/278) reported that rainy weather was the most inappropriate weather condition for spraying pesticides. Many participants 55.0% (153/278) thought it was appropriate

to enter recently sprayed fields. The majority of participants 93.5% (260/278) had ever used pesticides, over half of them, 51.5% (134/278) did not know how to safely use them. The majority of participants 67.6% (188/278) wore gumboots while spraying pesticides. According to the key informants, not only do pesticides affect the health of people if they do not protect themselves, but also affect the environment (soil micro-organisms and nearby water sources) if poorly managed.

Conclusion/Recommendations

Emergency comprehensive intervention measures should be put in place to reduce major health hazards to smallholder farmers, farmworkers, their families and nearby ecosystems. Such measures include training about safe pesticide application, access to personal protective equipment and measures that minimize cost barriers to taking on safe behaviors.

CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1 Introduction

Pesticides are often used to increase agricultural productivity and also control plant pathogens and insect pests, though over use can result into secondary pest outbreaks and insecticide resistance(Thao *et al.*, 2019). Globally, synthetic pesticides have been reported to be used in agriculture. Unfortunately, pesticides classified by World Health Organization(WHO) as being highly, extremely, or moderately hazardous have been used by smallholder farmers in developing countries(Clausen *et al.*, 2017a)**.** In Low-and Middle-Income Countries(LMICs), farmworkers, farmers and their families have been widely affected by increased acute pesticide poisoning due to inadequate health standards and safety precautions(Food and Agriculture Organisation, 2006). Globally, it is approximated that hundreds of thousands of people die every year due to negative impacts of pesticide exposure(Sekiyama, Tanaka and Gunawan, 2007) with suicide being the most problematic poisoning circumstance.

Consequently, the extensive and indiscriminate use of pesticides has resulted into serious health and environmental issues all over the world(Pimentel, 2005). Exposure to these pesticides can be oral, dermal and through inhalation. Failure to have the prescribed Personal Protective Equipment(Asmare *et al.*, 2022), having limited access and knowledge on how to use them also increases the risk of pesticide exposure to the smallholder farmers(Food and Agriculture Organisation, 2006). In a particular study, symptoms of pesticide intoxication included dizziness (56.5%), fatigue (45.6%), headaches (56.1%) and skin irritation (53.3%). This same study showed farmers' behavior during pesticide application as talking while spraying(59.8%), mixing pesticide with bare hands(31.1%), blowing clogged nozzles with the mouth(42.7%)(Moda *et al.*, 2022) which are unsafe pesticide practices and therefore increase exposure.

In LMICs, the smallholder farming sector occasionally finds it challenging to safely use pesticides due to limited awareness and low-risk perception among farm workers and owners(Schreinemachers *et al.*, 2015). Smallholder farming(farms with <2ha)(Lowder, Skoet and Raney, 2016). Majority of the smallholder farming operations are labor-intensive structures that put emphasis on growing a diverse crop supply that is economically and environmentally sustainable to the local community(Thao *et al.*, 2019). Smallholder farming provides food security,

income opportunities and also a major source of livelihood for many rural communities in Uganda. In most cases, smallholder farmers are limited by resources and thus undeserved, therefore making it difficult to obtain information and financial resources to improve farms(Castro, Krenz and Neitzel, 2003).

Limited capacity to safely store pesticides, maintain, safely clean and store application equipment among smallholder farmers increases their risk of exposure. Failure to abide by prescribed re-entry and pre-harvest intervals can result into acute and chronic health effects to farmworkers for example weeding in recently sprayed fields which is a high-exposure activity(Asmare *et al.*, 2022). Also, lack of disposal facilities for left-over products or empty containers have also attributed to increased risk of pesticide exposure to smallholder farmers.

Pesticides labelling is one of the ways pesticide users can get important information especially in regards to safe pesticide use practices since it is also a medium of instruction to them. A number of important properties of the pesticide and appropriate use precautions can be effectively communicated on the pesticide product label. Additionally, the pesticide label must include first aid measures, required protective measures, methods of container disposal, precautions recommending against use in certain environments, and application rates for particular pest species(Isbn *et al.*, 2011).

Using pesticides without adequate information, training and protective measures can result into serious environmental and health consequences. In a study by (Fuhrimann *et al.*, 2021) , two factors were expected to increase pesticide exposure that is applying pesticides outdoors using manual handheld knap-sack sprayers and mixing of pesticide active ingredients. This same study showed that three factors were expected to decrease pesticide exposure that is following time interval between application and change of clothes, overall average protection achieved by PPE use, covering different body areas and accounting for differences in application frequency and time interval between application and shower. Unfortunately, it has been shown that smallholder farmers in most cases lack adequate knowledge and understanding of the risks associated with pesticide use.

1.2 Background

Knowledge, attitudes and practices on pesticide exposure and safety among smallholder minority farmers including those in Mitete parish, Sembabule district has been largely unexplored. Understanding these factors is crucial in ensuring productive and safe farming practices in agricultural regions of Mitete parish, Sembabule district. Mitete parish is found in Sembabule district with majority of the people entirely depending on agriculture as their source of livelihood. Pesticide use is essential in enhancing food security and high agricultural productivity. However, unsafe pesticide practices resulting into exposure possess serious environmental and health issues, especially in smallholder farming communities.

Pesticide exposure is a serious public health threat due to the risks associated with it in case safety measures are not put in place. Occupational end users of pesticides are farm workers who participate in application of pesticides(Macfarlane *et al.*, 2013). Occupationally, as the smallholder farmers use the pesticides, there is a high risk of direct human exposure in different processes(e.g. mixing, application, storage, preparation and application)(Macfarlane *et al.*, 2013), contact with treated crops and contaminated equipment. As a result of occupational exposure to pesticides, farm workers and owners can experience bodily absorption of the pesticide products used which puts them at risk of possible health effects(Macfarlane *et al.*, 2013).

Dietary exposure can result from consumption of treated agricultural produce and drinking of water contaminated with pesticides. In case of dietary or direct human exposure in vulnerable groups such as infants, breast feeding women, immune-compromised persons and malnourished persons, severe health effects will occur(Food and Agriculture Organisation, 2006). This same study by Food and Agricultural Organization of the United Nations (FAO) showed that livestock, domestic animals, wildlife, environment and unintentional exposure to crops as a result of overflow, can compromise their health and food safety. It proceeds to show that contamination of ground and surface water, soils, air and plant material can result due to high levels of environmental exposure. This in turn can affect soil organisms, insects and other organisms that are beneficial to the ecosystem. Some pesticides have been identified to accumulate in the food chain(Food and Agriculture Organisation, 2006).

The following interventions have been suggested to reduce occupational and non-occupational exposure to pesticides and its adverse impacts on the health of smallholder farmers: Firstly,

awareness creation programs should be emphasized and organized for all stakeholders along the value chain; farm workers, extension workers, retailers, smallholder farmers(Andersson and Isgren, 2021). Secondly, dissemination and promotion of alternative approaches(Grewal *et al.*, 2017) such as Integrated Pest Management, bio-pesticides, agroecological methods and organic farming. Therefore, advisory services have to focus on communicating these alternative approaches to all farmers(Asmare *et al.*, 2022). Despite these, there is still a gap in knowledge, attitudes and practices regarding pesticide exposure and safety among smallholder farmers in Mitete parish.

Previous studies have highlighted the need to increase awareness on the risks associated with pesticide exposure and unsafe pesticide handling practices among smallholder farmers(Staudacher *et al.*, 2020). Therefore, this research aimed at exploring the knowledge, attitudes and practices on pesticide exposure and safety among smallholder farmers of Mitete Parish, Sembabule district. Appropriate interventions that promote safe and sustainable use of pesticides among smallholder farmers in the area have been developed from the insights gathered from the research.

CHAPTER TWO: LITERATURE REVIEW

2.0 Overview

By the year 2050, 9 million is projected to be the global population, and therefore matters of food availability and people's access to the food are of concern(Ali *et al.*, 2020). Therefore, this has driven farmers to use pesticides as a way of improving agricultural output and also protect their crops against damage(Mahmood *et al.*, 2016) so as to feed the growing global population. This is in a way similar to what was stressed in a particular study, that smallholder farmers carryout intensive pesticide and fertilizer usage so as to increase food production(Mergia *et al.*, 2021).

Every year in the rural areas of developing countries, it has been reported by WHO that more than 200,000 people die due to pesticide poisoning(Damalas and Koutroubas, 2016). The resulting negative health effects have been linked to long-term pesticide exposure(Afata *et al.*, 2022). In African countries, farmers have widely experienced acute symptoms which include dermatitis, respiratory problems, headache, vomiting, leukemia, brain tumors, nausea, burns and mental disorders(Sweatt,S.K, Gower, B.A, Chieh, A.Y, Liu, Y, Li, 2016). Among the chronic symptoms resulting from pesticide exposure among the users, these came out strongly: neurological, motor, cognitive and sensory deficiencies(Muñoz-Quezada *et al.*, 2016).

Evidently, farmers who did not use PPE were likely to get exposed to pesticides accidentally during the course of mixing, spraying, indirectly getting into contact with vegetation as they spray, directly as they clean up equipment used for spraying and contact with volatilized deposits of pesticides through vapor drift(Damalas, Koutroubas and Abdollahzadeh, 2019). Additionally, smallholder farmers are exposed to pesticides occupationally as they get closer to agricultural fields in activities such as weeding after spraying has been done and indirectly by eating food contaminated with pesticides(Ali *et al.*, 2018) especially if they consume food while spraying or even failure to wash their hands after spraying and instead get into contact with food.

Nevertheless, the route, type and period of exposure suggested the possible pesticide exposure(Francisco *et al.*, 2023) for example, during preparation of solutions and spraying, smallholder farmers and farmworkers are commonly exposed to pesticide chemicals through skin contact, inhalation and ingestion as they do their agricultural activities(Mormeta, 2017). Therefore, smallholder farmers and farmworkers are the primary risk group exposed to pesticides(Afata, Mekonen and Tucho, 2021).Generally, many studies done in Africa have shown poor knowledge

of farmers concerning pesticides and improper pesticide handling(Ndayambaje *et al.*, 2019). Consequently, this poses a risk to the environment and human health in general due to limited awareness of the appropriate pesticide management practices(Mergia *et al.*, 2021) and lack of training by agricultural extension workers to the farmers in their areas of jurisdiction.

Finally, there is an association between occupational and non-occupational pesticide exposure and the overwhelmingly increased health risks among smallholder farmers mainly linked to agricultural activities. To the best of my knowledge, gaps still exist in the available data on the knowledge, attitudes and practices on pesticide exposure and safety and associated risks among smallholder farmers in Sembabule district. Therefore, this study investigated the knowledge, attitudes and practices on pesticide exposure and safety among smallholder farmers of Mitete Parish, Sembabule district.

