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School of Public Health

Occupational pesticide exposure and associated factors, among rural farmers of Dawo districts, South West Shewa, Oromia Region, Ethiopia,

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A Research Thesis to be Submitted to the St. Paul's Hospital Millennium Medical College, School of Public Health in Partial Fulfillment of the Requirements for the Degree of Master of Public Health in Field Epidemiology

October, 2025

Addis Ababa, Ethiopia

Assessment of Occupational Pesticide Exposure and Associated Factors among
Rural Farmers of Dawo Districts, South West Shewa, Oromia, 2025

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Acronyms and Abbreviation

AOR	Adjust Odd Ratio
BIPOC	Black Indigenous and People of Color
CA	Carbamate
CBHI	Community-Based Health Insurance
CI	Confidence Interval
COR	Crude Odd Ratio
CRV	Central Rift Valley
GDP	Gr Domestic Product
HHP	Highly hazardous pesticide
IPM	Insecticide Pest Management
LMIC	Low and Middle-Income Countries
MOA	Ministry of Agriculture
MOLSA	Ministry of Labor and Social Affairs
NRR	Non-Response Rate
OCP	Organochlorine Phosphate
OHS	Occupational Health and Safety
OP	Organophosphate
PPE	Personal Protective Equipment
SPSS	Statistical Package Social science
UN	United Nation
UNEP	United Nations Environment Program
WHO	World Health Organization

Abstract

Background: Pesticides are chemical compounds used to kill pests, unwanted plants (weeds), including insects, fungi, and rodents. However, the unsafe use of pesticides poses major risks to human health and the environment. This study aims to assess occupational pesticide exposure and the associated factors among rural farmers in Dawo districts, 2025.

Method: A community-based cross-sectional study was conducted from February to March, 2025 in Dawo District. A total of 462 samples were selected using a systematic random sampling technique. Data were collected through face-to-face interviews using a structured questionnaire, and were collected using Kobo Collect and analyzed using the Statistical Package for the Social Sciences version 25 software. To identify factors associated with the dependent variable, a two-stage logistic regression analysis was conducted. Variables with 0.25 in the bivariate logistic analysis were included in the multivariate model. In the final model, statistical significance was determined at a p-value <0.05.

Result: Out of 462 farmers, 453 voluntarily participated, with a response rate of 98%. The prevalence of occupational pesticide exposure was 347 (76.6%), with 95% CI: (72.3-80.6). In multivariate logistic regression analysis: not knowledgeable (AOR = 2.02, 95% CI: 1.15–3.56), lack knowledge effects of pesticide on human health (AOR = 14.53, 95% CI: 7.95–26.56), Lack of knowledge on the amount of pesticide active ingredient (AOR = 5.46, 95% CI: 2.86–10.41), Lack of knowledge on exposure routes of pesticide (AOR = 2.09, 95% CI: 1.13–3.89), Limited knowledge of pesticide effect on the environmental (AOR = 2.14, 95% CI: 1.18–3.88), lack training on Pesticide safety use (AOR = 14, 95% CI: 8.3–25.2), Improper utilization Personal Protective Equipment (AOR=3.5, 95% CI: 1.1-10.9), failure to follow wind direction during spraying (AOR = 4.9, 95% CI: 2.50–9.29), were significant factors.

Conclusion: Pesticide exposure among farmers is strongly influenced by knowledge gaps, unsafe practices, and lack of training, additional behavioral factors, such as not using protective equipment, ignoring wind direction. These findings highlight the urgent need for comprehensive educational programs, behavioral change strategies, promoting consistent use of protective equipment, encouraging safe spraying techniques, and fostering positive attitudes toward pesticide safety and enforcement of safety protocols to reduce health risks in agricultural communities.

Keywords: Occupational, Pesticide, Exposures, Farmers, Dawo District

Introduction

1.1. Background

Pesticides are chemical substances or mixtures designed to prevent, destroy, repel, attract, or control pests such as insects, nematodes, weeds, disease pathogens, and vectors during the production, storage, transport, distribution, and processing of food, agricultural commodities, or animal feed(1–3). Agriculture is the second-largest industry globally in terms of employment(4) (and it plays an important role in Ethiopia's economy, contributing over 85% to the country's GDP growth(5,6). Ethiopia annually imports approximately 3,346.32 metric tons of various pesticides(7) (6). These chemicals are essential in modern agricultural practices, significantly reducing crop diseases and increasing yields. By using pesticides, farmers can prevent losses of fruits, vegetables, and grains by up to 78%, 54%, and 32%, respectively(1,2).

Despite their benefits in enhancing agricultural productivity and supporting both local and global economies, pesticides pose serious risks to human health and the environment(5). A significant portion of applied pesticides reaches non-target plants and environmental media, leading to human exposure and ecological damage. According to the World Health Organization (WHO) and the United Nations Environment Programme (UNEP), pesticide exposure results in approximately 200,000 deaths and three million cases of poisoning globally each year. Although developing countries use only 25% of the world's pesticides, they account for 99% of these fatalities(8). Studies in African nations show that less than 20% of global agrochemical production is consumed there, yet they experience up to 1.1 million cases (70%) of acute farm-related poisonings(10). In Ethiopia, 55.67% of farmers who used pesticides reported health issues related to exposure(11). According to research conducted in Ethiopia, the poisoning death rate varies between 0.3% and 27.6%(12).

All people are exposed to some degree to pesticides, but farmers are particularly susceptible due to the additional risk of occupational exposure(4). Occupational pesticide exposure is one of the most critical hazards faced by farmers and agricultural laborers in developing countries. Many workers use ineffective personal protective equipment (PPE) or fail to wear it properly(13). Pesticides are linked to both acute and chronic illnesses, with several risk factors increasing their toxicity in low-income regions. These include the absence of pesticide registration systems, the importation of highly toxic banned substances, lack of safety protocols and poisoning surveillance,

misuse and improper handling, neglect of re-entry intervals, involvement of children and women in farm work, and widespread illiteracy regarding safe agricultural practices (14).

Effective pesticide management requires the use of protective gear, adherence to label instructions, proper disposal of waste and containers, and safe storage practices(15). In the study area, farmers cultivate crops two to three times annually and rely heavily on pesticides to maintain productivity. However, there is no evidence on occupational exposure and its associated risk factors. Therefore, this study aims to assess occupational pesticide exposure and identify related risk factors among farmers in the Dawo district of Oromia

1.2. Statement of the Problem

pesticides have become a key component of modern agriculture, widely adopted as cost-effective, labor-efficient, and highly effective tools for pest management across most agricultural industries (16). Even if pesticides increase agricultural productivity through better management of pests that helps to improve the regional and global economy, their widespread use has led to significant environmental contamination and adverse effects on human health(5,17,18). Globally, agricultural activities are the leading contributors to water pollution, releasing vast amounts of organic and inorganic contaminants into water bodies(2). Pesticide-related malpractice is a serious public health concern, particularly in low- and middle-income countries where enforcement of pesticide regulations is weak and health surveillance systems are often ineffective(19,20) .

Occupational exposure occurs at multiple stages—from formulation and mixing with solvents to application methods such as spraying. Extensive pesticide use directly or indirectly contaminates air, soil, and water, disrupts ecosystems, remains in crops, and ultimately enters the food chain, posing serious threats to human health(21). Both active and inactive chemical components of pesticides have long-term cumulative impacts on human health(22). The increasing reliance on pesticides in agriculture has become a global public health issue, especially in developing countries. According to the World Health Organization (WHO), approximately 200,000 people in rural areas of developing countries died annually from pesticide poisoning. Additionally, 3 million farmers suffer from severe poisoning, while 25 million experience mild symptoms. These exposures result in an estimated 180,000 deaths among farm workers each year(23).

In Africa, limited knowledge about pesticide safety has led to the use of substances classified under the WHO risk classification system. In Ethiopia alone, the Pesticide Risk Reduction Program (PRRP) reported that out of 302 registered pesticides, 160 contain active ingredients classified as

WHO Class II (moderately hazardous) (21). Agricultural and public health workers are most likely to be exposed to highly hazardous pesticides (HHPs) during the handling, dilution, mixing, and application processes. Exposure occurs primarily through dermal contact during spray preparation and both dermal and inhalation routes during application. Ingestion may occur through contaminated food or oral contact with pesticide residues on hands. Contaminated clothing also serves as a significant source of exposure (22,24)

A disproportionately high number of pesticide poisonings and deaths occur in developing countries due to inadequate workplace safety standards, lack of personal protective equipment (PPE), poor sanitation, illiteracy, insufficient understanding of pesticide hazards, absence of pesticide registration systems, and the importation of banned toxic substances (25). Additional risk factors include the lack of national monitoring plans for pesticide residues, absence of safeguards and poisoning surveillance systems, misuse and improper handling of pesticides, involvement of children and women in farm work, illiteracy regarding good agricultural practices, excessive use of household pesticides, prevalence of infectious and parasitic diseases, multiple exposures to toxic chemicals, and poverty(14). These factors either increase the likelihood of pesticide exposure or intensify its toxic effects on the human body.

In Ethiopia, most farmers do not take adequate protective measures, and the use of PPE is extremely limited. Among rural farmers, none were found to use complete PPE during pesticide application, leaving their faces, hands, palms, and fingers exposed(26). It is therefore critical to raise awareness among affected communities about the health and environmental impacts of pesticide exposure and the mechanisms through which exposure occurs.

There are limited studies on occupational pesticide exposure and associated factors in the country, particularly in the study area. This study aims to assess the magnitude of occupational pesticide exposure and associated factors among rural farmers in the Dawo district, Southwest Shewa Zone, Oromia Region, Ethiopia. Such insights are essential for informing targeted interventions and strengthening pesticide safety regulation for vulnerable farming communities.

1.3. Significance of the study

This study offers valuable insights into pesticide usage, awareness, and practice patterns among rural farmers, with particular emphasis on their environmental and human health implications. Quantifying the prevalence and level of occupational pesticide exposure in the Dawo district it provides crucial baseline data to inform future research and guide policy development. The study

emphasizes the importance of educating communities about the risks of improper pesticide use, strengthening outreach efforts, and delivering actionable information to agricultural departments and health offices. It also highlights the need for collaboration among planners, programmers, and stakeholders to implement effective interventions. By identifying key factors contributing to pesticide exposure, the research supports targeted public health strategies aimed at reducing health risks among rural farming populations. Engaging local communities in these efforts may develop a sense of ownership and accountability, encouraging the adoption of safer agricultural practices. Ultimately, the study contributes to the broader goal of protecting vulnerable farming communities.

2. Literature Review

2.1. Pesticides and their use among farmers

According to a study conducted Pesticides are widely utilized worldwide due to their confirmed efficiency, speed, and affordability in controlling agricultural pests(27). The study revealed that pesticides are classified based on their target, mode of action, duration of action, toxicity, or chemistry as insecticides, bactericides, fungicides, herbicides, nematocides, and rodenticides (28). Pesticides are divided into two groups based on their chemical composition: organic and inorganic. Copper sulfate, ferrous sulfate, copper, lime, and sulfur are examples of inorganic pesticides. Organophosphorus, carbamate, and pyrethroids are examples of organic pesticides that may be categorized based on their chemical structure(16). According to WHO guidelines, pesticides are classified based on toxicity as shown in Table (18).