2.1 Knowledge on pesticide exposure and safety

In a study conducted among small-scale farmers in Western Ethiopia, it was portrayed that only (42.2%) of them knew about safe pesticide use out of (87.2%) who used pesticides in agriculture, especially for weed control (52.6%). This same study depicted that majority of the participants (93.6%) were not aware of the recommended distance for mixing and loading of pesticides from residential areas to water streams. It was approximated that (76.3%) of the participants had the belief that pesticides were useful; nonetheless they generally did not know the negative impact of pesticides on the environment and humans. Most of the farmers had not received training (83.9%) on pesticide handling and use. Considering farmers who had used pesticides for more than 10 years (49%), still, (96.8%) of them did not understand the instruction and label provided on the pesticide container. Additionally, close to (85%) of these farmers used pesticides purchased illegally from private agro-input dealers at a low cost and worst case scenario, they used them in concentrations more than what is recommended(Afata *et al.*, 2022). This predisposed them to harmful effects due to unsafe pesticide use.

It was stated in a study done in Paya sub-county, Tororo district in Eastern Uganda that even though a coding system indicating the toxicity level of the pesticides is provided on containers, buyers are not aware of these color codes. More than half (68%) of the participants stated unfamiliarity with the coding system and only (12%) understood and could accurately mention the codes for the most toxic pesticide formulas. It is also important to note that safety and efficacy

testing of these pesticides were conducted so as to generate toxicity and use information while considering circumstances that were not similar to those experienced by African farmers(Andersson and Isgren, 2021).

In a study conducted in two districts of Uganda that is Wakiso, an urban district nearby Kampala that produced mainly vegetables and Pallisa, a rural area covering a distance of 170km from Kampala, where cotton was the main produce, in its aim to assess the effects of IPM training in small-scale farmers, it was reported that farmers who had not received training had less knowledge regarding the pesticide effects for example when the recommended side of the environment was not observed such as wind, failure to use synthetic pesticide alternatives and not understanding the color codes on pesticide containers and products indicating their toxicity levels(Clausen *et al.*, 2017b).

In a study done among Hmong farmers, to start with, (75%) of the farmers were not familiar with the term IPM, (60%) were unfamiliar with other pest control alternative measures and (61%) did not know that bugs were beneficial. In fact, only (42%) had practiced another pest management technique alternatively to pesticides namely organic methods (18%), physical/ mechanical methods (14%) and crop rotation (4%). Use of IPM practices was limited by (46%) of the people who required more information whereas (38%) thought that using conventional pesticides was more economical than IPM (38%). It was also noted that (96%) of the farmers expressed their interest for additional training and therefore recommended that pesticide training should be availed in Hmong(Thao *et al.*, 2019). Therefore, training advances knowledge on pesticide safety measures and in the long run reduces exposure and its negative impacts.

Considering a study carried out in Uganda, the focus group discussions carried out portrayed that instructions and any other information provided on pesticide products and containers were not accessible to customers specifically farmers since they were not translated into local languages such as Luganda but instead typically written in only Kiswahili, English or even Chinese and using technical terms. On that note therefore, it was stated that (82%) of female-headed households and (57%) of male-headed households that responded were unable to read and comprehend information on the labels. Furthermore, there is inadequate information regarding proper handling of pesticides received by farmers from pesticide sellers. In terms of farmers who in most cases purchase pesticides from agro-input dealers that were licensed, (84%) indicated that to some

extent, they were provided with such information unlike (28%) who accessed pesticides from non-formal sources. However, the informal traders' quality of information disseminated to these farmers should be considered as increasingly questionable since they have limited pest management training and knowledge about the specific pesticides they deliver to farmers(Andersson and Isgren, 2021). Similarly, it was suggested that information on the use of PPE needed to be provided on the label of the pesticide container and also through agro-input dealers(Mueller *et al.*, 2022). Unfortunately, consistent dissemination of this information may not be a guarantee.

2.2 Attitudes on pesticide exposure and safety

It was shown in a study done in Uganda that most of the participants (78%) did not have the recommended pesticide application equipment and used either what was commonly referred to as the local method that involved using a basin made of plastic and a grass-like broom for a manual pesticide applicator or they would keep on borrowing knapsack sprayers from friends and neighbors. The local method posed a high risk of exposure to pesticides and this was highly perceived as dangerous by the males. This was because few male-headed households (18%) and majority of the female-headed households (83%) concurrently used the high-risk local method. Likewise, farmworkers that were hired to spray from about (23%) of households surveyed were also at risk of pesticide exposure as they frequently contributed to the poorest section in the community(Andersson and Isgren, 2021). These people usually mind of money and tend to have low risk of pesticide exposure and its associated effects.

A study done by (Thao *et al.*, 2019) in California showed that few farmers (39%) perceived a significant and large amount of risk, (39%) had a feeling of exposure to toxic and dangerous risks and 18% linked moderate risk to potential exposure to pesticide chemicals. During a Focus Group Discussion conducted in Uganda, the risk of exposure to pesticides was perceived to be gender based. One group declared that women were more at risk of pesticide chemical exposure since they spent much of their time in the gardens performing agricultural activities such as thinning, weeding and harvesting of crops. Looking at other pesticide handling aspects, women wash pesticide equipment and clothes which predisposes them to these pesticides However, the other group stated it was the men who were more susceptible to pesticide exposure since they were the ones mainly in spraying activities(Andersson and Isgren, 2021).

2.3 Practices related to pesticide exposure and safety

During a Focus Group Discussion in a study conducted in Uganda, it was reported that most of the farmers dressed up in their ordinary clothes and footwear (in case one had any) during pesticide application. One of the farmers confirmed that "we just go the way you see us, although we endeavor to wear long sleeved shirts. I do not have any rubber boots though I can go barefoot the way I am. The only consideration I make is determining the wind direction so that spills do not occur on me." Few farmers used the appropriate PPE for example gloves (4%), overall (8%) and gumboots (14%). Even though these PPE are expensive and inaccessible to the poor smallholder farmers, group discussions and interviews conducted showed that the absence of these PPE in the neighboring shops was a barrier to the farmers. One farmer said that these PPE are hardly seen in the local shops and markets therefore difficult to access them by people in their community(Andersson and Isgren, 2021). Poor sprayer hygiene practices were recorded , only (22%) bathe, (57.4%) wash only hands and (6.8%) change clothes before or after spraying(Afata *et al.,* 2022).

A study done in Ethiopia indicated that about (64.7%) of the participants did not consider the direction of wind while spraying pesticides. Likewise, most of the farmers (93.8%) mentioned that they never showered after spraying pesticides. According to the Key Informants (KIs), containers that were used for mixing pesticides were used by farmers for other activities for example storing drinking water and holding fruits and vegetables. Wide usage of pesticides was reported by the vegetable farmers with (45.7%) mixing and spraying pesticides 12 to 15 times per season, (12.4%) of the farmers reported spraying more than 15 times per season and (11.9%) of the farmers sprayed 3 to 5 times per season. Nearly (12.4%) sprayed fungicides up to 12 times and insecticides up to 16 times per harvesting season(Mergia *et al.,* 2021). These are potential exposure pathways for pesticides to humans and the environment and their related effects.

Poor pesticide products' disposal practices were known to increase exposure, common empty pesticide container practices identified from the participants include; throwing them in latrines(67%), throwing them in the garden(13%), burying in the ground(6%), recycling them(11%) and burning them(3%)(Andersson and Isgren, 2021). This is similar to a study that was conducted among small-scale farmers of Ethiopia whereby (40.6%) of them stored pesticides in

unsafe places and (67%) indiscriminately exposed leftover pesticides in open fields(Afata *et al.*, 2022) which potentially exposed them to these chemicals.

CHAPTER THREE: PROBLEM STATEMENT, JUSTIFICATION, RESEARCH QUESTIONS AND CONCEPTUAL FRAMEWORK

3.1 Problem statement

Pesticide exposure is associated with acute and chronic effects and this makes it of public health concern in Uganda. In a study by Fuhrimann among Ugandan smallholder farmers, overall pesticide exposure was associated with complex attention, perpetual-motor function and impaired visual memory(Fuhrimann *et al.*, 2021). Glyphosate is the most widely used herbicide in the world(Benbrook, 2016). Animal studies have shown the neurotoxic effects of glyphosate and glyphosate-based herbicides, including depressive behavior and decreased locomotor activity(Ait Bali, Ba-Mhamed and Bennis, 2017). The adverse effects of glyphosate exposure on visual memory are of concern, (i.e. 77% applicators reported applying glyphosate(Fuhrimann *et al.*, 2021).

According to a study carried out in Eastern Uganda, exposures to profenofos, endosulfan, permethrin and dimethoate were associated with an increased risk of cough/throat irritation, dizziness, skin irritation, nausea and breathing difficulties(Andersson and Isgren, 2021). This is similar to other studies, where symptoms of pesticide intoxication included headaches (56.1%), dizziness (56.5%), skin irritation (53.3%) and fatigue (45.6%)(Moda *et al.*, 2022). On the other hand, various neurological health effects which include acute and chronic neurological symptoms for example sleep problems or headache have been associated with exposure to pesticides(Fuhrimann *et al.*, 2022).

A rapid assessment following training in Sembabule district by Uganda National Association of Community and Occupational Health (UNACOH) revealed the use of Highly Hazardous Pesticides (HPPs), containing common active ingredient, phosphate in order to ensure perennial weeds control(Sustainable and Goals, 2021). In addition, passion fruits, cabbage, tomatoes, watermelon, coffee and tomatoes were the most sprayed crops using the ingredients of HHPs which include; Carbendazim, Mancozeb, Chlorpyrifos, Abamectin, Prefenofos, Cypermethrin, Thiamexothan and Carbofuran. According to the Agricultural Chemicals Control Act, 2007, one of the functions of the Agricultural Chemicals Board is to: “advise the minister on policies on the efficient, prudent and safe use, storage and disposal of agricultural chemicals by conducting public

awareness campaigns to this effect when necessary"(Supplement, 2007). However, there are still gaps in implementation of these policies especially in Sembabule district.

Mitete Parish in Sembabule district is part of those areas with increased agricultural production. Unfortunately, there is limited data on the levels of knowledge, attitudes and practices regarding pesticide exposure and safety among smallholder farmers. Therefore, this study assessed the knowledge, attitudes and practices on pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district. The study aimed at providing evidence-based information to agro input dealers, policy makers and other relevant stakeholders to design sustainable and effective interventions that will ensure safe pesticide precautionary measures among smallholder farmers and thus curb pesticide exposure.