According to Indian research, herbicides account for 47.5% of pesticide contributions, insecticides ranking second at 29.5%, fungicides at 17.5%, and other insecticide kinds at 5.5%(6). According to a study done in Kenya, pesticides are frequently used in agriculture to increase crop output and against disease and insects(8).

According to cross-sectional research carried out in Misrak Badawacho Woreda, Ethiopia, pesticides were composed of insecticides (3%), fungicides (28%), herbicides (55%), and veterinary control (14%)(5). However, their use causes significant health risks, especially for rural farmers who often work directly with these chemicals (8), who are unaware and do not use proper protective measures(29).

2.2. Effects of pesticide exposures among farmers

The study conducted in Spain revealed that farmers living in rural areas with significant pesticide usage and those not wearing protective gloves were at higher risk(30).According to a study conducted in Brazil Pesticide-spraying farmers were found to have a significantly higher incidence of cancers of the thyroid, skin, kidneys, lymph nodes, larynx, lung, colon, and prostate(32,34).

A study in Sub-Saharan Africa shows that Women's exposure to pesticides during pregnancy or breastfeeding can pose a serious health risk for the fetus and newborn babies(32)The research done in Kenya indicated that (26%) reported farmers having health problems after applying pesticides, with the majority of symptoms being felt after using dimethoate, malathion, carbofuran, carbaryl, and heptachlor(8). A cross-sectional study in Tanzania reveals that the cholinergic inhibition brought by exposure to organophosphorus pesticides is linked to hormonal alterations, aberrant

sperm, ovaries, and egg development, as well as neurological, gastrointestinal, dermatological, and respiratory symptoms(33).

According to a cross-sectional study done in East Hararge districts, an extensively larger number of applicators (36%) had health issues obviously due to pesticide exposure than residents (16%). Residents are less likely to experience skin irritation, shortness of breath, coughing, or dizziness than applicators(20).

2.3.The Magnitude of Pesticide Exposure

According to a WHO and United Nations Environment Programme (UNEP) estimate, three million people worldwide are poisoned, and 200,000 die as a result of pesticide exposure, mainly in poor nations. Pesticides are widely used without accuracy, which leads to a variety of detrimental consequences on human health, ranging from acute poisoning to chronic illnesses such as cancer (brain cancer, breast cancer, prostate cancer, bladder cancer, and colon cancer(23). The study done in Thailand indicated pesticide exposure as one of the most important threats to health among farmers. Morbidity rates of 49,000-61,000 cases per year have been reported, accounting for 76.4-96.6 individuals per 100,000 people, of which most cases were farmers and farm workers(34).

A cross-sectional survey done in Misrak Badawacho Woreda, Ethiopia, the majority (93%) complained of suffering from pesticide-related health signs and symptoms during or after the application of pesticides(5).A hospital-based prospective cross-sectional research in western Oromia, Ethiopia, found that pesticide exposure and food poisoning contributed to 32.70% and 20.91% of the poisoning incidence, respectively(35).

2.4. Factors associated with pesticide exposure

2.4.1. Sociodemographic factors

A community-based cross-sectional study conducted in the South Wollo Zone's revealed that no formal education 2.32 times less safe practice pesticide and lack of training (AOR = 3.73; 95% CI: 2.33–5.98)(25).A community-based cross-sectional study conducted in south Gondar zone, Ethiopia indicated educated farmers (AOR): 3.19, 95% CI: 1.44–6.71safe practice pesticide and those two experience of pesticide exposure (AOR: 6.85. 95% CI: 2.426–9.35)(19).Accordingly, study conducted in Southwest of Ethiopia farmers with at least primary education status were two times more likely (AOR: 2.1, 95% CI: 1.25–3.54) to practice good handling practices than those who didn't attend any formal education. farmers who had 2 or more years of experience with

pesticide use were 4.7 times more likely to practice good handling than the less experienced farmers(36).

2.4.2. Training and knowledge

A systematic review conducted in Portugal showed that Preparing and spraying pesticides without considering or reading the information on the product label (safety precautions, suggested dose, disposal of empty containers, weather conditions, targeted pest issue, among other information) was mentioned in 40% of the studies(37).

A study conducted in Nepal revealed that farmers with a higher understanding of pesticide handling were 8.3 times more likely to conduct safe purchasing, four times more likely to practice safe mixing and spraying, and twice as likely to practice safe storage and disposal(38). The study conducted in Saudi Arabia also reveals that about 48.2% do not follow the instructions(39)

A community-based cross-sectional study done in Gondar town in Ethiopia revealed that the study participants with good knowledge had 3.23 times more likelihood of better practice (AOR = 3.23, CI 95% (1.91, 5.46) about pesticide handling and storage as compared with those having poor knowledge. Farmers who have desirable/good attitudes reported 1.77 times more likely better practice (AOR1.77, 95% CI (1.11, 2.81)as compared to those with undesirable/poor attitudes (40)

2.4.3. Personal Protective Equipment Use

The study shows that using protective measures among applicators is a critical factor for reducing health hazards associated with occupational pesticide exposure. The cost of preventive measures is considerably lower than the cost of medical treatment of health effects from pesticide exposure(20).

A cross-sectional study done in Chitwan District, Nepal indicated that 54% of farmers used protective clothing when mixing and spraying insecticides(38).

The use of PPE is essential for minimizing exposure; however, many rural farmers do not have access to or do not utilize appropriate protective wear (41). A cross-sectional study was carried out in Ethiopia's Badawacho Woreda When applying pesticides, around 54% of agricultural workers used regular clothing, 17% wore boots, 11% wore eyeglasses, 8% used handkerchiefs, 3% wore masks, and 2% wore cotton(5)According to study conduct in Ethiopia's Central Rift Valley (CRV), the vast majority of farmers (63%) will not use personal protection equipment when handling and spraying pesticides(42).

2.4.4. Pesticide Storage and Disposal Empty Pesticide Container and Management

The African region is shown via a meta-analysis and systematic review. 51% and 26% of respondents reported having pesticides stored in the living room and containers used for various purposes respectively. A substantial proportion of the respondents reported storing pesticide residues in their living rooms, and the reuse of pesticide empty containers(43).

A cross-sectional study conducted in Ethiopia showed that 69% and 80% of the respondents reported that leftover pesticide residues were sold/offered to other fellow farmers and disposed of empty pesticide containers on an open field, respectively(20) Another cross-sectional research conducted in , Ethiopia revealed, 55% of the participants reused pesticide containers for keeping food and water in the home, and 38% of the study participants did not follow directions while applying pesticides(5)

2.4.5. Farmers' Sanitation Behavior after Holding Pesticides

According to a study conducted in rural Kano state, Nigeria, 70.4% of people wash their hands with soap and water after using pesticides, while 25.4% said they merely use water(44).

The study was conducted in Ethiopia's south Gondar zone's Fogera district of those who respondents, 187 (43.5%) said they changed their clothing after applying pesticides, and 175 (40.7%) indicated they would take a shower afterward(19).

2.4.6. The Environmental Weather Conditions

The study conducted in the USA shows that climate also affects herbicide, insecticide, and fungicide use by altering their effectiveness and persistence. Establish that temperature rises can decrease persistence and, as a result, increase the needed number of applications(45).

The study conducted in China shows Pesticide moves away from the target plants, resulting in environmental pollution. Such chemical residues impact human health through environmental and food contamination(16). As the study shows in the absence of moisture, the desired effects of some pesticides are significantly reduced, making them less effective in controlling target pests. Herbicides applied during drought lose effectiveness and result in non-target movement that affects other plants or negatively impacts nearby bodies of water, resulting in the potential for community and environmental degradation(45).

A cross-sectional study in Fogera district south Gondar zone, Ethiopia shows three hundred (69.8%) of the participants too care of weather conditions while spraying and dry place (19).

Conclusion

Pesticide occupational exposure among rural farmers is a major public health concern that requires quick attention. People are at a higher risk due to a combination of variables such as a lack of training, poor PPE use, economic status, cultural attitudes, and environmental circumstances, all of which contribute to the increased risk experienced by these individuals. Addressing these challenges requires targeted education, improved access to protective equipment, and strong regulatory frameworks to protect rural farmers' health and promote sustainable agricultural practices.

2. 3. Conceptual framework

A conceptual framework helps to visualize the relationship between various factors that influence pesticide occupational exposure among rural farmers. This framework can guide research and interventions aimed at reducing and improving health outcomes. This conceptual framework is adapted from different previous literature conducted on occupational pesticide exposure and associated risk factors of pesticide exposure among rural farmers(8,20,36,46),

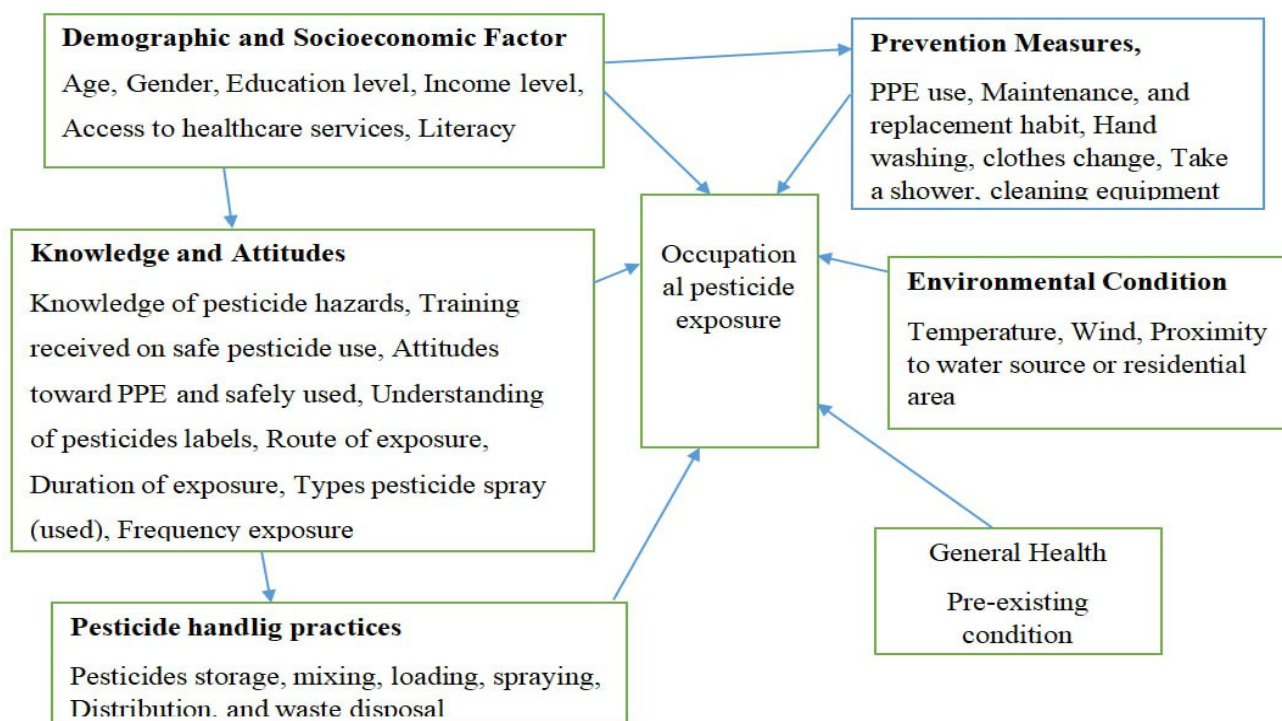


Figure 1: The conceptual frame work, of occupational pesticide exposure and associated factors pesticide exposures among rural farmers of Dawo district

Sources: Adapted after reviewing different literature on lead exposure(48–50)

3. Objective

3.1. General Objective

- To assess occupational pesticide exposure and associated factors among rural farmers of Dawo district, South West Shewa, Oromia, Ethiopia, 2025.

3.2. Specific objective

- To assess the magnitude of occupational exposure to pesticides among rural farmers of Dawo (51)district, South West Shewa, Oromia, Ethiopia, 2025.
- To identify the associated factors of pesticide exposure in Dawo district, South West Shewa, Oromia, Ethiopia, 2025.

4. 2. Study Design and Period

A community-based cross-sectional study was conducted from February 15, March 30, 2025.

4.3. Population

4.3.1. Source population

All farmers who live in the Dawo district during data collection

4.3.2. Study population

All farmers residing in the selected kebeles during the data collection period were included. In households with more than one applicator, one was randomly selected using a lottery method.

4.4. Inclusion and Exclusion Criteria

4.4.1. Inclusion criteria

Farmers living and working in the selected kebeles, aged 18 years and above, were willing to participate actively in farming activities

4.4.2. Exclusion

Uncooperative farmers, not willing to give consent, and unable to communicate, were excluded

4.5. Sample Size Determination

The sample size was estimated using a single population proportion formula considering 24% of the prevalence of pesticide usage among rural farmers from a study conducted in Fogera district Amhara region, Ethiopia(19) and determined based on the following assumptions: 95% confidence level, margin error (5%), design effect (1.5)(because of a design effect of 1.5 is a practical and conservative estimate that balances the need for accuracy and feasibility in many research contexts), and non-response rate (NRR) of 10. Ultimately, 462 was the sample size. The proportion of pesticide utilization (from a previous study done in Fogera district, Amhara region) =0.24. n=sample size, margin of error (E) =0.05, Design of effect (DE) = 1.5, non-response rate (NRR) =0.10, Z-score for a 95% confidence level=1.96 and g= design effect (1.5)

$$n = \frac{(z_{1-\alpha/2})^2 P (1-p)}{d^2} \times g, \quad n = \frac{(1.96)^2 0.24(1-0.24)}{0.05^2} \times 1.5 = 420$$

Therefore, the calculated sample size is 420, and 10% of NRR is used. Thus, the final sample size is 462.

Table 1: sample size determination for the occupational pesticide exposure and associated factors of pesticide exposure among rural farmers of Dawo districts, South West Shewa, Oromia, Ethiopia, 2024

Factors											
S.no		Ratio	Power	Confidence level	Odd Ratio	Design effect	non-responder rate	Proportion of outcome		Sample size	References
1	Access of PPE (Yes as non-exposed, no as exposed)	1:1	80 %	95 %	2.71	1.5	10%	Non-exposed 23	Exposed 47	274	(19)
2	Knowledge Having good of Safety practices of pesticide use (yes as non-exposed no as e	1:1	80	95	5.95	1.5	10	24.99	63.3	89	
3	Attitude towards pesticide handling and storage practice	1:1	1	95	2.1	1.5	10	27.9	44.8	455	(40)
4	Education Certificate and above	1:1	80	95	9.8	1.5	10	15.1	63.6	63	

The sample size for the second objective was also calculated using Epi info version 7.2.6.0. The calculated sample size for the first objective was 462, and for the second objective, it was 455. The calculated sample size for the first objective was greater than that for the second objective. Therefore, the final size for this study is 462 (n=462).

3.6. Sampling procedures

Dawo district has 2 urban and 22 rural kebeles. From 22 rural kebeles in the district, eight kebeles was selected using a simple random sampling method. The sample was allocated proportionally to the number of households in each of the selected kebeles. To select the study household from each selected kebeles, systematic random sampling was used through k^{th} interval ($k=20$), to determine the starter household, lottery method was used. From each contacted household, an eligible pesticide applicator (age >18 years who can properly communicate) was interviewed. If there were more than one pesticide applicator in the household, we a randomly selected using a lottery method. The family folder at the kebeles level is used as a sampling frame to select households. The procedure was continued until the final sample size was obtained.

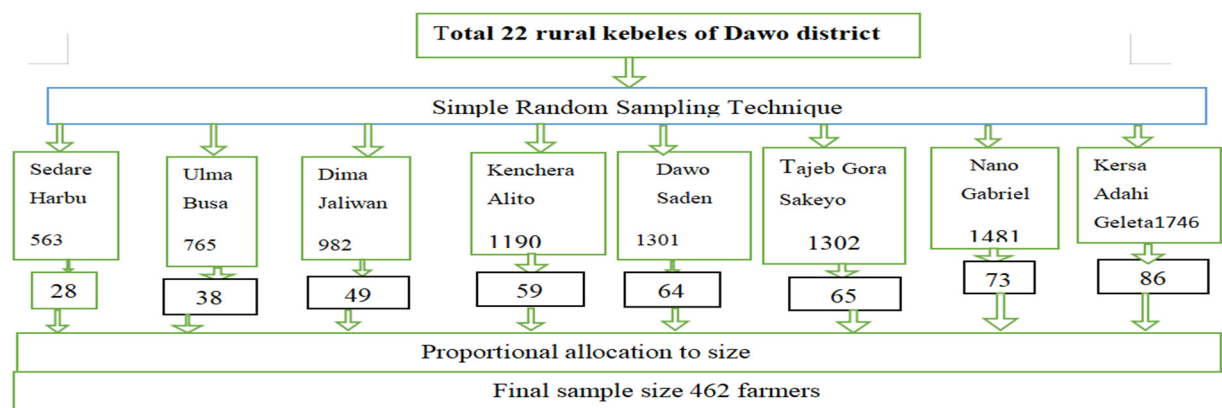


Figure 3. Schematic presentation of sampling procedure on pesticide utilization, occupational exposure, and associated factors among rural farmers of Dawo districts, 2025.

4.7. Data collection procedure

Data collected from those family members who have experience with pesticide application. The data were collected using structured questionnaire adapted from different relevant literature with required modifications based on the objectives of the study and fit to the local context (8, 10, 36, and 46). The questionnaire was designed to gather data on socio-demographic traits, occupational pesticide exposure, and associated risk factors. The tool was primarily prepared in English and translated into Afan Oromo (the commonly used language), and later on translated back to English. To collect the data, eight data collectors who spoke Afan Oromo and held at least a diploma in health or agricultural extension were selected from the district's health facilities and agricultural extension services. Data collection was supervised by three health officers. Data was gathered and recorded using the Kobo Collect application on Android devices, which allowed data collectors to submitted information to a central server and save it when the connection was interrupted.

4. 8. Study Variables

4.7.1. Dependent Variables

Occupational pesticide exposure

4.7.2. Independent variables

- Sociodemographic factors: sex, Age, Marital status, family size, Educational status, Monthly income, community-based health insurance
- Training and Knowledge
- Personal protective equipment
- Pesticide Mixing, storage, Disposal of empty pesticide containers
- Sanitation and hygiene
- Wind direction

9. Operational definition

Occupational pesticide exposure knowledge. The respondents who scored less than or equal to the mean value of the responses for 13 pesticide exposure knowledge-related questions were considered as having a “poor level of knowledge.” Scores more than the mean value were considered as having a “good level of knowledge. Each correct answer was given a score of 1, and

a score of 0 for no correct response. Based on the scores, the total knowledge score was calculated(38),(20)".

Occupational pesticide exposure _(Inhalation, ingestion, dermal observation of during agricultural activities such as mixing, loading, spraying, transportation, application of pesticide, and handling treated crops)in the absence of personal protective equipment(3,18)

Unexposed -participants who did not exposed to pesticides during mixing, loading, Spraying, and handling pesticides

Personal Protective equipment use- any clothes, materials or devices that provide protection from pesticide exposure during handling and application(3).

Pesticides used-pesticides used among the farmers currently sprayed

4.10. Data quality assurance

To ensure the quality of the data, the English language of the questionnaire was translated from English to Afaan Oromo and back again to English to confirm the correctness and consistency of the translation. A pretest was conducted on 23 farmers (5% of the total sample size) at Maket Santar, which was not included in the actual sample size, to assess clarity, length, and completeness. Corrections were made to skip patterns, and difficult questions were rephrased.

This was allowed for error correction, time estimation, and any necessary adjustments to improve the tool's quality. Data collectors and supervisors were getting three days of training on the study's purpose, tool, confidentiality, data-gathering instruments, and general protocols. During the data collecting process, data collectors verified that the questionnaire was complete and took appropriate action to address any missing information. The supervisors were conducting on-site supervision during the period of data collection and checking the completeness of the questionnaires daily. The principal investigators was control the overall data collection process by physical contact and phone calls. Finally, the data was checked during coding and data input, as well as cross-checked prior to analysis.

4.11. Data entering and analysis

Descriptive analysis: mean and standard deviation were used for age, average monthly family income, and duration of participation in farming activities. Data were collected using Kobo Collect and exported to SPSS version 25 for further analysis. Multi-collinearity was checked using the Variance Inflation Factors (VIF) test to avoid highly correlated variables (VIF<10 was included for further analysis). Hosmer and Lemeshow test was used to test model fitness. The completed

questionnaires was collected on a daily bases to check for its consistency and completeness. For further analysis, the descriptive data, such as frequencies, percentages, and means were computed and reported. Then, a bivariate binary logistic regression analysis was done to evaluate the relationship between the result variable and the independent factors. All independent variables with a P value of less than 0.25 in the bi-variable binary logistic regression analysis were chosen for the multi-variable logistic regression model utilizing a backward stepwise model-building method. Multiple logistic regression analysis was used to determine the independent variable(s) that have a significant relationship with the outcome variable. Finally, factors with a p-value less than 0.05 and a 95% confidence interval (CI) in the multi-variable logistic regression model was evaluated as having a statistically significant connection with the outcome of interest. Finally, to evaluate the association between the outcome variable, and each independent variable, both the crude odds ratio (COR) and adjusted odds ratio (AOR) with 95% confidence intervals was be reported.

4. 12. Ethical consideration

The SPHMMC Institutional Review Board was provided ethical clearance before the start of the study. Then the letter was written to the Dawo district, South West Shewa Zonal Health Department, and Health Offices for data collection. A permission letter was provided for the administration units of the selected kebeles. The study participants were fully informed about the study's goal, risks, benefits, data-collecting technique, and study. Following that, their desire to cooperate was checked through formal communication before asking questions based on the checklist. Respondent names were not be mentioned in the data-gathering tool. The collected data was only accessible to individuals participating in the inquiry, who was enter all of the data and save the electronic spreadsheet with a password. Furthermore, participation was based on the farmers' willingness.