3.2 Justification of the study

The knowledge, attitudes and practices of smallholder farmers in Mitete parish, Sembabule district related to pesticide exposure and safety were critical for understanding the extent of the problem and identifying potential solutions since very few studies have been done. Without this understanding, it would have been challenging to develop effective interventions around safe pesticide application and storage practices. Therefore, this will aid in reducing the health burden experienced in the area as a result of pesticide exposure, and thus move the district at large in regards to meeting its commitment to sustainable development goals.

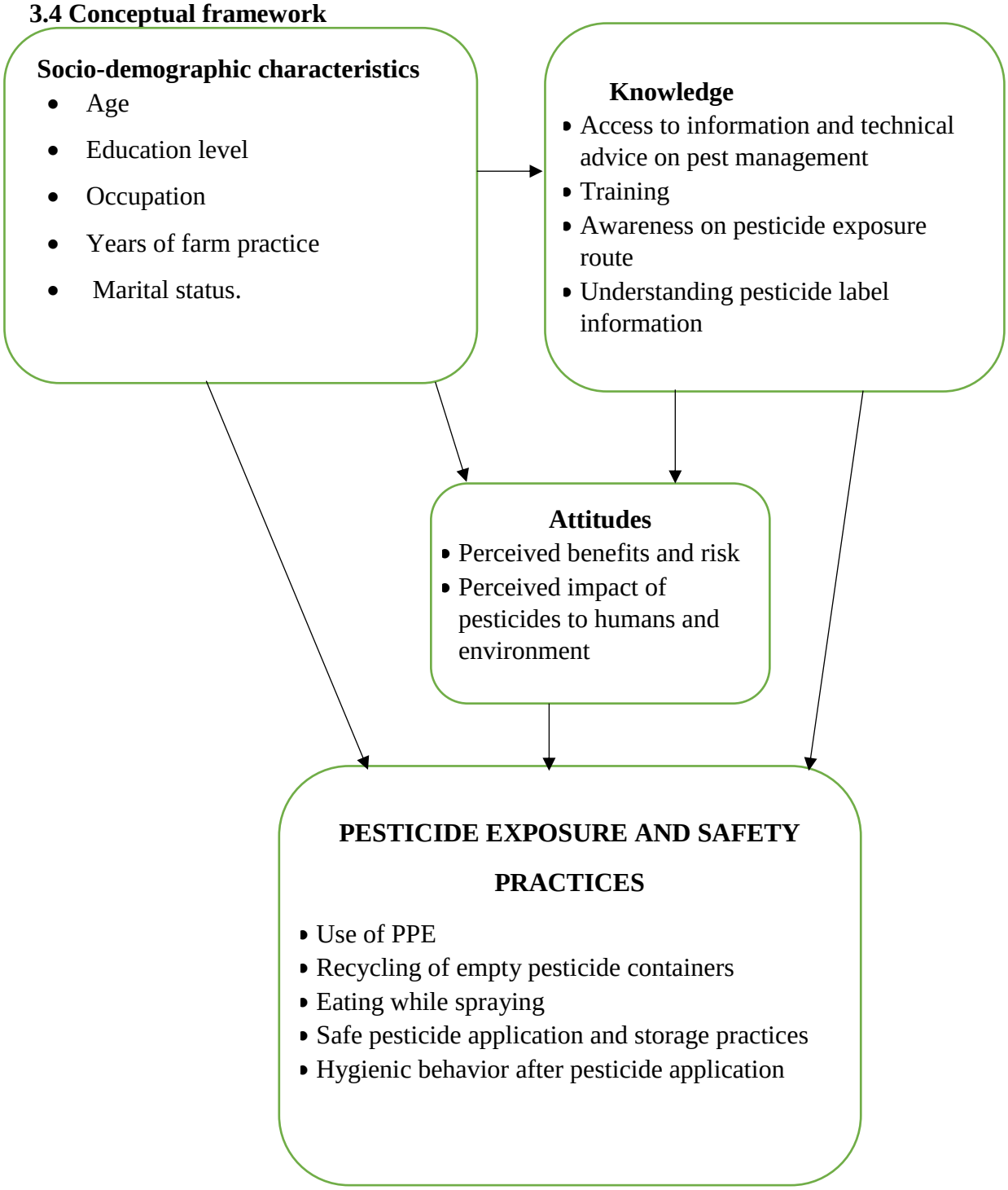
Policies to protect farmers and the environment from the harmful effects of pesticides may be developed by local, national and international organizations. This research will enhance knowledge-based initiatives around the adoption of non-synthetic pest-control methods and also strengthen capacity building programs. On the other hand, this study will contribute to existing literature on pesticide exposure and safety in rural communities of Uganda. Following what has been addressed above, this research sought to understand the knowledge, attitudes and practices on pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district.

3.3 Research questions

1. What is the knowledge on pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district?
2. What are the attitudes towards pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district?

3. What are the practices on pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district?

3.4 Conceptual framework



Narrative:

The above conceptual framework describes the interrelationship between variables that contribute to smallholder farmers' behaviors concerning pesticide exposure and safety. Farmers' socio-demographic characteristics can affect their knowledge which influences their attitudes which in turn can affect their pesticide exposure and safety practices.

Therefore, the dependent variable is pesticide exposure and safety practices: use of Personal Protective Equipment (PPE)**,** recycling of empty pesticide containers**,** eating while spraying**,** mixing pesticides with bare hands**,** safe pesticide application and storage practice, hygienic behavior after pesticide application.

The independent variables include knowledge: determined by information and technical advice on pest management**,** training**,** awareness on pesticide exposure route and understanding pesticide label information.

Additionally, independent variables also include attitudes: perceived benefits and risk and perceived impact of pesticides to humans and environment. Likewise, under independent variables are socio-demographic characteristics including age, education, occupation, years of farm practice and marital status.

Overall, interventions aimed at enhancing smallholder farmers' knowledge and promoting positive attitudes towards safe pesticide practices are important to ensure sustainable use of pesticides in agriculture.

CHAPTER FOUR: OBJECTIVES OF THE STUDY

4.1 Broad Objective

To assess the knowledge, attitudes and practices on pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district so as to get information that can be used to control this public health challenge.

4.2 Specific objectives

1. To assess the knowledge on pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district.
2. To explore attitudes towards pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district.
3. To describe practices on pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district.

CHAPTER FIVE: METHODOLOGY

5.1 Study area

This study was conducted in Mitete Parish found in Mateete Sub-county, Sembabule district located in Central Uganda. Sembabule district is bordered by Mubende district to the North, Bukomansimbi district to the east, Gomba district to the northeast, Lyantonde district to the southeast, Lwengo district to the south and Kiruhura district to the northwest. Mitete Parish is predominantly a rural agricultural area subdivided into 17 villages that is Kalumu, Kanyogoga B, Kyabakagga B, Mitete B, Nakaseeta, Kalububbu, Kanyogoga C, Lukaka A, Mitete C, Kalukungu, Kijju, Lukaka B, Nabiyagi A, Kanyogoga A, Kyabakagga A, Mitete A, Nabiyagi B. In 2012, the national census estimated the population of Sembabule district to be 129,000. Agriculture is the mainstay of Sembabule district's economy. The main crops grown for food and sale in the area include matooke, cassava, maize, tomatoes, pineapples, sweet potatoes, ground nuts, passion fruits, cabbage, millet etc. Majority of these crops are grown conventionally that is to say while using pesticides which puts farmers at risk of exposure.

5.2 Study population

The study was conducted among smallholder farmers of Mitete Parish, Sembabule district. Smallholder farmers are farmers capable of producing crops on a small piece of land without necessarily using expensive and advanced technologies.

5.3 Study design

A mixed methods study was adopted consisting of a cross sectional descriptive study design and a qualitative study design.

5.4 Sample unit and participants

Quantitative data from the cross-sectional study was collected at household level with smallholder farmers being the participants. Qualitative data was collected from Key Informants including agrochemical retailers, agricultural extension worker, heads of farmers' groups and Local Council 1 Chairpersons.

5.5 Sampling procedure

Of the 17 villages in Mitete Parish, 10 villages were randomly selected using Microsoft Excel codes that is Kalububbu, Kalukungu, Kalumu, Kanyogoga B, Kanyogoga C, Kijju, Kyabakagga A, Kyabakagga B, Mitete B and Nakaseeta since they were corresponding to the first codes between 1 and 17 so as to represent the entire parish. In these 10 villages, systematic sampling was used to select the households. The lists of all smallholder farmers in each village were generated with the help of the respective LC 1s. The first individual to participate in the study was randomly selected using computer-generated codes in Microsoft Excel. The rest of the participants were selected using systematic sampling where the number of households were divided by the sample size to get the predetermined sampling interval until the required sample size was obtained.

5.6 Inclusion criteria

Smallholder farmers in Mitete parish aged 18 years and above.

5.7 Exclusion criteria

A smallholder farmer who was with a household member already enrolled in this study. Smallholder farmers who were ill and or who were not at home at the time of the study were excluded.

5.8 Sample size

The sample size was determined using Kish Leslie formula with desired 95% Confidence Interval (Kish 1965) as elaborated below;

$$n=\frac{Z^2 p(1-p)}{\sigma^2}$$

$$n=\frac{1.96^2 * 0.22(1-0.22)}{0.05^2}$$

n=263.6874

n=264 participants

Considering 5% non-response;

100%+5%=105%

$\frac{105}{100}$ *264

277.2

n=278 participants

Where;

n= sample size

p= prevalence of high level knowledge of smallholder farmers on pesticide use in a study conducted in the two districts of Uganda i.e. Wakiso and Pallisa was 22% (Oesterlund *et al.*, 2014).

σ= desired precision for the study (5% or 0.05 was be used) as standard error.

Z= critical value for standard normal deviation corresponding to 95% Confidence Interval on the normal distribution curve, that is 1.96

5.9 Data collection tools

This study employed a structured questionnaire for quantitative data collection. This questionnaire was administered by the researcher and it had four main sections namely; socio-demographic characteristics, knowledge, attitudes and practices on pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district.

Qualitative data was collected using a key informant interview guide. This guide included open ended questions so as to capture different opinions on the knowledge, attitudes and practices on pesticide exposure and safety.

5.10 Data collection procedures

A structured questionnaire using Kobo mobile data collection tool was used to collect quantitative data on knowledge, attitudes and practices towards pesticide exposure and safety.

Key Informant Interviews were used to collect qualitative data and these included 3 agrochemical retailers, 1 agricultural extension worker, 4 heads of farmers' groups and 2 Local Council 1 Chairpersons. Therefore, ten (10) Key Informant Interviews were conducted. The researcher interviewed the KIs at their places of residence or work. Qualitative interviews were conducted until saturation, that is, until when no new information was being obtained from the interviews.

5.11 Quality control

In order to obtain good quality data, the structured questionnaire was pre-tested among smallholder farmers of Kayunga parish, Mateete sub-county, Sembabule district. This aimed at checking ease or complexity of the drafted questions so that any issues could be addressed before using it on the targeted participants. The questionnaire was translated into Luganda since it was the commonly used language in the area. The questionnaires that were completed were cross-checked every single day of data collection to ensure that errors were rectified before leaving the field.

5.12 Variables

For this study, the dependent variable was pesticide exposure and safety practices. Under practices, the study considered the use of Personal Protective Equipment (PPE), recycling of empty pesticide containers, eating while spraying, safe pesticide application and storage practices, hygienic behavior after pesticide application.

The independent variables included knowledge, attitudes and socio-demographic characteristics.

Knowledge involved: information and technical advice on pest management**,** training, awareness of pesticide exposure routes and understanding pesticide label information provided on pesticide products. Concerning attitudes, the study focused on perceived benefits and risks and perceived impact of pesticides to humans and the environment.

Data was also collected on socio-demographic characteristics including age, education, occupation, years of farm practice and marital status.

5.13 Data management and analysis

Quantitative data collected was downloaded into Microsoft excel for cleaning, to lookout for errors and completeness, and made corrections where necessary. The cleaned data was later exported to STATA, Stata 14 (64-bit) Software for univariable analysis. Univariable analysis was conducted, means and their standard deviations were calculated for continuous variables. In addition, percentages and frequencies were calculated for categorical variables. This data was then presented in graphs, pie-charts and frequency tables.

Qualitative data was recorded, transcribed and analyzed thematically. This involved identifying similarities and differences between the categories of data collected and drafting reliable conclusions.

5.14 Ethical considerations

The researcher got permission from Makerere University School of Public Health so as to carry out the study. Additionally, the researcher also sought for permission from the LC 1 Chairpersons of the selected villages so as to conduct the study. Besides, informed verbal and written consent was got from the participants and their information was kept confidentially and only used for the intended purpose of conducting this study.

5.15 Dissemination of Findings

This dissertation will be submitted to Makerere University School of Public Health in partial fulfilment of the award of a Bachelor's degree in Environmental Health Sciences. Likewise, study results will be given to Sembabule district especially agricultural extension workers, policy makers and other relevant stakeholders so that the necessary interventions are put in place. Findings from this study will also be published in open access peer reviewed journals for reference in future research.

CHAPTER SIX: RESULTS OF THE STUDY

6.1 Socio-demographic characteristics of participants

A total of 278 participants from ten villages participated in the study including 58.3% (162/278) males with a mean age of 26.4 years (SD 11.9 years). Among the participants, 74.8% (208/278) were married/cohabiting and 50.0% (139/278) had attained primary education. The majority of participants were farmers 87.8% (244/278) and 89.6% (249/278) practiced subsistence farming. Almost all the participants 91.4% (254/278) had a farming experience of more than 10 years (Table 1).

Table 1. Socio-demographic characteristics of participants

Variable	**Frequency(n=278)**	**Percentage (%)**
Mean age	26.4 years (SD 11.9 years)	
Sex		
Male	162	58.3
Female	116	41.7
Marital status		
Married/Cohabiting	208	74.8
Divorced/Separated	10	3.6
Widowed	26	9.4
Single	34	12.2
Highest level of education		
None	92	33.0
Primary	139	50.0
Secondary	36	13.0
Tertiary	11	4.0
Occupation		
Salary employee	4	1.4
Self employed	6	2.2
Farmer	244	87.8
Casual labor	20	7.2
Unemployed	2	0.7

Housewife	2	0.7
Farming type practiced		
Subsistence	249	89.6
Commercial	29	10.4
Farming experience		
1-3 years	7	2.5
5-10 years	17	6.1
>10 years	254	91.4

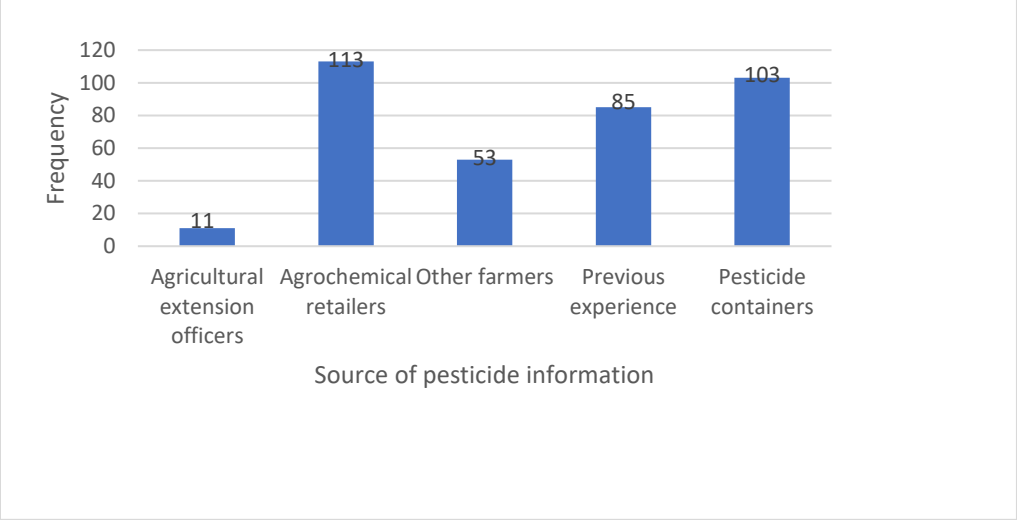
6.2 Knowledge on pesticide exposure and safety of participants.

This section generally presents the study findings about the knowledge on pesticide exposure and safety of participants. The subsections under it specifically present results about source of pesticide information, awareness of pesticide exposure and safety and awareness of toxicity codes present on the pesticide containers among the participants.

6.2.1 Source of pesticide information

The bar graph below shows that agrochemical retailers (113/278) and agricultural extension officers (11/278) were the most and least sources of pesticide information respectively (Figure 1).

Figure 1. A bar graph showing the frequency of the source of pesticide information of participants.



From the key informant interviews conducted, one agrochemical retailer reported that farmers consult from them mainly on pesticide dosage and not safety precautions while using the pesticides.

> *"When farmers consult from us on how on the pesticide dosage, we inform them. However, some farmers insist and say that these recommendations are for us, since we never stay in the gardens and end up following their own guidelines. Nonetheless, some farmers are lucky, their guidelines work out for them and others end up messing up and instead blame us who sold the pesticides to them."* **Agrochemical retailer**

Figure 2. Pesticide containers as a source of pesticide information

Heads of farmers' groups said that pesticide containers have the information on how to use pesticides.

> *"Pesticide containers bought by farmers have the necessary information on how to safely use pesticides. However, some farmers only mind of the pesticide dosage and do not mind of the safety precautions to consider while using the pesticides. Other pesticide containers only have information written in English and yet majority of the farmers do not understand it. Therefore, they cannot make the best use of this information."* **Head of farmers' groups**

6.2.2. Awareness of pesticide exposure and safety

The majority of participants, 93.5% (260/278) had ever used pesticides and among these, 51.5% (134/260) did not know how to safely use pesticides. Among the participants, 86.7% (241/278) had never had any training on how to use pesticides. More than half of the participants were aware of the pesticide exposure routes 51.4% (143/278) and mainly from skin/dermal contact 70.6% (101/143). The majority of participants 59.7% (166/278) were not aware of biological or other forms of integrated pest management and 60.1% (167/278) could not understand information written on pesticide packages. Lastly, 53.2% (148/278) did not know that skin irritation, salivation, nausea, blurred vision and vomiting were potential pesticide exposure symptoms. (Table 2)

Variable	Frequency	Percentage (%)
Ever used pesticides	**n=278**	
Yes	260	93.5
No	18	6.5
Knowledge regarding safe use of pesticides	**n=260**	
Yes	126	48.5
No	134	51.5
Known possible pesticide exposure routes *	**No. of participants out of 143**	
Inhalation	95	66.4
Skin/Dermal contact	101	70.6
Oral	76	53.2
Eye contact	47	32.9
Awareness of biological or other forms of integrated pest management	**n=278**	
Yes	112	40.3
No	166	59.7
Ability to understand the information written on the pesticide packages	**n=278**	
Yes	111	39.9
No	167	60.1
Knowledge of potential pesticide exposure symptoms; skin irritation, salivation, nausea, blurred vision and vomiting	**n=278**	
Yes	107	38.5
No	148	53.2
I don't know	23	8.3

***Multiple choice responses*

Table 2. Awareness of pesticide exposure and safety

According to the heads of farmers' groups in all the villages who were part of the key informants, they stressed that farmers hardly receive training on pesticide exposure and safety by the agricultural extension workers.

> *"We hardly see any agricultural extension workers coming to visit our farms or even organize trainings on pesticide exposure and safety and its impacts. It is only a few farmers who take a personal initiative to listen to farmers' programs on radios like CBS that receive some information on how to safely use pesticides."* **Head of farmers' groups**

Some people reported that using broken knap sackers for spraying pesticides increases exposure to pesticides through skin/dermal contact.

> *"Farmers at times do not repair their knap sackers and even when they are broken and leaking, they continue using them increasing pesticide exposure through skin contact."* **Head of farmers' groups**

Similarly, the qualitative findings as shown by the key informants emphasized that inhalation, skin contact, eye contact are possible pesticide exposure routes.

> *"Through inhalation, pesticides can affect the lungs and also via skin contact causing skin irritation. The eyes are also affected when a farmer is mixing or even spraying pesticides. If you are not well protected, the skin and eyes can be affected for example I was almost killed by pesticides since I did not have gumboots."* **Agrochemical retailer**

According to the agricultural extension worker, the other alternative to pesticides that can be deployed by farmers is using the integrated pest management approach whereby pesticides are used as the last option after the other physical methods, management have failed.

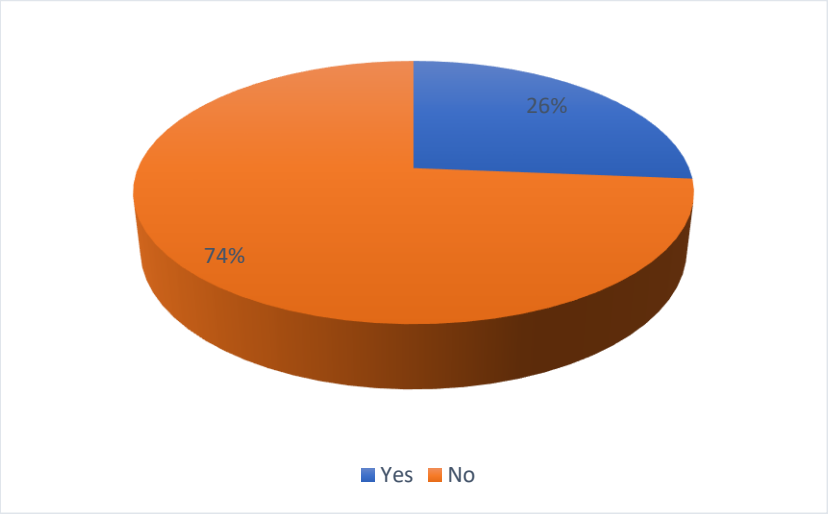
> *"I usually tell farmers, only use pesticides especially for these common pests after physical or management practices have failed. The challenge is that farmers are going in for pesticides first."* **Agricultural extension worker**

Furthermore, other key informants reported using ash for banana(matooke) pests or even red pepper mixed with human urine and ash to kill pests can be alternatives to pesticides that can be deployed by farmers.