4.13. Result Dissemination

The result will be submitted to the SPHMMC School of public health department of epidemiology. It will be submitted to ministry of health, Oromia regional health bureau, South West Shewa Zonal health department and Dawo district health offices. The principal investigator will work on the report in an effort to publish the results in a peer reviewed journal and will present them at scientific conferences.

5. Results

5.1. Socio-demographic Characteristics and Economic Status

Out of 462 farmers, 453 voluntarily participated in the study, with a response rate of 98%. 398 (87.8%) participants were males and, 238 (52.7%) were falls in the age range of 45-60 years old with a mean age of 44.3 and a Standard Deviation (SD) of ± 9.9 years. The majority, 400 (88.3%) of the study participants were married, while 16 (3.5%) were widowed. According to the current study, more than half (52.1%) of the study participants attended primary education and only, 72 (15.9%) attended grade nine and above. As of the current study, more than three-fourths (76.2%) of study participants have a family size of 4-6 in their home. Moreover, the current study provided that nearly three-fourths (72.6%) of the study participants fell in the monthly income quintal of 700-1700 ETB (Ethiopian Birr), while 8 (1.8%) earned below 700 ETB. Among the participants, 391 (86.3%) were member of Community-Based Health Insurance (CBHI).

Table 2: Socio-demographic characteristics of study participants in Dawo district, south west show, Oromia, Ethiopia 2025 (n= 453)

Variables		Frequency	Percent
Sex	Male	398	87.9
	Female	55	12.1
Age	18-30	44	9.7
	31 -45	156	34.4
	46-60	238	52.5
	>60	15	3.3
Marital status	Single	14	3.1
	Married	400	88.3
	Divorced	23	5.1
	Widowed	16	3.5
Family size	1-3	30	6.6
	4-6	345	76.2
	>6	78	17.2
Educational status	No formal education	143	31.6
	Primary	236	52.1
	Secondary	55	12.1
	College and above	19	4.2
Farmers monthly income	<700	8	1.8
	700-1700	329	72.6
	1701 – 2700	92	20.3
	>2700	24	5.3
Is head of member CBHI member	Yes	391	86.3
	No	62	13.7

5.2. Magnitude of pesticide exposure

The overall prevalence of occupational pesticide exposure among farmers was 347 (76.6%), with 95% CI of (72.6 – 80.6).

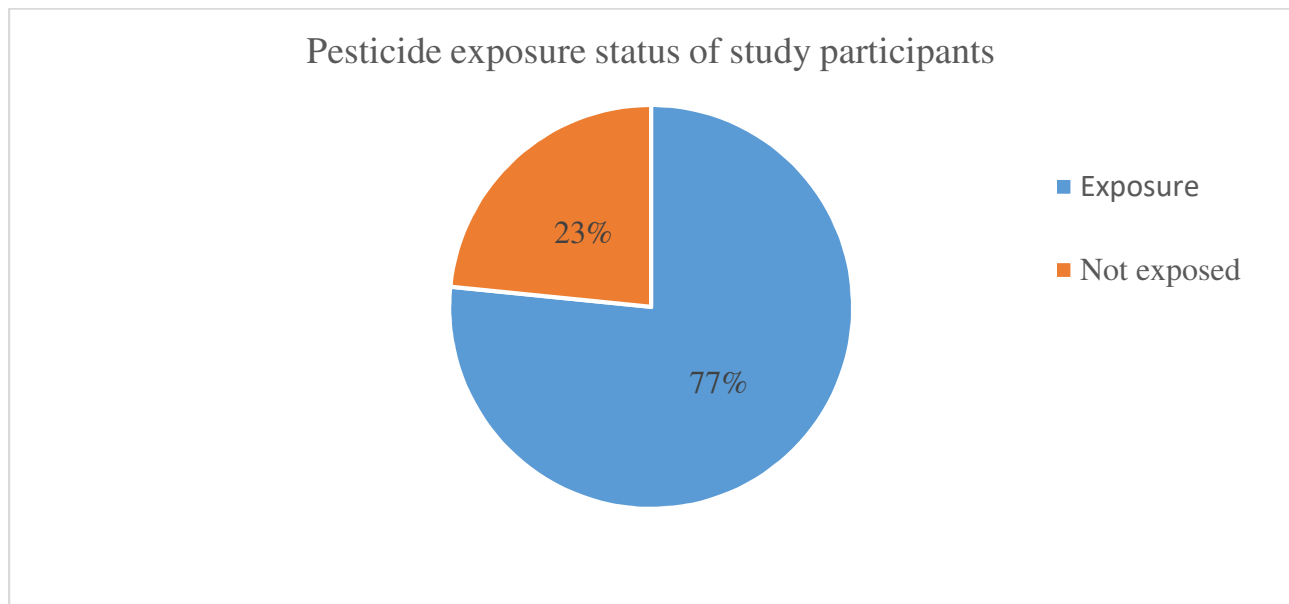


Figure 4-Pesticide exposure status of study participants in Dawo district, south west show, Oromia, Ethiopia 2025

5.3. Types Pesticides used and WHO toxicity Class

Herbicides, fungicides, and insecticides were the most frequently reported types of pesticides used by agricultural workers in the study area. The majority of participants applied chemical herbicides for weed control. Specifically, 345(76.2%) participants used 2,4-D, a moderately hazardous herbicide, while 340 (75%) used Granstar, classified as slightly hazardous. Additionally, 270 participants (59.6%) reported using Mancozeb (a fungicide), and 250 (55.2%) used Karate (an insecticide). Both Mancozeb and Karate are categorized as hazardous pesticides under WHO Class II.) Moderately hazardous. According to the WHO classification, 56.4% of the reported a moderately hazardous (Class II), 24% were slightly hazardous (Class III), and 13.3% were unlikely to present an acute. 56.4% pesticides used were reported as probably carcinogenic Group 2A (strong evidence that it causes cancer in humans, but not yet conclusive, and 24% possibly carcinogenic (Group 2B) (evidence some suggest it can cause cancer in humans, but not yet conclusive)

Table: 3 Types of chemical pesticide used in Dawo district, south west Shewa, Oromia, Ethiopia 2025

Types Pesticide	Chemical	Frequency	%	Toxicity
Herbicide	Dichlorophenoxyacetic (2,4-D)	345	76.2	Moderately
	Granstar 75 DF (tribenuron methyl)	340	75	Slightly
	(Roundup 36 SL) (Glyphosate)	293	64.5	Moderate
	Pallas 45 OD (Pyroxsulam)	150	26	Moderate
	Richway 750 WDG (Tribenuron Methyl)	50	11	III slightly
	Redstar	44	9.7	Moderate
	Ambassador	15	3.3	Moderate
	Topik 080 EC Clodinafop-propargy	14	14	Slightly
Fungicides	Mancozeb 80 WP (Mancozeb)	270	59.6	Non
	Matco (metalaxyl 8% + Mancozeb)	150	33	Highly
	Nativo SC 300 (trifloxystrobin 100 gm/lt + tebuconazole 200 gm/l)	90	26	Slightly
	Natura 250 EW (tebuconazole)	50	11	Non
	Tilt 250 EC (Propiconazole)	35	7.7	Slight
	Amistar Xt 280 SC (azoxystrobin 200 gm/lt +cyproconazole 80 gm/lt)	10	2.2	(moderate hazardous
	Karate 5% (lambda-cyhalotrin)	250	55.2	Moderate
	Ajanta 72%, (profenofos)	122	27	Moderate
Insecticide	Profit 72% EC (profenofos)	70	15.5	Moderately hazardous
	Malathion 50% EC	38	8	Slightly
	Confidence 350 SC*(Imidacloprid)	26	5.8	Moderately hazardous
	Hunter 40 EC	22	4.9	Moderate
	Farrate (lambda -Cyhalothrin)	15	3.3	Moderate
				hazourdous

More than half of the pesticides used were classified as Class II (moderately hazardous), accounting for 56.4%, while only 6.2% were categorized as Class I (highly hazardous)."

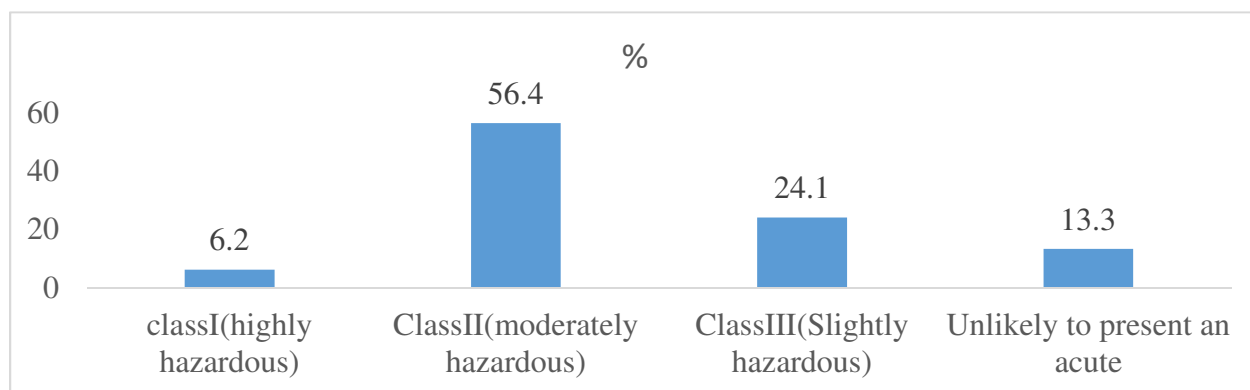


Figure 5: WHO Toxicity classification of pesticides in Dawo district, south west show, Oromia, Ethiopia 2025.

This study found that headache was the most common health symptom perceived, affecting 70(15.5%), skin irritation 58(12.8%) and the least health problem perceived was liver disease.

The study identified headache as the most commonly perceived health symptom, reported by 70 participants (15.5%), and followed by skin irritation with 58 cases (12.8%). Liver disease was the least reported health issue.

Table: 4 perceived of Sign and symptoms (self-report) of pesticide on Applicators in Dawo district, South West Show, Oromia, Ethiopia 2025

Sign and symptom	frequency	%
vomiting and nausea	23	5
Headache	70	15.5
Skin Irritation	58	12.8
Eye Irritation	10	2.2
Dizziness	3	0.7
Abdominal cramp	9	2
Blurred vision	6	1.3
Coughing	8	1.8
Chest pain	5	6.2
Asthma	28	6.2
Diabetes	16	3.5
Cardiovascular	7	1.5
Kidney diseases	12	2.6
Liver diseases	3	0.7
	257	4

5.4. Training and knowledge

Of the 453 study participants, 105 (23.2%) had received training on pesticide application techniques, while only 50 (11.0%) had been trained on the associated health risks and safe usage practices. Additionally, 124 (27.4%) study respondents reported that they had read, understood, and adhered to the instructions provided on pesticide labels. On the other hand, more than half (57.4%) of current study participants have knowledge about pesticides.