6.2.3 Awareness of toxicity color codes present on the pesticide containers among the participants.

The pie chart shows that the majority 73.7% (205/278) of participants were not aware of the toxicity color codes present on the pesticide containers (Figure 3).

Figure 3. A pie chart showing awareness of toxicity color codes present on the pesticide containers among the participants.



6.3 Attitudes on pesticide exposure and safety of participants.

Most of the participants 59.0% (164/278) agreed that protective equipment should be worn by farmers while spraying pesticides. More than half of the participants 54.7% (152/278) did not care about the negative impacts of pesticide exposure. Most of the participants 47.5% (132/278) reported that pesticides cannot affect the environment. Almost all the participants 91.4% (254/278) thought that it was important to observe the weather conditions before spraying and the least conducive weather condition for spraying reported was rainy 85.0% (216/254). The majority of participants 55.0% (153/278) thought it was appropriate to enter recently sprayed fields (Table 3).

Table 3. Attitudes on pesticide exposure and safety

Variable	Frequency	Percentage (%)
Wearing of protective equipment while spraying	**n=278**	
Yes	164	59.0
No	114	41.0
Concern about the negative impacts of pesticide exposure	**n=278**	
Yes	152	54.7
No	126	45.3
Ability of pesticides to affect the environment	**n=278**	
Yes	124	44.6
No	132	47.5
I don't know	22	7.9
Importance of observing weather conditions before spraying	**n=278**	
Yes	254	91.4
No	16	5.7
I don't know	8	2.9
Least conducive weather for spraying	**n=254**	
Windy	13	5.1
Rainy	216	85.0
Sunny	21	8.3
Not sure	4	1.6
Appropriateness of entering recently sprayed fields	**n=278**	
Yes	153	55.0
No	125	45.0

The key informants reported that there are possible negative effects of pesticides on people and the environment.

> *"Pesticides affect the health of* people *if they don't protect themselves but also Cancers and Diabetes are on a rise due to increased pesticide use. Farmers who spray these pesticides on tomatoes and immediately sell without allowing the pesticides to decompose, yet majority of the final consumers do not properly wash them accelerate pesticide residues*

in these crops. Pesticides also affect the soil PH if not properly used." **Agricultural extension worker**

Pesticides affect the soil micro-organisms such as earthworms and snakes, which we no longer see since farmers continuously use pesticides. The nearby water sources sprayed with pesticides are also affected leading to water pollution. Pesticides can also negatively impact other crops in the same garden for example coffee pesticides can kill bananas or even distort their maturity if sprayed and yet they are grown in the same plantation. Besides, cassava rots in a farm that has been sprayed with pesticides." **Agrochemical retailer**

The heads of farmers' groups said that people who spray pesticides are more at risk of exposure.

"These pesticides are too strong in that if one sprays without eating enough food before, they can collapse in the garden. Furthermore, these pesticides smell so much/evaporate to the extent that people from nearby areas can inhale these pesticides especially herbicides e.g. 2,4 D Amine. Therefore, people who spray and those who enter recently sprayed fields or even pass by them are at risk of pesticide exposure and its negative effects." **Head of farmers' groups**

The agricultural extension worker noted that as a way to prevent pesticide exposure and its effects among farmers, I tell them to observe the weather conditions before spraying.

"I advise farmers to avoid spraying during the least appropriate time such as when its windy. I tell them to be observant of where the wind is blowing so that they don't spray against it to prevent pesticides from repulsing back to them. However, most farmers mind of the rainy weather as the least conducive condition only, to avoid wastage of pesticides especially if it rains and yet they have just sprayed the pesticides." **Agricultural extension worker**

One of the heads of farmers' groups reported that following the recommended time to enter a recently sprayed field is difficult.

"I listen to the radio and they advise farmers to enter a recently sprayed field at least after four days. This is hard for us to abide by since at times, we find that, we have to collect

food, firewood from these recently sprayed fields which increases exposure through inhalation and skin contact, which we ignore at that moment." **Head of farmers' groups**

6.4 Practices on pesticide exposure and safety of participants.

This section generally presents the study findings about the practices on pesticide exposure and safety of participants. The subsections under it specifically present results about pesticide exposure and safety practices, PPE used while spraying, reasons for not using PPE and responsible pesticide use and handling.

6.4.1 Pesticide exposure and safety practices

The majority of participants 79.1% (220/278) never ate/drunk while mixing or spraying. Furthermore, 30.6% (85/278) participants often apply pesticides 3-5 times per season. Most participants 78.4% (218/278) reported farmland as the appropriate location for mixing pesticides, 85.6% (238/278) wash only hands after spraying pesticides. In addition, most of the participants 60.4% (168/278) stored pesticides in the house (where children do not reach), while 61.5% (171/278) burnt or buried empty pesticide containers (Table 4).

Table 4. Pesticide exposure and safety practices

Variable	**Frequency**	**Percentage (%)**
Eating/drinking while mixing or spraying	**n=278**	
Always	15	5.4
Sometimes	43	15.5
Never	220	79.1
Frequency of applying pesticides	**n=278**	
3-5 times per season	85	30.6
7-10 times per season	67	24.1
12-15 times per season	39	14.0
More than 15 times per season	25	9.0
Others	62	22.3

Appropriate locations/devices for mixing pesticides*	**No. of participants out of 278**	
Home	28	10.1
Farmland	218	78.4
Near water source/well	2	0.7
Blue containers/drums	92	33.1
Knap sackers	68	24.5
Others	15	5.4
Practices after spraying pesticides*	**No. of participants out of 278**	
Wash only hands	238	85.6
Bathe	103	37.1
Change clothes	102	36.7
Others	30	10.8
Storage of pesticides	**No. of participants out of 278**	
Open field	3	1.1
Store for pesticides	19	6.8
Toilet	1	0.4
Roof	9	3.2
Kitchen	2	0.7
Animal shelter	1	0.4
Under the bed	8	2.9
Store for farm equipment	71	25.5
House (where children do not reach)	168	60.4
Others	19	6.9
I don't store pesticides	21	7.8
Disposal of empty pesticide containers*	**No. of participants out of 278**	
Throw on the farmland	154	55.4
Recycle at home	12	4.3
Throw in streams	4	1.4
Sell to others(scrap)	8	2.9

Burnt or buried	171	61.5
Return to disposing agent	5	1.8
Others	48	17.3
*Multiple choice questions		

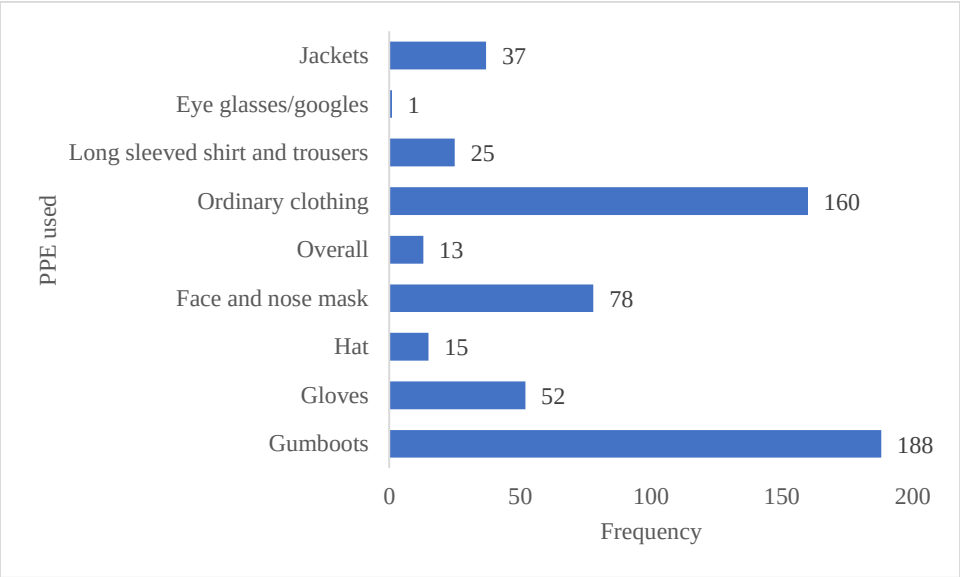
Heads of farmers' groups reported the good and bad practices done by farmers after spraying pesticides.

> *"Some farmers drink milk after spraying pesticides as they were told that it reduces on the toxicity of chemicals that they were exposed to through inhalation and skin contact. Most farmworkers when hired to spray pesticides do not mind washing their hands with soap after spraying, but instead just grab what to eat and continue with their businesses. Others hired to harvest tomatoes, just eat them with even the pesticides on top while in the farms without first washing them. Some farmers only change clothes after spraying if the knap sacker they were using was leaking due to smelling of the clothes."* **Head of farmers' groups**

6.4.2 PPE used while spraying

The bar graph below shows that gumboots (188/278) was the most PPE used while spraying and eye glasses (1/278) was the least used PPE while spraying among the participants (Figure 4).

Figure 4. A bar graph showing the frequencies of PPE used by participants while spraying.



The key informants reported that PPE such as gumboots, gloves, masks, overalls and googles should be used by farmers to protect themselves against pesticide exposure.

One of the agrochemical retailers said that they also endeavor to protect themselves as they sell pesticides.