Table 5: Training and knowledge of pesticide on Applicators and Residents in Dawo district, south west show, Oromia, Ethiopia 2025

Variable	Option	Occupational status	
		Frequency	%
Do you train about Pesticide	Yes	155	(34.2)
	No	298	(65.8)
Training about pesticide?	On how to use pesticide	103	22.7
	on health risks of pesticides	32	7
Do you understand Pesticide labeling?	On health and safety	20	4.4
	Yes	124	27.4
	No	329 (53.4)	72.6

5. Personal Protective Equipment

The appropriate use of personal protective Equipment (PPE) and the adoption of measures and attitudes during the preparation and application of pesticides are important in reducing occupational exposure to pesticides. The implementation of personal protective equipment (PPE) and safety tools among participants was varied and generally low. 75(16.6%) participants were reported used face mask, gloves 17(3.8%), rubber boots 14(3.0%), hats 11(2.43%), and coveralls 11(2.43%) were used.

Table 6: Association between instruction followed and applying preventive measures among pesticide applicators and Residents in Dawo district, South West Show, Oromia, Ethiopia, 2025

Variable	Option	Occupational exposure status	
		Frequency	%
Read and follow the label instructions on pesticide containers	Yes	124	27.4
	No	329	72.6
Use face mask	Yes	75	16.6
	No	378	83.4
Google safety	Yes	9	1.99
	No	444	98

Use glove	Yes	17	3.8
	No	436	96.2
Use rubber boots	Yes	14	3
	No	439	96.9
Use coveralls	Yes	11	2.4
	No	442	97.6
Hat	Yes	11	2.4
	No	442	97.6
Personnel Hygiene practice	Wash hands only by H2O	37	8.2
	Wash hands with soap	308	68
	Taking shower	30	6.6
	Changing Clothes	38	8.4
	Never	40	35.3
	Visited health facility	215	47.5
	Intervention taken when experienced a symptom presumably due to pesticide exposure		
	home-based care	74	16.3
	Did not take any action	164	36.2

5.6. Farmers' Sanitation and Hygiene Behavior after Holding Pesticides

Regarding sanitation and hygiene practices, 308 (70%) of respondents reported washing their hands with soap after pesticide application. However, only 38(8.4%) and 37(8.2%) of participants changed their clothes and washed their hands only by water following application, respectively. Only 30 (6.6%) participants reported taking a shower after pesticide application, while 40(8.8%) individuals did not engage in any form of sanitation or hygiene practice. These findings suggest that while basic hygiene practices like hand washing are relatively common, more comprehensive

5.7. Pesticide Mixing, Storage and Disposal: Empty Pesticide Container and Management

Among the current study participants, over three-fourths (78.4%) reported using a stick to mix pesticides, while 313 individuals (69.1%) prepared the mixture near a water source. These practices reflect common handling behaviors, though mixing pesticides close to water bodies may pose environmental and health risks due to potential contamination. A total of 179 participants (39.5%) stored pesticides in their living rooms, and 194 (42.8%) kept spraying equipment inside the household, indicating a prevalent trend of in-home storage for pesticide-related materials. Farmers frequently use different practices to dispose of empty containers; 113 (32.6%) respondents left empty pesticide containers on the ground; 44.4% of respondents re-used them for household purposes such as storing food products, carrying water, purchasing kerosene, selling them at local

markets with the assumption that once thoroughly washed with soap and water, they did not harm people, and 22 (6.3%) of respondents buried in the empty container within their farm. These practices reflect widespread misconceptions and pose significant health and environmental risks.

Table: 7 Pesticide Mixing, Storage and Disposal Empty Pesticide Container and Management in Dawo district, south west show, Oromia, Ethiopia 2025

Variable	Option	Applicators Frequency	%
Method of mixing pesticides	By manual	82	18
	By stick	355	78.4
	By joke	21	4.6
Place mix pesticides	In the house	53	11.7
	Near water body	313	69
	At spraying area	87	19.2
Place of storing pesticide	Any place in the leaving room	179	39.5
	Stored with other materials	119	26.3
	In the kitchen	13	2.9
	Stored with other materials	119	26.3
Place storing spray equipment	Store in the household	194	42.8
	Stored in separate place	118	26
	Hanging on the wall	141	31
What you do with empty containers of pesticide	Sell to others	35	7.7
	Burn	31	6.8
	Burying	25	5.5
	Dump on the field	155	34.2
	Used storing food and H2O	218	48.1
Prefer time to spray	Morning	276	60.9
	Mid-day	37	8.2
	Afternoon	89	19.6
	Any time	51	11.3
Follow wind direction	Yes	149	32.9
	No	304	67.1

5.8. The Environmental Conditions

This study showed timing of spray pesticide among participants was varied. A majority 276 (60.9%) reported applying spray in the morning, 89(19.6%) afternoon, 37(8.2%) mid-day and 51(11.3%) at any time. As study revealed that approximately one-third of participants (37.3%) actively considered wind direction when applying pesticide.

5.9. Pesticide use, exposure, and Risk Conditions

A significant majority of respondents, 344 (75.9%) individuals, had been applying pesticides for 10 years or more, indicating prolonged and potentially high-risk occupational exposure. Of the study participants, 423 (93.4%) reported that pesticide use increases annually, indicating a clear upward trend over time. The average duration of a single pesticide application was approximately 40 minutes, with an average frequency of 5.4 times per month, suggesting regular and sustained exposure. A total of 22 (4.9%) participants reported engaging in eating and drinking during pesticide application, behaviors that may increase the risk of direct ingestion or inhalation of toxic substances. Only 50 (11%) respondents were aware that pesticide residues can persist in water, food, air, and soil, indicating a low level of environmental health awareness among the study population. Among the study participants, 241 (53.2%) experienced pesticide splash incidents during mixing and application, resulting in frequent direct contact with hazardous chemicals.

5.10. Factors Associated occupational exposure status of farmers

The association of dependent and independent variables were explored by bi-variables and multi-variable logistic regression. In the bivariate logistic regression analysis the following variables showed a statistically significant associated ($p < 0.25$) with occupational pesticide exposure were therefore included in the multivariable logistic regression model: sex, knowledge of pesticides by name, pesticide formulation used, health effects of pesticides on humans, pesticide doses used, routes of pesticide exposure, pesticide effects on the environment, places of pesticide mixing, preferred times to spray, wearing PPE when cleaning pesticide equipment, washing spray tanks, regular maintenance of sprayer tanks, following wind direction during pesticide use, places for storing spraying equipment, experiencing signs and symptoms after application, interventions when signs and symptoms are experienced, types of PPE used, and training on pesticide safety measure.

5.10.1. Bi-variable Logistic Regression

Table: 8: Bi-variable Logistic regression analysis Factors affecting occupational exposure status of farmers in Dawo district, south West Show, Oromia, Ethiopia 2025

Variable	Option	Yes, (%)	No (%)	P. value	COR (95% CI)
Sex	Male	311 (68.7)	87 (19.2)	0.04	1.9 (1.03-3.45)
	Female	36 (7.9)	19 (4.2)		1
	1-3	25 (5.5)	5 (1.1)	0.093	0.4 (0.14-1.16)
	4-6	270 (59.6)	75 (16.6)	0.032	0.6 (0.33 – 0.95)
	>6	52 (11.5)	26 (5.7)		
Knowledge status	Knowledgeable	216 (47.7)	44 (9.7)	0.025	1
	Not knowledgeable	131 (28.9)	62 (13.7)		2.3(1.49 – 3.62)
Knowledge of health effects of pesticide on a human	Yes	271(78)	20(19)	.000	1
	No	76(22)	86(81)		15.33(8.855-26.5)
Knowledge of pesticide doses used	Yes	193(55.6)	17(16)	.000	1
	No	154(44.4)	89(84)		6.56(3.75-11.49)
Knowledge of route pesticide exposure	Yes	262(75.5)	65(61)	.007	1
	No	85(24.5)	41(38.9)		1.94(1.23 -3.08)
Knowledge of pesticide-related environmental risks	Yes	157(45.2)	38(35.8)	.088	1
	No	190(54.8)	68(64.2)		1.48(.94 -2.32)
Use of personal protective equipment (PPE) by Farmers	Yes	127(36.6)	10(9.4)	.000	1
	No	220(63.4)	96(90.6)		5.5(2.788—11)
Do received Pesticide health risk training?	No	278(80.1)	20 (18.9)		17.3(9.96-30.13)
	Yes	69(19.9)	86(81%)	.059	1
Self-reported acute pesticide poisoning experience	Yes	157(45.2)	16(15)	.000	14130/3040/
	No	190(54.8)	90(85)		4.64(2.62-8.24)
Follow the wind direction	Yes	136(30.0)	13 (2.9)	.000	4.61 (2.48 – 8.56)
	No	211(46.6)	93(20)		2743
Do you wear PPE When cleaning your pesticide equipment(1)	Yes	120	25	.035	1
	No	227	81		1.713(1.039--2.824)
Did have any Pesticide incidents?(1	Yes	194	47	.037	1.592(1.027-2.466)
	No	153	59		1
Prefer time to spray	Morning	233(67)	43(40.6)	.000	1
	Mid –day	20(5.8)	17(16)	.000	4.6(2.23-9.49)
	After noon	78(22.5)	11(10.4)	.458	.764(.376-1.56)
	Any time	16(4.6)	35(33)	.000	11.9(6.04-23.28)
Intervention taken when experienced a symptom	Visited health facility	178(51.3)	37(34.9)	00	1
	home-based care	62(17.9)	12(11.3)	.844	.931(.457-1.89)
	Did not take any action	107(30.8)	57(53.7)	.000	2.56(1.58-4.13)
Where do you store pesticides?	Any place in the leaving room	104(29.97)	75(70.8)	39.5 .000	1

Method of mixing pesticides	Stored with other materials	101(29)	18(16.98) 26.3		.000	.247(.1.38-.443)
	In the kitchen	7(2.02)	6(5.7)	2.9	.764	1.189(3.84-3.68)
	Stored in separate	135(38.9)	7(6.6)	31.3	.000	0.72(.32-.163)
	By manual	55(15)	27(25.5)	18.1	.025	
	By stick	282(81)	73(68.9)	78.4	.017	527(.311-.894)
	By joke	10(4.3)	6(5.7)	4.6	.724	1.22(.402-3.716)

Multivariable Logistic Regression

Variables that showed a p-value less than 0.25 in the bivariate logistic regression were entered into the multivariable logistic regression model to identify independent predictors of occupational pesticide exposure. After adjusting for potential confounder, the following factors remained significantly associated ($p < 0.05$) with occupational pesticide exposure: Knowledge of knowing about pesticides, health effects of pesticides on humans, pesticide doses used, routes of pesticide exposure, pesticide effects on the environment, not using personal protective equipment (PPE), Training on Pesticide Safety, Acute perceived health after application, and Failure of following wind direction when using pesticides.

Table: 9 Multivariable Logistic regression analysis factors affecting occupational exposure status of farmers in Dawo district, South West Show, Oromia, Ethiopia 2025

Variable	Option	Occupational exposure status		AOR (95% CI)	P.Value
		Yes	No (%)		
Knowledge status	Knowledgeable	216 (47.7)	44 (9.7)	1	
	Not knowledgeable	131 (28.9)	62 (13.7)	2.00(1.147-3.56)	.015
Knowledge of health effects of pesticide on a human	Yes	271(78)	20(19)	1	
	No	76(22)	86(81)	14.53(7.95-26.56)	0.000
Knowledge of pesticide doses used	Yes	193(55.6)	17(16)	1	
	No	154(44.4)	89(84)	5.46(2.86-10.41)	0.000
Knowledge of route pesticide exposure	Yes	262(75.5)	65(61)	1	
	No	85(24.5)	41(38.9)	2.09(1.13-3.89)	.020
Knowledge of pesticide effect on environment	Yes	157(45.2)	38(35.8)	1	
	No	190(54.8)	68(64.2)	2.14(1.18-3.88)	.012
Using personal protective equipment (PPE)		127(36.6)	10(9.4)	1	
	Yes				
Training of farmers about the health risk of pesticides)	No	220(63.)	96(90.6)	3.51(1.1-10.9)	0.034
	Yes	278(80.1)	20 (18.9)	1	0.000
		69(19.9)	86(81%)	14.12(8.3---25.2)	

Experience of poisoning among farmers)self-report	Yes	157(45.2)	16(15)	1	0.009
	No	190(54.8)	90(85)	4.00(1.4-11.33)	
Follow the wind direction	Yes	136(30)	13 (2.9)		0.000
	No	211 (46.6)	93(20.5)	(4.92 (2.50 – 9.29)	

Key: **= $p < 0.001$ highly significant, *= $p < 0.05$ significant, and 1 = reference

6. Discussion

Occupational pesticide exposure remains a pressing global health concern, particularly in agricultural communities where protective measures are often limited(20). Numerous studies have highlighted the widespread nature of this issue and its association with serious health risks, including. Our study contributes valuable insight by assessing the prevalence of occupational pesticide exposure among agricultural workers in Dawo district. We found a prevalence rate of 76.6%, which, while lower than the 87.2% reported in Western Ethiopia, may reflect differences in sample size and study design(51). This figure aligns closely with findings from rural India (74%)(4) and is slightly lower than the rate observed in Northern Thailand (83%), potentially due to technological advancements and improved awareness over time(52). These comparisons reinforce the global urgency for targeted interventions to mitigate pesticide-related health risks.

This study found that a lack of pesticide safety training increased the odds of occupational exposure 14-fold, a much stronger effect than a prior North eastern Ethiopian(25) study (2.07 times risk) and Nepal(53) (5.6 times risk) that linked training to improved safety practices. This discrepancy highlights a critical distinction: while training is essential for improving general practices, its most powerful and non-negotiable protective effect is in preventing the severe outcome of direct exposure itself. This implies that comprehensive safety training is an exceptionally effective and urgent intervention for preventing serious health harm to agricultural workers.

This study found that farmers lacking knowledge about pesticides were 2.02 times more likely to experience occupational pesticide exposure compared to their knowledgeable counterparts. This finding is strongly consistent with previous research in similar settings, which reported (AOR of 1.54-fold in the East Hararghe Zone(20) and a 4.18-fold increased likelihood in South West Ethiopia((36). This implies there is an urgent need for continuous educational programs targeted at farmers. Training in safe pesticide handling, the use of affordable PPE, and first-aid measures. Agricultural and health regulatory bodies should collaborate to strengthen extension services and mandate certified training for farmers purchasing and using classified pesticides.

This study demonstrates that inadequate knowledge of pesticide dosage significantly increases the odds of occupational exposure by 5.46 times, a finding that substantiates and intensifies the association 3-fold increase in risk reported in a prior U.S.A study(54). The heightened effect size suggests contextual severity, potentially due to the use of more toxic compounds or weaker safety

protocols, thereby transforming dosage mastery from a mere technicality into a fundamental pillar of exposure prevention. This implies that effective risk mitigation demands interventions precisely tailored to local practices and specific chemical hazards.

This finding showed that farmers who lack knowledge about the health effects of pesticides on humans are 14.5 times more likely to experience occupational pesticide exposure than those who are informed. The risk is significantly higher than in other countries—Thailand (55) reported a 1.37-fold increase, and Malaysia(56) a 3.83-fold risk, suggesting a consistent link between health knowledge and exposure across agricultural settings, though severity varies with local practices, regulations, and training access. This strong association reveals a major gap in health literacy and calls for targeted educational interventions.

This study revealed that rural farmers who lack knowledge about the environmental effects of pesticides were 2.14 times more likely to experience occupational exposure than those who are informed. This suggests that environmental awareness may influence safer handling practices, indirectly reducing exposure risk. Interestingly, this finding contrasts with data from Northwest Ethiopia(57), where environmental knowledge showed a protective effect with an odds ratio of 0.54, indicating that informed farmers were significantly less likely to be exposed. This contrast highlights the variability in how environmental awareness translates into behavior across regions. The implication is clear: raising environmental awareness alone is not enough—it must be paired with hands-on education, access to protective equipment, and community-level engagement to effectively reduce occupational pesticide exposure.

This study revealed that rural farmers with occupational pesticide exposure were four times more likely to report acute health symptoms (AOR = 4.00), aligning with global research on pesticide-related health risks. This elevated risk mirrors findings from Nepal(38) (2.2-fold) and Bhutan(58) (1.08-fold). Though risk levels vary due to differences in pesticide types, usage methods, PPE access, and study design, the direction of association confirms a clear link between exposure and acute health effects. These findings call for culturally tailored IPM training, affordable PPE distribution, and community-based support systems to promote safe practices. Without such interventions, farmers remain exposed to serious and preventable health risks

Our study found that individuals who failed to use personal protective equipment (PPE) were 3.5 times more likely to experience occupational exposure compared to those who used PPE appropriately. These findings align with a similar study conducted in Los Angeles(59), which

reported that failure to use PPE was associated with 1.57 times increased risk of exposure, and a study in Indonesia(60) found that non-use of PPE was a 1.14 times risk factor for health problems. The higher odds ratio in our study might be due to factors such as education level or socioeconomic status, which may influence PPE usage and risk perception.

In our show that study, failure to follow wind direction during pesticide application was significantly associated with a 4.9-fold increase in the odds of occupational exposure. This finding aligns with previous studies 1.86-fold increase reported in Zuway Dugda District of Arsi Zone(61), and a markedly higher 21.423-fold increase in Quara District, west Gondar(62). These variations may reflect differences in pesticide types, application methods, or environmental conditions. The consistent association across studies underscores the critical importance of wind direction awareness. Ensuring proper spraying techniques is a simple yet powerful intervention to reduce direct exposure and protect worker health.

Strength and limitation of the study

Strength

The study's key strengths included the adaptation of validated questionnaires from prior research and the use of interviews and administered questionnaires, which enhanced data validity and minimized recall bias.

Limitation

This study relied on self-reported data, which may be subject to recall bias or social desirability bias. Additionally, the cross-sectional design limits causal inference. Future longitudinal studies could provide deeper insights into behavioral change over time

7. Conclusion

The prevalence of this study showed that higher prevalence of occupational pesticide exposure. Farmers' exposure to pesticides is strongly influenced by gaps in knowledge, lack of training, and unsafe practices. Understanding of health risks, dosing, exposure routes, and environmental impact significantly increases vulnerability. Behavioral factors, such as not using protective equipment and ignoring wind direction. Together, these elements contribute to a heightened likelihood of pesticide exposure in farming communities.

8. Recommendation

Health Sector

- Introduce targeted awareness campaigns on the health risks of pesticide exposure.

- Strengthen poison control services and ensure timely reporting and treatment of pesticide-related illnesses.
- Integrate pesticide safety education into routine health outreach, especially in rural areas.
- Establish surveillance systems to monitor cases of pesticide poisoning and track PPE safety
- Train healthcare workers to recognize symptoms of acute pesticide poisoning.

Agricultural Sector

- Provide regular, hands-on training for farmers on safe pesticide use, correct dosing (chemical ingredient), and environmental protection.
- Ensure access to protective equipment and enforce safety standards during pesticide application
- Promote integrated pest management (IPM) techniques to reduce reliance on chemical pesticides.
- Promote protective/Safe guard/ zones and safe disposal methods to reduce environmental Contamination

Community & Farmers

- Encourage peer-to-peer learning and local champions to model safe practices.
- Foster community dialogue on pesticide risks and alternatives.
- Adopt simple but effective behaviors—like checking wind direction before spraying, to reduce exposure.

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Annex I: Consent sheet

Title of the study- Occupational pesticide exposure and associated factors of pesticide exposure among rural farmers of Dawo district, Southwest zone, Oromia region, Ethiopia, 2025

My name is I am here on behalf of ----- of SPHMMC of health Science. They are conducting research on Occupational pesticide exposure and associated risk factors of pesticide exposure among rural farmers of the Dawo district, for the partial fulfillment of a master's in Field Epidemiology in SPHMMC. Before you decide whether or not to participate in this study, I would like to explain to you the purpose of the study, the procedure, any risks, benefits, and what is expected of you. Your participation in this study is entirely of your own free will. You are under no obligation to participate; you may choose to participate or not to participate. If you decide not to participate, no freedoms were taken away from you. If you agree to participate, you were asked to sign in the space provided below.

Purpose of the study

The purpose of this study is to assess Occupational pesticide exposure and associated factors of pesticide exposure among rural farmers of Dawo district

Procedure

After you have signed the informed consent form, and have a chance to ask questions, you were requested to answer questions asked by interviewers

Risks

No risks are involved apart from the use of your time for answering questions.

Benefits

Agreement to participate will not result in any immediate benefits to you. But by taking part in this study, you were able to provide true information that will help relevant health sector, communities, to give factors-oriented health education, authorities, and policymakers to come up with strategies and policies that will help to increase knowledge on occupational pesticide exposure among rural farmers and this was benefit the community at large.

Confidentiality

The information that you provide was confidential to the data collectors only and it was used for the purpose of this study only

Informed consent form

I have been aware of this research undertaking for a partial fulfillment of the MPH degree which is fully supported and coordinated by the SPHMMC of Health Science Department of Public Health and the designated principal investigator is **Tesfaye Dejene**. I have been fully informed in the language I understand about the purpose of this research. I have been informed that all the information I shall provide to the interviewer was kept confidential. I understood that the research has no risk and no composition. I have assured that the right to ask for information that is not clear about the research before and or during the research work and also taking part in this study is purely voluntary. I have read this form/ it has been read for me in the language I know and understood the condition stated above.

So, I am agreed to participate in this study.