> *"We usually have air conditioners to take away the pesticide odors. We always use PPE to protect ourselves as we sell pesticides. We also have water taps nearby for always washing our hands after getting into contact with pesticides."* **Agrochemical retailer**

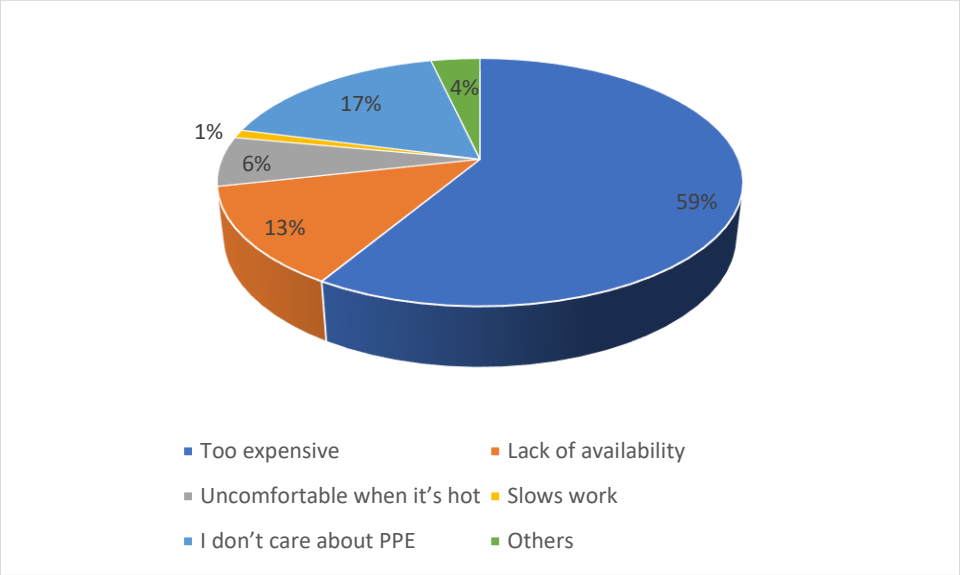
This same agrochemical retailer emphasized on how farmers should dispose of empty pesticide containers.

> *"Farmers can throw the empty pesticide containers in the toilets or burn them. It would not be proper for farmers to reuse them since it is difficult to have those remaining pesticides get done. However, some farmers reuse them especially jerrycans. I would not recommend farmers to return these empty pesticide containers here at my shop since I don't have the capacity to manufacture pesticides and therefore don't need the empty pesticide containers. In case they get those empty pesticide containers with me here, they can even arrest me."* **Agrochemical retailer**

6.4.3 Reasons for not using PPE

The pie chart below shows that most of the participants (59%) reported being too expensive as the reason for not using PPE (Figure 5).

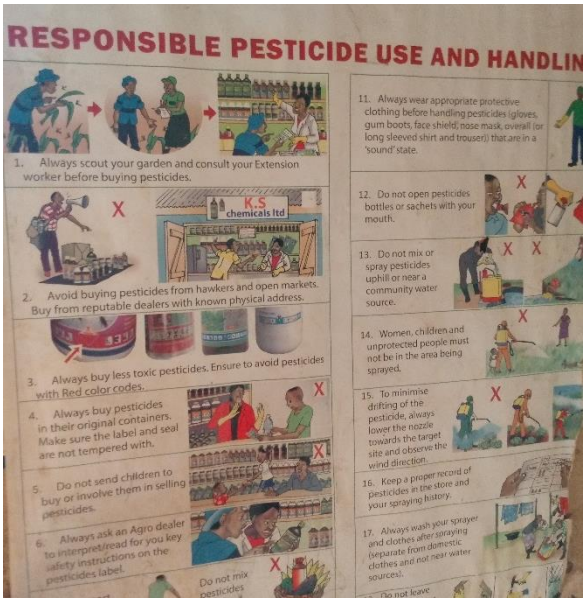
Figure 5. A pie chart showing the reasons for not using PPE among participants.



The heads of farmers' groups reported that majority of the farmers do not dress fully in the necessary PPE even when they are provided as a package when someone buys knap sackers or as recommended on the material safety data sheet of pesticide containers.

> *"The recommended PPE to use while handling pesticides are shown on the material safety data sheet of pesticide containers, but as Ugandans, we take things for granted and therefore do not use them and instead just put on ordinary clothes and spray. Other farmers say that longtime, pesticides were strong, but these days, pesticides are duplicate and therefore no need for PPE. Other farmers say that nose masks specifically cause difficulty in breathing especially when it's hot and that is why farmers do not use them. Some farmers only use nose masks when its windy and if the pesticides are so smelly. Oher farmers say that they find no reason to use PPE especially if they are going to spray pesticides on a small piece of land."* **Head of farmers' groups**

Figure 6. Picture showing responsible pesticide use and handling



This picture was taken from one of the agrochemical retail shops after asking for consent. However, this information is in English and majority of the farmers may not be able to understand the safety precautions when they have come to buy pesticides.

CHAPTER SEVEN: DISCUSSION

There is very little information about pesticide exposure and safety in Sembabule district, and consequently being a public health concern. Therefore, the main focus of this study was to determine the knowledge, attitudes and practices on pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district.

Knowledge on pesticide exposure and safety

Participants indicated that their main source of information on pesticides (40.7%) was from agrochemical retailers followed by pesticide containers (37.1%) rather than agricultural extension officers. Another study also asserted that almost all agro-input dealers (95.3%) perceived themselves to have been a source of information to farmers whereas among these (52.7%) of them believed that they were the best source of information to farmers in terms of safe pesticide use(Staudacher *et al.*, 2021). Therefore, agrochemical retailers should be equipped with the relevant knowledge concerning safe pesticide handling and use, and later pass it on to smallholder farmers as they purchase the pesticides.

Pesticide labels are a fundamental source of safety information and recommendations for use. However, a study by (Sekabojja *et al.*, 2023) reported that a low level of literacy among smallholder farmers to understand information on pesticide labels hinders achieving its purpose of protecting human health and the environment. In my study, participants only asked agrochemical retailers on issues concerning product price and choice and not safety precautions. This suggests that agrochemical retailers should explain to the smallholder farmers about safe pesticide handling measures as they buy the pesticides.

Most of the participants (86.7%) had never had any training on how to use pesticides. This finding has also been reported in a study done in Uganda where only a smaller (15%) of the respondents had received any training associated with management of pests in the past five years (Andersson and Isgren, 2021). Furthermore, this same study showed that for those who received the trainings, it was an effort of donor-funded NGOs rather than the responsible governmental personnel in these areas. This could imply that deficient access to technical advice and inadequate institutional support, on pesticide exposure and safety strategies gravely constrains current pesticide management. Therefore, farmer trainings should be done since they have proven to play a

significant role in increasing farmer knowledge and embracing of pesticide safety interventions(Tambo *et al.*, 2023).

Despite many participants in this study reporting that they were aware of the pesticide exposure routes (51.4%) of them majority (70.6%) reported skin/dermal contact as the most possible pesticide exposure route. This is contrary to a study by (Röösli *et al.*, 2022) that regarded the most pertinent pesticide exposure pathway as ingestion (especially residues of pesticides in food), followed by drinking water, air drift and dermal contact. This variation in awareness of possible pesticide exposure routes could be attributed to the high levels of education among the workshop participants, which was not the case among the smallholder farmers of Mitete parish whose highest level of education was primary. Therefore, it is necessary to equip farmers with knowledge concerning possible pesticide exposure routes and prevention measures.

Attitudes on pesticide exposure and safety

Many farmers (47.5%) thought that pesticides cannot affect the environment. This could be because the direct impact of pesticides onto the environment takes a long time to be realized. This could also have been attributed to failure to have any other option to pesticides, since the crop diseases were very many and also hiring people to weed seemed more expensive than using herbicides. This finding is similar to a study done in Rwanda which found that only (1.5%) of the farmers were capable of explaining the interconnectedness between pesticide use and negative outcomes on the environment(Ndayambaje *et al.*, 2019). Therefore, deliberate trainings on pesticide safety can be fruitful in enhancing safe pesticide practices to protect animal, human health and the surrounding ecosystems.

The majority of participants (85.0%) reported that rainy weather was the most inappropriate weather condition for spraying pesticides. This is because they believed that the rain washes away the pesticides in case they sprayed after it had rained or when it was raining, which would in turn lead to losses. Very few (5.1%) of the participants reported windy weather as the most inappropriate weather condition for spraying. This finding is similar to results from a study done by (Mergia *et al.*, 2021), which reported that the majority (64.7%) of participants did not consider wind direction during the spraying of pesticides. Technically, farmers should consider windy as the most inappropriate weather condition for spraying because failure to consider the wind

direction before spraying can result into inhalation of pesticides by the person spraying and also bad odor.

Practices on pesticide exposure and safety

The majority of participants (85.6%) reported washing only hands after spraying pesticides. Indeed, only (37.1%) reported bathing after spraying pesticides. Similarly to my study, a study done by (Mergia *et al.*, 2021) found that (93.3%) of farmers did not take a shower after mixing or spraying pesticides. This suggests that farmers' awareness on personal hygiene practices during and after spraying should be enhanced so as to prevent chronic pesticide intoxication.

Most of the participants reported gumboots (67.6%) and ordinary clothing (57.6%) as the frequently used PPE. This finding is similar to a study by (Ndayambaje *et al.*, 2019) which indicated that almost every participant was observed wearing their ordinary clothing (99.5%) while spraying pesticides. In fact, most participants (59.0%) said that PPE being too expensive was the reason as to why they did not use them. However, a study by (Marete *et al.*, 2021) asserted that failure to abide to protective clothing while applying and handling pesticides on the farm was a gross wrongdoing of protocols in pesticide safety which focus attention on using protective clothing including googles, hand gloves, boots and overalls. Therefore, agrochemical retailers of Mitete parish should avail these protective clothing in their shops so that farmers can easily access them at an affordable price. This suggests that farmers will protect themselves from high risks of pesticide poisoning.

The majority of participants (60.4%) revealed that they stored pesticides in the house where children could not reach. Similar to this finding, a study done in Rwanda indicated that all study participants stored pesticides in form of liquid or powder in their homes as observed during the household visits(Ndayambaje *et al.*, 2019). In addition, this same study emphasized that improper pesticide storage practices were an extra source of pesticide exposure to the humans and animals. I would recommend farmers to only buy pesticides that they can use up at once without the need of storing excess unused pesticides. Furthermore, farmers can also have small houses meant for storing pesticides only and only adults should access this area of which they should be fully protected to reduce pesticide exposure through inhalation and skin contact.

Study limitations

- The cross-sectional study was dependent on self-reported information from the farmers which had chances of recall bias. However, these biases were reduced by integrating self-reported information with qualitative data, but also probing was done during data collection leading to more accurate results.
- The simple random sampling method that was used may not have accurately reflected the population it was supposed to represent for example more participants were chosen from some villages than others depending on their level of convenience. Therefore, the study results may not accurately represent the entire Mitete parish.

CHAPTER EIGHT: CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion

This study suggests that high potential for pesticide exposure was due to limited basic pesticide safety practices among smallholder farmers of Mitete parish, Sembabule district. Explicitly, the farmers' knowledge and skills revealed to be inadequate to stop risks and hazards (such as affecting the environment and their individual health) associated with pesticide management.

Emergency comprehensive intervention measures should be put in place to reduce major health hazards to smallholder farmers, farmworkers, their families and nearby ecosystems. Such measures include training about safe pesticide application and storage before use, access to personal protective equipment and measures that minimize cost barriers to taking on safe behaviors.

Therefore, interventions that include a multisectoral approach are required including private, public and civil stakeholders so as to reduce pesticide exposure and enhance safe handling of pesticides among smallholder farmers of Mitete parish, Sembabule district.

8.2 Recommendations

Recommendations to smallholder farmers of Mitete parish

- Farmers should follow the manufacturers' prescription and safe handling precautions from the labels.
- Organic farming should be embraced so as to minimize use of synthetic pesticides.

Recommendations to Mitete parish Local Council

- Agrochemical retailers who are the direct source of pesticide information to the smallholder farmers should be trained continuously on crucial pesticide safety and handling modules.
- Organic farming demonstration plots and inputs that enhance this should be put in place.
- Pesticide education programs and public health campaigns in villages should be conducted by agricultural extension officers to enhance the knowledge of smallholder farmers in regards to pesticide exposure and safety.

Recommendations to Government of Uganda

- The government of Uganda should play its role in eliminating some pesticides, specifically counterfeits from the market.
- The government through the Ministry of Agriculture, Animal Industry and Fisheries should sensitize farmers and enhance coordination and regulation on the sale and use of agro-inputs. Agro-input dealers who don't comply with the regulations should be penalties.

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APPENDICES

Appendix I. Consent form

My name is NAKUYA EVELYN, a third-year student pursuing a Bachelor's degree in Environmental Health Sciences at Makerere University School of Public Health. I am conducting a study aimed at assessing the knowledge, attitudes and practices on pesticide exposure and safety among smallholder farmers of Mitete parish, Sembabule district. The information gathered is intended for academic purposes only and will be kept anonymous and confidential. I therefore request to get an informed consent from you as an act of ethical protocol in this study. There are no risks in taking part in this study, questions asked are directly forward, however a few may cause emotional discomfort. There are no direct benefits accorded to you for participating in this study but the research findings will be used to design appropriate interventions that promote safe and sustainable use of pesticides among smallholder farmers in Mitete parish.

During the interview, you are required to answer questions about pesticide exposure and safety and it will cost you about 20 to 30 minutes to complete the entire interview, you will not have to incur any other extra costs on top of the time given to me. Your participation will not attract any compensation in form of money or refreshments during the course of the interview and there will be no any form of reimbursement. Participation in the study is completely voluntary, you can withdraw at any time as you desire without penalty and refusing to participate in the study will not affect you in any way.

If you have questions or concerns about this study, feel free to reach out to me at 0752680235/0760901897. For any questions concerning your rights, do not hesitate to contact my supervisors from Makerere University School of Public Health, DR. VICTORIA NANKABIRWA at 0755757460 and MS. LESLEY ROSE NINSIIMA at 0703186003/0785254323.

Signature of respondent……. Date…….

Signature of interviewer…… Date……..

CONSENT FORM TRANSLATED TO LUGANDA

Amannya gange nze NAKUYA EVELYN, ndi muyizi mu mwaka ogwokusatu ng'asoma diguli ya Bachelor's mu Sayansi w'ebyobulamu mu butonde bw'ensi mu Makerere University School of Public Health. Nkola okunoonyereza okugenderera okwekenneenya okumanya, endowooza

n’enkola ku kukwatibwa eddagala n’obukuumi mu balimi abatonotono mu kigo ky’e Mitete, mu disitulikiti y’e Sembabule. Amawulire agakung’aanyiziddwa gagendereddwamu kusoma kwokka era gajja kukuumibwa nga tegamanyiddwa mannya era nga ga kyama. N’olwekyo nsaba okufuna okukkiriza okutegeerekese okuva gyoli ng’ekikolwa eky’empisa mu kunoonyereza kuno. Tewali bulabe bwonna mu kwetaba mu kunoonyereza kuno, ebibuuzo ebibuuzibwa biba butereevu mu maaso, wabula ebitonotono biyinza okuleeta obuzibu mu nneewulira. Tewali migaso gya butereevu gy’oweebwa olw’okwetaba mu kunoonyereza kuno naye ebizuuliddwa mu kunoonyereza bijja kukozesebwa okukola enteekateeka entuufu ey’okuyingira mu nsonga ezitumbula enkozesa y’eddagala eritta ebiwuka mu ngeri ey’obukuumi era ey’olubeerera mu balimi abatonotono mu kigo ky’e Mitete.

Mu interview, olina okuddamu ebibuuzo ebikwata ku kukwatibwa eddagala ly’ebiwuka n’obukuumi era kijja kukumalako eddakiika nga 20 ku 30 okumaliriza interview yonna, tojja kusasula ssente ndala zonna ez’okwongerako ku budde bwe bampa. Okwetaba kwo tekujja kusikiriza kuliyirirwa kwonna mu ngeri ya ssente oba okunywa ebiwoomerera mu kiseera ky’okuyita mu yintaviyu era tewajja kubaawo ngeri yonna ya kuddizibwa ssente. Okwetaba mu kunoonyereza kwa kyeyagalire ddala, osobola okuvaamu essaawa yonna nga bw’oyagala awatali kibonerezo era okugaana okwetaba mu kunoonyereza tekijja kukukosa mu ngeri yonna.

Bw’oba olina ekibuuzo oba ekikweraliikiriza ku kunoonyereza kuno, wulira nga oli waddembe okuntuukirira ku 0752680235/0760901897. Ku kibuuzo kyonna ekikwata ku ddembe lyo, tolwawo kutuukirira ba supervisor bange okuva mu Makerere University School of Public Health, DR. VICTORIA NANKABIRWA ku ssimu 0755757460 ne MS. LESLEY ROSE NINSIIMA ku ssimu 0703186003/0785254323.

Omukono gw’oyo abuziddwa…… Olunaku olw'omweezi…….

Omukono gw'oyo abuuza ebibuuzo..... Olunaku olw'omweezi……..

Appendix II. Questionnaire

KNOWLEDGE, ATTITUDES AND PRACTICES ON PESTICIDE EXPOSURE AND SAFETY AMONG SMALLHOLDER FARMERS OF MITETE PARISH IN SEMBABULE DISTRICT.

Questionnaire number……. **Interview number……**

Parish……. **Village……**

Date of interview……/……/……

SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS

Circle or tick the appropriate option(s) and fill in the spaces where necessary.

A1. What is your gender?

a) Male
b) Female

A2. What is your age?

a) 20-30
b) 31-40
c) 41-50
d) 51-60
e) >60

A3. What is your highest level of education?

a) None
b) Primary
c) Secondary
d) Tertiary

A4. What is your main source of income/occupation?

a) Salary employee
b) Self employed

c) Farmer
d) Casual labor
e) Unemployed
f) Housewife

A5. What is your marital status?

a) Married/Cohabiting
b) Divorced/Separated
c) Widowed
d) Single

A6. What is the farming type practiced?

a) Subsistence
b) Commercial

A7. What is your farming experience?

a) 1-3 years
b) 5-10 years
c) > 10 years

SECTION B: KNOWLEDGE ON PESTICIDE EXPOSURE AND SAFETY

B1. Have you ever used pesticides?

a) Yes
b) No

B2. If yes, do you know how to safely use pesticides?

a) Yes
b) No

B3. What is your main source of pesticide information for usage?

a) Agricultural extension officers

b) Agrochemical retailers
c) Other farmers
d) Previous experience
e) Pesticide containers

B4. Have you ever had any training on how to use pesticides?

a) Yes
b) No

B5. Are you aware of the pesticide exposure routes?

a) Yes
b) No

B6. If yes, what are the possible pesticide exposure routes you know?

a) Inhalation
b) Skin/dermal contact
c) Oral
d) Eye contact

B7. Are you aware of biological or other forms of integrated pest management?

a) Yes
b) No

B8. Are you able to understand the information written on the pesticide packages?

a) Yes
b) No

B9. Are you aware of the toxicity color codes present on the pesticide containers?

a) Yes
b) No

SECTION C: ATTITUDES ON PESTICIDE EXPOSURE AND SAFETY

C1. Do you care about the negative impacts of pesticide exposure?

a) Yes
b) No

C2. Do you think that the following can be potential pesticide exposure symptoms; skin irritation, salivation, nausea, blurred vision and vomiting?

a) Yes
b) No
c) I don't know

C3. Do you think that pesticides can affect the environment?

a) Yes
b) No
c) I don't know

C4. Do you think it is important to observe the weather conditions before spraying?

a) Yes
b) No
c) I don't know

C5. If yes, which of the following is the least conducive weather for spraying?

a) Windy
b) Rainy
c) Sunny
d) Not sure

C6. Do you think it is appropriate to enter recently sprayed fields/farmlands?

a) Yes
b) No

C7. Do you think you should wear protective equipment while spraying?

a) Yes
b) No

SECTION D: PRACTICES TOWARDS PESTICIDE EXPOSURE AND SAFETY

D1. How often do you drink / eat while mixing or spraying?

a) Always
b) Sometimes
c) Never

D2. How often do you apply pesticides?

a) 3-5 times per season
b) 7-10 times per season
c) 12-15 times per season
d) More than 15 times per season
e) Others (Specify)

D3. What do you wear while spraying? **(CIRCLE ALL THAT APPLY)**

a) Gumboots
b) Gloves
c) Hat
d) Face and nose mask
e) Overall
f) Ordinary clothing
g) Long sleeved shirt and trousers
h) Eyeglasses/goggles
i) Jackets

D4. What are the reasons for not using PPE? **(CIRCLE ALL THAT APPLY)**

a) Too expensive
b) Lack of availability
c) Uncomfortable when it's hot
d) Slows work
e) Others

D5. What are the appropriate locations/devices for mixing pesticides?

a) House
b) Farmland
c) Near water source/well
d) Blue containers/drums
e) Knap sackers
f) Others

D6. What practices do you do after spraying pesticides?

a) Wash only hands
b) Bathe
c) Change clothes
d) Others (Specify)

D7. Where do you store pesticides? **(CIRCLE ALL THAT APPLY)**

a) Open field
b) Open shed for pesticides
c) Toilet
d) Roof
e) Kitchen
f) Animal shelter
g) Under the bed
h) Store for farm equipment
i) House (where children do not reach)
j) Others (Specify)
k) I don't store pesticides

D8. What do you do with the empty pesticide containers? **(CIRCLE ALL THAT APPLY)**

a) Throw on the farmland
b) Recycle at home
c) Throw in streams

d) Sell to others(scrap)
e) Buried or burned
f) Return to disposing agent
g) Others

Thank you

QUESTIONNAIRE TRANSLATED TO LUGANDA

KNOWLEDGE, ATTITUDES AND PRACTICES ON PESTICIDE EXPOSURE AND SAFETY AMONG SMALLHOLDER FARMERS OF MITETE PARISH, SEMBABULE DISTRICT.

Questionnaire number……. **Interview number……**

Parish……. **Village……**

Date of interview……/……/……

EKITUNDU A: EBINTU BY'OMUSINGO /EBINTU BY'OMUNTU

Weetooloole oba ssaako akabonero ku ngeri (ebintu) ebituufu era ojjuze ebifo we kyetaagisa.