Participants agree: Yes No

If yes sign_____ Time started _____Time Finished_____

Person to contact for problems or questions/ at any time for further explanation

Name of principal investigators: - Name _____ phone No: +2519 _____

Annex II: Data Collection tool

Name of Kebele _____

Questionnaire ID _____

Date of interview _____

Name of interviewer _____

Signature _____

Checked by: Name of supervisor _____

Table 5: Data collection tools for Occupational pesticide exposure and associated risk factors among rural farmers Dawo district, South West Shewa, Oromia, Ethiopia, 2025

Part: 1. Socio-Demographic Factors

1	Sex of respondents	1.Male 2.Female
2	Age in Years	_____
3	What is your current marital status	1.Married 2.Single 3.Divorced 4.Widowed
4	How many people living in the house	1.>5yrs 2.<5yrs
5	What is your Level of education	1.Not write and read 2.Primary 3.Secondary 4.College and above
6	How much of your monthly income in ETB?	1.Less than, 700 birrs 2. Between 700, and 1,700birrs 3.1700 between and 2,700 birrs 4.More than 2,700 birrs
7	Is head of this house a member of community health Insurance	1.Yes 2.No

Part: 2. Knowledge Related Question

10	What do you know about pesticides you spray? Respondent can select more than option	1.Its name only, 2.Function of pesticide,3.Heath effects 4.Environmental effect 5.Others
11	What type of pesticide formulation does the farm use?	1. Powder

		2.Liquid Spray,3. Granules
12	Do you think pesticides could affect human health?	1.Yes 2.No
13	Specify as many problems as you can	-----
14	Do you know the major environmental problems associated with pesticide use? If the respondent says No, go to Q 16.	1.Yes 2.No
15	Specify as many problems as you can	
16	What are your sources of information related to the health risks of pesticides? Respondent can tick more than one option	1.Health extension workers 2. Agricultural. extension workers 3.Model farmers 4.Mass media 5.Pesticide retailers 6.Other, specify
17	Do you understand pesticide labeling?	1.Yes 2.No
18	Do you know the doses of every pesticide you use?	1.Yes 2.No

Part: 3. Pesticide storage, Mixing, spraying, distribution, and disposal of empty pesticide carriers and pesticide practice

19	How do you mix pesticides?	1. Manual 2. Automated 3. Others (specify
20	What is the common time of spraying?	1. Early morning 2. Mid-day 3. Late afternoon
21	Where do you store pesticides?	1. Living room 2. store room with other materials 3. kitchen 4. 4.other -----
22	Where do you mix pesticides?	1. In the house 2. Near water bodies 3. At the spraying area 4. Other
23	Do you consider wind direction while mixing?	1. Yes 2. No

26	What are the types of currently used pesticides in your farmland?	_____
27	Do you wash the sprayer tank after the application?	1.Yes 2.No
28	Is the sprayer tank maintained regularly?	1.Yes 2.No
29	How do you dispose of the leftover pesticide? Respondents can select more than one option	1.Burn 2.Burly 3.Dump on the open field 4.Use for storage of food items 5.Use for storage of water 6.Specify Other----
30	What do you do with empty pesticide containers? Respondents can select more than one option	1.Burn 2.Burly 3.Dump on the open field 4.Use for storage of food items 5.Use for storage of water 6.Specify Other-----

Part: 4. pesticide use and exposure and Risk Condition

31	Do you take food, drink/smoke, during application time?	1. Yes 2. No
32	Did you have any pesticide incidents so far?	1.Yes 2.No
35	Are there any Pesticide residues present in the food we eat, the air we breathe, the water we drink, and the soil in the environment	1. Yes 2. No
36	Which pesticide do you use commonly?	1. Herbicides 2.Insecticides 3.Fungicides 4. Rodenticides 5.Other specify_____
37	For how many years have you used pesticides in your farmland?	1.<1years 2.1-5 years 3.5-9 years 4.Over 10 years

38	Over the past five years, the amount of pesticide products used on your farmland decreased, increased, or remained unchanged?	1.Decreasing 2.Increasing
39	On average, how long time does a pesticide application or spraying take?	1. In minute----?
40	How many times do you apply pesticides in a month?	2. Number---?

Part: 5. General health

42	Have you ever felt discomfort/illness after pesticide application?	1.Yes 2.No
43	If yes, to the above question, what was your feeling?	1.Nausea/ Vomiting 2. Headache 3. Skin irritation 4. Eye irritation 5. Dizziness 6. Abdominal cramp 7. Blurred vision 8.Others (Specify)
44	Have you ever had any of the following medical conditions? If respondent says Yes, please ask to indicate the year of diagnosis.	1.Yes 2.No
	Asthma	1.Yes 2.No
	Diabetes	1.Yes 2.No
	Cardiovascular disease (e.g. high blood pressure, heart attack, stroke, etc.) → Specify type of disease:	1.Yes 2.No
	Kidney disease → Specify type of disease	1.Yes 2.No
	Liver disease → Specify type of disease:	1. Yes 2. No
	Cancer → Specify type of disease:	1. Yes 2. No

	Other chronic condition → Specify disease_	1. Yes 2. No
--	--	--------------

Part: 6. Environmental effect of pesticides used

45	What are the indicators of environmental effects/impacts on the environment at local levels?	1.Loss of fish and frogs in local rivers, 2.reduced numbers of bird 3.Honey bees reduce, 4.others, please specify
46	What are the possible effects to the environment?	1.Effect on drinking water, 2.Beneficial insects like honey bee, 3.Fish & aquatic animals, 4.Birds,5.Other effects please specify

Part: 7. Preventive measure

47	Do you follow instructions on how to prepare pesticides for application?	1. Yes 2. No
48	Are you trained on the health risks of pesticides, pesticide use, management & application?	1.Yes 2.No
50	What measure have you taken when you experienced a symptom presumably due to pesticide exposure/poisoning? Respondent can select more than one option?	1.Visited health facility 2. Used home-based care (drink milk, etc.) 3.Did nothing 4.Other, specify
51	Did you used any preventive measure during pesticide handling and application? If the respondent says No, go to Q 53/	1.Yes 2. No
52	Did you used the following personal protective equipment when handling and applying pesticide products?	1. Yes 2. No
	Face mask/Maski	1.Yes 2.No

	Respirator	1.Yes 2.No
	Goggles or safety glasses	1.Yes 2.No
	Gloves	1.Yes 2.No
	Rubber boots	1. Yes 2. No
	Coveralls	1. Yes, 2. No
53	Do you use any preventive measures other than personal protective equipment during handling and applying a pesticide product?	1.Yes 2.No
54	What are the main reasons for not using preventive measures?	1. Not important 2.Very expensive, 3.Not available to buy. 4.Not comfortable 5.I do not care
55	Which personal hygiene practice do you Perform after spraying pesticides?	1. wash hands only with water 2. washing hands using soap with water, 3.Taking shower 4.Changing clothes, 5.Never

Foormii Odeeffannoo (Information Sheet Afan Oromo Version)

Nagaa: Akkam bultan/ooltan?

Hello, Ani _____jedhama. Ani kanan dhufe Yuunvarsitii SPHMMC Barnoota Fayyaa Hawaasaati. Ragaa qorannoo xumura barnoota maastarsiif oolu walitti qabuuf. Kaayyoon qoorannoo kanaa haala itti (Saaxilamummaa hojii Keemikaala farra aramaa, ilbiisotaa, fangasii fi wantoota keemikaala kanaaf Qoteebultoota akka saaxiluu danda’an ilaalchisee gaaffiiwwan tokko tokko isin gaafachuudhaf.Saaxilamummaa qotee bulaan hojiirratti Keemikaala farra aramaa, ilbiisotaa, fangasii fayyadamuu fi wantoota keemikaala kanaaf akka saaxiluu danda’an ilaalchisee gaaffiiwwan tokko tokko isin gaafachuudhaf. Kunis sagantaa fi saaxilamumma keemikaala farra aramaa, ilbiisota fi fangasii hir’isuu keessatti baay’ee nu gargaara. Qoorannoo Keenya gaggeesuudhaaf, ani gaaffii murtaa ‘een isin gaafadha. Gaaffannoon

kiyya daqiiqaa 20-30 isin tursiisuu nidanda'a. Deebii keessan akka anaaf kennitan kabaja guddaadhan isin gaafadha. Yaadni fi deebiin isin anaaf kennitan hunduu iciitidhaan eegama. Maqaa keessan ibsuu hin baarbachisu. Hirmaannan keessan feedhii irratti kan hundaa 'ee dha, yeeroo feetanitti dhaabu ni daandeesu. Gaafiif deebii kana keesatti hirmachuudhaaf fedha qabduu?

Eyyeen____(itti fufi). Miti_____ (Galatoomaa, dhaabi)

Maqaa nama ragaa walitti qabuu_____Guyyaa_____

Mallattoo (nama ragaa walitti qabuu) _____Guyyaa_____

(Mallattoon nama ragaa walitti qabuu, qooqaan heeyyama argaachuu agarsiisa.)

Maqaa to'ataa_____Guyyaa_____

Mallattoo to 'aataa _____Guyyaa_____

Annex III: Data Collection tool (VershiniiAfaan Oromoo)

II. Gaaffii Saaxilamummaa qotee bulaan hojiirratti Keemikaala farra aramaa, ilbiisotaa, fangasii fayyadamuu fi wantoota keemikaala kanaaf akka saaxilamaan isaan godhu ilaalchisee gaaffiiwwan tokko tokko isin gaafachuudhaf

Kutaa 1: Odeeffannoo Eenyummaa Abbaa Warraa/Haadha Warra

T.Lakk	Variables/Gaaffii	Deebii
1	Saala	Dhiiraa
		Dhalaa
2	Umriin kee waggaadhan meeqa?	
3	Waltti dhufeenyi kee fi bulchaa ykn itti gaafatamaa mana kanaa maali?	Bulchaa Mana
		Haadha warra
		Obbeleessaa/Obboleetti
		Kan biro caqasi
4	Haalli Gaa 'ila kee kan ammaa maal fakkaatta?	Kan heerumte/fuudhe
		Takkaa kan hin heerumne/fuune
		Kan hiikte/hiike
		kan haati manaa/abbaan manaa jalaa dute / du'e
5	Baay'ina Maatii mana kana keessa jiraatu	>5
		<5
6	Sadarkaa Barumsaa	Kan Barreessuu fi dubbisuu hin dandeenye
		Sadarkaa tokkoffaa (1-8)
		Sadarkaa lammaffaa (9-12)

		Sadarkaa Kollejii fi isaa
7	Galiin kee ji'a qarshiin Meeqa?	Qar <700 gadi
		Qar 700-1700
		Qar 1700-2700
		Qar >2700
9	Abbaan warraa /haati warraa mana kanaa miseensa inshuraansii fayyaa hawaasaa tii?	eeyyee
		Lakki

Kutaa: 2. Gaaffilee Beekumsa Waliin Wal Qabatan

T.Lakk	Variables/Gaaffii	Deebii
10	Waa'ee qoricha farra arama, ilbisoota fi fangasii maal beekta?	1.Maqaa qofa
		2.Hojii isaa
		3 . Miidha fayyaa irratti qabachuu
		4.Midha naannoo irratti qabachuu
		5.kan biro
11	Qoricha aramaa bifa akkamiin qophaa'e fayyadamta?	1. Daakuu
		2.Dhangala'aa)
		3.waan akka jajjabo
12	Qoricha Farra arama, ilbisootaa fi fangasii midhaa fayyaa namarratti ni fidu jettee yaadda?	1.eyye
		2.lakk
13	Eyyee yoo tahe haala kamiin miidhaa fidu?	1.yeroo qaama nama nyaata waliin galaan
		1.Yeroo afuura baafannuu fi galfannuu seenuudhaan
		2.Kallattii ijaan seenuun
		3.Yeroo fayyadamun qaama keenyaa walquxu
14	Midhaa gurguddoo itti fayyadamni qoricha farra arama, ilbisootaa fi fangasii naannoo irratti qabu beekta?	1.Eyyee
		2.Lakki
15	Midhaalee keemikaala farra arama, ilbiisota fi fangasii beektu tarreessi---	-----
		1. HEF (Hojjatu Ekistenshini Fayya)