A1. Oli wa kikula ki?

a) Musajja
b) Mukazi

A2. Olina emyaka emeka?

a) 20-30
b) 31-40
c) 41-50
d) 51-60
e) >60

A3. Obuyigirize bwo obw'oku ntikko buli ki?

a) Sa soma

b) Nakoma mu pulayimale

c) Nakoma mu siniya

d) Nakoma mu ssetendekero

A4. Ensibuko yo enkulu ey'ensimbi/omulimu gwo y'eruwa?

a) Ndimukozi w'omusaala

b) Nekoseza

c) Ndi mulimi

d) Ndi mukozi ow'akaseera obuseera

e) Silina mulimu

f) Ndi mukyala w'awaka

A5. Embeera yo mu bufumbo eri etya?

a) Ndi mufumbo

b) Nanoba/Twayawukana

c) Nnamwandu

d) Ssili mufumbo

A6. Kika ki eky'okulima kyokola kubino wamanga?

a) Okweyimirizaawo/kulya nakutunda ebisigadewo

b) Nsuubuza/Ntunda

A7. Omaze banga ki ng'olima?

a) Emyaka 1-3

b) Emyaka 5-10

c) > Emyaka 10

EKITUNDU B: OKUMANYA KU BY'OKUKOLAGAANA NEDDAGALA N'OBUKUUMI

B1. Ensibuko yo y'amawulire agakwata ku ddagala ly'ebirime mukugula n'okulikozesa yeri wa?

a) Abakuggu abakola ku by'obulimi/abalimisa

b) Abasuubuzi b'eddagala ly'ebirime

c) Abalimi abalala

d) Obumanyirivu obw'emabega

e) Ebichupa/edidomola bye ddagala

B2. Wali ofunye okutendekebwa kwonna ku ngeri y'okukozesaamu eddagala ly'ebirime?

a) Yee

b) Nedda

B3. Omanyi ebitunddu byomubiri eddagala lye birime mweliyita okukosa omuntu ngalikozesa?

a) Yee

b) Nedda

B4. Bwe kiba nti yee, bitunddu ki ebyomubiri eddagala lye birime mweliyita okukosa omuntu ngalikozesa?

a) Mukussa

b) Okukwatagana n'olususu/olususu

c) Biyiita mukamwa

d) Okukwatagana n'amaaso

e) Ebirala(Lambika)

B5. Omanyi engeri endala ez'okulwanyisamu ebiwuka mu ngeri ey'omuggundu etali kukozesa ddagala kubirime?

a) Yee

b) Nedda

B6. Osobola okutegeera amawulire agawandiikiddwa ku bipapula ebibera ku bidomola/ecupa by'eddagala ly'ebirime?

a) Yee
b) Nedda

B7. Omanyi obubonero bwobutwa/langi z'obutwa eziri ku bidomola/ecupa by'eddagala ly'ebirime?

a) Yee

b) Nedda

EKITUNDU C: ENDOWOOZA KU KUKOLAGAANA KU DDAGALA N'OBUKUUMI

C1. Olowooza olina okwambala eby'okwekuuma ng'ofuuyira/ngokozesa eddagala lye birime?

a) Yee

b) Nedda

C2. Ofaayo ku buzibu bwoyinza okufuna nga okozesa eddagala lye birime?

a) Yee

b) Nedda

C3. Olowooza bino wammanga biyinza okuba obubonero obuyinza okuva mu kukwatibwa eddagala ly'ebirime; okusisiwala kw'olususu, okusesema/okusindukirira ememe, okufulumya/okuwandula amalusu, okuziyira, obutalaba bulungi n'okusiiyibwa?

a) Yee

b) Nedda

c) Simanyi

C4. Olowooza nti eddagala ly'ebirime liyinza okukosa obutonde?

a) Yee

b) Nedda

c) Simanyi

C5. Olowooza kikulu okwetegereza embeera y'obudde nga tonnafuuyira?

a) Yee

b) Nedda

c) Simanyi

C6. Bwe kiba nti yee, ku bino wammanga obudde ki obutasanidde kufuuyiramu?

a) Odudde bw'empewo

b) Odudde bw'enkuba

c) Obudde bw'omusana

d) Simanyi

C7. Olowooza kyabulabe okuyingira mu nnimiro naddala nga bakamala okufuuyira mweyo enimiro?

a) Yee

b) Nedda

EKITUNDU D: ENKOZESA EY'OKUKOLAGAANA NEDDAGALA N'OBUKUUMI

D1. Wali okozesezzaako eddagala ly'ebirime?

a) Yee

b) Nedda

D2. Bwe kiba nti yee, omanyi engeri y'okukozesaamu eddagala ly'ebirime mu ngeri ey'obukuumi?

a) Yee

b) Nedda

D3. Emirundi emeka gy’onywa / gy’olya ng’otabula oba ng’ofuuyira edaggala ly’ebirime?

a) Bulijjo

b) Oluusi

c) Nedda

D4. Okoseza eddagala ly’ebirime emirundi emeka mu sizoni?

a) emirundi 3-5 buli sizoni

b) emirundi 7-10 buli sizoni

c) emirundi 12-15 buli sizoni

d) Emirundi egisukka mu 15 buli sizoni

e) Ebirala(Lambika)

D5. Kiki ky’oyambala ng’ofuuyira? (WETOOLOZE BYONNA EBIKOLA)

a) Gambutuusi
b) Gilaavu
c) Enkoofiira
d) Masiki y’okumaaso n’ennyindo
e) Ovuulo
f) Engoye eza bulijjo
g) Essaati n’empale ez’emikono emiwanvu
h) Galubiindi samaaso
i) Jacketi

D6. Ensonga ki ezikuviirako obutakozesa PPE (ebyokwekuuma ng’ofuuyira)?

a) Za beeyi nnyo

b) Tezibeerawo

c) Zimalako eddembe olwe bbugumu

d) Zikendeeza kubudde bw’okukola

e) Tetufayo ku byokwekuuma

f) Ebirala(Lambika)

D7. Bifo ki ebisaanira okutabuliramu eddagala ly'ebirime?

a) Awaka

b) Munnimiro

c) Okumpi n'oluzzi

d) Mu pipa

e) Mu bomba

f) Ebirala(Lambika)

D8. Bikolwa ki by'okola ng'omaze okufuuyira eddagala ly'ebirime?

a) Naaba mu ngalo zokka

b) Naaba omubiri gwona

c) Nkyusa engoye

d) Ebirala(Lambika)

D9. Eddagala ly'ebirime mulitereka wa? (WETOROOZE BYONNA EBIKOLA)

a) Munnimiro

b) Mu store y'eddagala ly'ebirime

c) Kaabuyonjo

d) Mukasolya

e) Muffumbiro

f) Mukifo awakuumirwa ebisolo

g) Wansi wekitanda

h) Mutterekero ly'ebikozesebwa mu nnimiro

i) Mu nnyumba (abaana webatatuka)

j) Ebirala (Lambika)

k) Sitereka ddagala

D10. Ebidomola/ebicupa ebivuddemu eddagala ly'ebirime obikola otya? (WETOOLOZE BYONNA BYOKOLA)

a) Mbisuula mu nnimiro

b) Nzilamu okubikozesa awaka

c) Mbisuula mu nzizi

d) Mbiguza abalala (aba scrap)

e) Mbiziika oba mbyokya

f) Mbizaayo gye nabigula/ ku dduka

g) Ebirala(Lambika)

Appendix III. Key informant interview guide

Dear respondent, my name is NAKUYA EVELYN, a third-year student pursuing a Bachelor's degree in Environmental Health Sciences at Makerere University School of Public Health. I have selected you as a key informant due to your wide knowledge on pesticide exposure and safety among smallholder famers in Mitete parish, Sembabule district.

K1. What is the importance of pesticides in agriculture?

K2. What are the possible negative effects of unsafe pesticide use specifically among farmers? (Probe how?)

K3. What are the possible routes of pesticide exposure among end users? (Probe why?)

K4. In your opinion, what has been done to prevent pesticide exposure which in the long run ensures pesticide safety among the end users?

K5. What else do you suggest should be done that probably has not been done yet to ensure pesticide safety? (Probe, who should do that?)

K6. Do you think that there are other alternatives to pesticides that can be deployed by farmers? (Probe, what are they?)

Thank you

Key informant guide translated to Luganda

Ssebo/Nyabo omwagalwa, elinnya lyange nze NAKUYA EVELYN, omuyizi ow'omwaka ogwokusatu ng'ansoma diguli ya Bachelor's mu Sayansi w'Ebyobulamu mu Butonde bw'ensi mu Makerere University School of Public Health. Nkulonze ng'omuwabuzi omukulu olw'okumanya kwo okungi ku kukwatibwa eddagala n'obukuumi mu balimi abatono mu kigo ky'e Mitete, mu disitulikiti y'e Sembabule.

K1. Migaso ki egiri mukukozesa eddagala lye birime?

K2. Bibi ki ebiyinza okuva mu kukozesa eddagala lye birime mu ngeri etali ya bukuumi eri abalimi? (Buuza mu ngeri ki?)

K3. Bitundu ki ebyomubiri ebisobola okukosebwa ngori akozesa eddagala lye birime? (Buuza lwaki?)

K4. Mundowooza yo, ngeri ki eyo bukuumi etekeddwa munkola okutangira okukosa ebitundu by'omubiri ebyabo abakozesa eddagala lye birime?

K5. Kiki ekirala ky'oteesa ekirina okukolebwa, oboolyawo ekitannaba kukolebwa okulaba ng'eddagala lye birime likozesebwa n'obukuumi? (Buuza ani ayina okubikola?)

K6. Olowooza waliwo ebirala ebiyinza okukozesebwa/okukolebwa abalimi mu kifo kye ddagala lye birime? (Buuza bye biriwa?)

Appendix IV: Introduction Letter

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COLLEGE OF HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH

Department of Disease Control & Environmental Health

20th December 2023

To Whom It May Concern

Dear Sir/Madam,

RE: INTRODUCTION OF NAKUYA EVELYN: REG: 21/U/0451

This is to introduce NAKUYA EVELYN a third-year student at Makerere University School of Public Health doing Bachelor of Environmental Health Sciences Program. She is undertaking research titled: "Knowledge, attitudes and practices on pesticide exposure and safety among smallholder farmers of Mitete Parish, Sembabule District." as part of the requirements for the award of the Bachelor's degree.

Therefore, the purpose of this letter is to seek your permission for the student to collect data for her research within your area.

Any assistance rendered to the student in the process will be highly appreciated.

Yours Sincerely,

Abdullah Ali Halage
BEH Programme Coordinator
Email: ahalage@musph.ac.ug
Tel: +256 772 663 033