16	Maddi odeeffannoo miidhawwan saaxilamummaa QFAIFF maal?	HMH (Hojjata Misooma Hundaa)
		3.Qonnaan bulaa adda duree
		4.Miidiyaalee hawaasa
		5.Dhiyeessitoota FAIFF
		6.kan biro-----
	Barreefama QFAIFF irra ni hubatta?	1.Eyyee
17	Hamma qorichoota FABFF fayyadamtu ni beekta?	2.Lakki
		1.Eyyee
17	Hamma qorichoota FABFF fayyadamtu ni beekta?	2.Lakki
		1.Eyyee

Kutaa: 3. Hojiilee Kuusaa, Waliin Makuu, Raabsuu, Riifuu fi Dhabamsiisa, Hafte keemikaala fi Baattu qorichoota QFAIFF (Q=Qorichaa (Keemikala), F=Farra, Ilbiisota, F=Fangasii,F=Fayya damu)

18	Haala kamiin qorichoota FABFF waliin makta?	1. Harkaan
		2. Mashiinaan
		3. kan biro
19	Baattoo QFAIFF keessa dhume maal itti goota?	1.Gabaatti gurgura
		2.Biyyee keessatti awwalaa
		3.Kan biroo -----
20	Yeroon itti baay'inaan qorichi biiftu kam?	1. Ganama suphii
		2.Guuyyaa walakkaa
		3. LSA'aatii booda
21	QFAIF eessatti kuusta?	1. Mana jireenyaa keessa
		2. Kutaa kuusaa meeshaa keessa
		3. Mana nyaanni itti qophaa'u keessa
		4-Kan biraa _____
22	QFAIFF eessatti waliin makta?	1.Mana keessatti
		2.Bishaan cinatti
		3. Burqaa Bishaan irratti
		4. Kan biraa -----
23	Yeroo QFAIF waliin maktuu kallatti qilleensa yaada keessa ni galchita	1. Eyyee
		2.Lakki
24	Yoo eyyee ta'e maal gootayyuu?	1.Qilleensi ana irra achi QFAIFF waliin bubbiisaa

		2.Qilleensi gara Kootti QFAIFF waliin bubbiisaa
25	Erga QFAIFF fayyadamte qulqullina dhuunfaa raawwate?	1.Bishaan qofan harka dhiqadha 2.Harkaa bishaanii fi samuunan dhiqadha 3.Qaama dhiqadha 4.Uffata jijjiiradha 5.Gonkuma homa hin raawwadhu
26	Yeroo amma kana lafa keerratti QFAIFF gosa kam fayyadamta?	_____
27	Meeshaa biiffa erga itti fayyadamta booda ni dhiqxa?	1.Eyyee 2.Lakki
28	Meeshaa biiffaa keemikaala itti fufiinsa suphita?	1.Eyyee 2.Lakki
29	Hafta QFAIFF haala kamiin dhabamsiista? Deebii tokko ol filachuun danda'ama	1.Nan gubaa 2.Nan Awwala 3.Dirree irratti kuusa 4.Qotee bulaa biraatiif gurgura/ kenna 5.Iddo balfi itti eegamuttin deebisaa. 6.Kan biraa ibsi-
30	Baatoo QFAIFF keessa dhume maal itti goota? Deebii tokko ol filachuun danda'ama	1.Nan Guba 2.Nan awwala Awwala 3.Dirree irratti Kuusaa 4.Kuusaa nyaataaf fayyadama 5.Kuusaa bishaanif fayyadama 6.Kan biro ibsi

Kutaa: 4. Fayyadamimmaa keemikala, saaxilamu and Rakkoo dhufuu danda'u

31	Yeroo QFAIFF hojiirra olchituu nyaata, dhugaati,siigaaraa fayyadamte?	1.Eyyee 2.Lakki
32	Kana dura QFAIFFtiif saaxilamte?	1.Eyyee 2.Lakki
33	Gaaffin gubbatti ibsame Eyyeen yoo ta'e yoom?	1.Kuusaa keessa isaa keeessatti 2.Yeroo Qophii/waliin makamu 3.yeroo fayyadamun/biifuu 4. kan biraa--
34	Haalli Qorichi FAIFF yeroo amma ati itti fayyadamtu rakkoo fayyaatiif si saaxila?	1.Eyyeen 2.Lakki
35	Haften Qoricha QFAIFF nyaata nyaannu, bishaan dhugnu, qilleensa nuu hargannu, fi biyyee keessa ni jira?	1.Eyyee 2.Lakki
36	Gosa qorichi kam baay'inaan fayyadamta?	1.Kan aramaa

		2.Kan ilbiisota
		3.Kan fanfasi
		4.Kan biro
37	Waggaa meeqaf QFAIFF lafa kee irratti fayyadamta?	1. Waggaa <1
		2. Waggaa 1 hanga 5
		3. Waggaa 5 hanga 9
		4. waggaa 10 ol
38	Waggoota shanan darban keessa itti fayyadamni QFAIF akkam ture?	1.Ni hir'isee
		2.Ni dabalee
		3.Daabbataadha
39	Giddugaleessatti QFAIFF daqiiqaa meeqaf itti fayyadamta?	1.Daqiiqaa_____?
40	QFAIFF ji'atti yeroo fayyadamta?	2.Lakkoofsa_____?
41	Kana duraa maatii kee keessaa namni keemikaala kanaaf saaxilame jira?	1.Eyyee
		2.Lakki

Kutaa: 5. Waliigala haala fayyaa

Kutaa: 3: Waangua Naana Fayyaa			
42	Kana duraa erga QFAIFF fayyadamte booda dhukkubni sitti dhagahame jira?	1.Eyyee	
		2.Lakki	
43	Yoo gaaffin Armaan olii kun eyyee maaltu sitti dhagahame?	1. ol ol jechuu, Balaqqamsisaa, 2. dhukkubbii mataa 3. Gubiinsa gogaa 4. ijji gubuu 5.Mataa jonja’u/ Balance eeggachuu dhabu 6.Garaachi ciniinu 7.IJaa duraa maru 8.kan biroo	
44	Ati kana dura rakkoo fayyummaa armaan gadii qabda?yoo deebiin eyyee bara itti qoratame gaafsdhu	1.Yes	Bara itti qoratame adda bahe barreessi
		2.No	
	Dhukkuba Asmii	1.Yes	-----
		2.No	
	Dhukkuba Sukkaraa/	1.Yes	-----
		2.No	
	Cardiovascular disease(e.g. high blood pressure, heart attack, stroke, etc.) → Specify type of disease:	1.Yes	-----
		2.No	
	Dhukkuba Kalee →: Specify	1.Yes	-----
		2.No	
Dhukkuba Tiruu → Specify	1.Yes	-----	
	2.No		

	Dhukkuba Kansarii → Specify		-----
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Kutaa: 6 . Dhiibbaa keemikaala kana fayyadamuu naannoo irratti fidu

45	Agarsiistu dhibba QFAIFF naannoorratti qabu maal?	1.Dhumaatii qurxummii, raachaa lagaa keessa
		2.Lakkoofsi sinbirroon xiqqachuu
		3.Kanniisni damma xiqqachuu
		kan biro_____
46	Keemikalaa kana fayyadamuudhaan wanti naannoo irra maal?	Dhibba bishaan dhugarratti
		Dhumaatti kannisaa dammaa
		qurxummiifi bineensota bishaan keessa jiraatan miidhaamuu
		sibirroo miidhamu irratti
		kan biro ibsi

Kutaa: 7. Haala ittisaa Keemikala farra Arama, Ilbiisota, Fungasii

47	Yeroo QFAIFF qopheessisu ajajaa ni hordofta?	1. Eyyee		
		2. Lakki		
		3. Sometimes/Yeroo tokko tokko		
48	Leenjii waa’ee rakkoo keemikalli fidu danda’u,fayidaa keemikaala, to’achuu fi hojiirra oolmaa irratti leenjitee?	1.Eyyee		
		2.Lakki		
49	Yeroo qorichaa FAIFF waliin maktu, fi fayyadamtu ajajaa irratti barreeffame ni dubbista/ hordota?	1.Eyyee		
		2.Lakki		
50	Yoo qoricha kanaaf saaxilamu kee shakkittee Mallattoo argitee tarkanfiin maal fudhatta? Deebiin tokko ol tahu danda’a?	1.mana yaala deemu		
		2.manatti yaalamu, aannan dhuguu		
		4.Homa fudhachuu dhiisuu		
		Kan biroo---		
51	Yeroo QFAIFF fayyadamtu Meeshaa ittisaa saaxilamumma fayyadamta?	Eyye		
		Lakki		
52	Hammam Meeshaa ittisaa saaxilamummaa qoricha FAIFF itti fayyadamta?	Yes	No	
	Maski	Yes	No	
	(Respirator)Meeshaa ittisaa wantoota miidhaa fidu/waan summawwaa, awwaraa,qilleensa faalama	Yes	No	
	Fullee Ijaa	Yes	No	
	Gloves/Gilaavi	Yes	No	
	Rubber boots/Caamaa ol dheeraa	Yes	No	
	Tuutta	Yes	No	
53				

	Meeshaa ittisaa QFAIF alaatti malli ittisa qorichaa QFAIF fayyadamtu jira?	Lakki
54	Sababbonni gurguddoon meeshaa ittisa QFAIF akka hin fayyadamne si godhee maal?	barbaachisa miti 1.Hin barbaachisuu 2.Mi'a 3.Bituuf kan argamne tahu 4.Yeroo fayyadamtu mijaata tahu dhabu 5.Nan barbaachisuu
55	Uffata kee erga QFAIF fayyadamte booda ni jijjiirrata?	1.Eyye Lakki
56	Akkuma qoricha QFAIF biifte qaama kee ni dhiqatta?	Yeroo hundaa Yeroo tokko tokko Gonkuma hin dhiqadhu

Declaration

I, the undersigned, declare that Assessment of Occupational Pesticide Exposure and Associated Factors among Rural Farmers of Dawo district my own work. In compliance with internationally accepted practices, I have acknowledged and refereed all materials used in this work. I understand that non-adherence to the principles of academic honesty and integrity, misrepresentation/fabrication of any idea/data/fact/source was constituting sufficient ground for disciplinary action by the college and can also evoke penal action from the sources which have not been properly cited or acknowledged.

Name of the resident: Tesfaye Dejene Signature: ____

Date: October 13, 2025 Place: Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia

This body of work with thesis has been submitted for examination with our approval as a Candidate.

Approval of the Primary Advisor Name of the primary advisor:

Dr. Bizatu Mengiste Signature: _____ Date: _____

Approval of the Co-Advisor Name of the Co-advisor:

Mr. Temesgen Geleta Signature: _____ Date: _____