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Pesticide Use Knowledge, Attitude, Practices and Practices Associated Factors Among Floriculture Workers in Bahirdar City, North West, Ethiopia, 2020

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ABSTRACT: Pesticides are substances that are used to kill, decrease, or repel pests and are used extensively to boost agricultural production. Ethiopian floriculture is one of the pesticide-intensive agricultural production centers and it provides jobs for 1000s of Ethiopians. Despite its significant contribution to the national economy, many issues are raised by the workers. The study aimed to assess the knowledge, attitudes, practices, and factors associated with the practices of workers against pesticide exposure among floriculture workers in Bahirdar city. A cross-sectional occupational study was done. The participants were recruited using a stratified sample technique. The final study participants were chosen using a simple random sampling procedure. The survey received 300 responses, 95.2% response rate from the entire sample size. The mean age of floriculture workers was 20 (SD ± 3.21) years, with a range of 17 to 48 years. The majority of workers (228) were females, and 36 (12.0%) of workers were illiterate. About 259 (86.3%) of floriculture workers did not know the name of the pesticide they were using. More than three-fourth 256 (85.3%) of respondents know at least one type of pesticide-related health problem. In this study, the most known type of pesticide routes of entry into the body were eyes (72.3%), skin (67.3%) followed by ingestion (67.0%). About 100 (33.3%) of the participants had good overall knowledge related to pesticide use and 134 (44.7%) of workers had a positive attitude on safe pesticide application. The level of good practice was 61.3% (N = 184). Knowing the impact of pesticide on environment (AOR, 0.54; 95% CI, 0.30-0.96), Knowing pesticide health problems, (AOR, 0.36; 95% CI, 0.20-0.63), willingness to wear and invest for PPE (AOR, 0.53; 95% CI, 0.28-0.98) and PPE supply (AOR, 0.29; 95% CI, 0.16-0.51) were significantly associated with workers pesticide handling practices. Workers who didn't know pesticide health problems were 36% less likely to have a good practice. The likelihood of having good practices among works who disagree to wear and invest on PPE 53% lower than those who agree on it. The likelihood of having good practices among workers who didn't have any PPE supply was lower than their counterparts with (AOR, 0.29; 95% CI, 0.16-0.51). Floriculture workers had poor handling practices therefore continuous pesticide training programs for workers could be implemented.

KEYWORDS: Exposure, pesticide, floriculture, workers

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Introduction

Pesticides are substances that are used to kill, decrease, or repel pests, which are used to increase agricultural production.[1] Agricultural workers are exposed to dangerous pesticides during storage, mixing, and application stages. Pesticides can enter in the human body through the skin or dermis, by ingestion, or through the lungs.[2] The dermal and inhalation routes of entry are typically the most common routes of farmers' exposure to pesticides.[2] Pesticide exposure through ingestion can occurs when hands are not properly washed before eating or smoking.[2]

Ethiopian floriculture industry farms started to export flowers to Europe and ranking only second to Kenya in Africa.[3,4] The sector's contribution to the country's economy is huge. It is one of the sectors that contribute to obtaining foreign currency. Floriculture is a labor-intensive industry that creates job opportunities for large number of workers.[4] Despite its significant contribution to the national economy, many issues are raised related to the adverse effects of pesticides.[3,4] Workers in the floriculture sector are highly exposed to various chemicals. In particular, workers who are staying longer in enclosed spaces such as packhouse, greenhouse, and spraying department are highly vulnerable. Because, use of pesticides in the floriculture sector is very high compared to other agriculture areas, which further increases the exposure among workers.[5]

Pesticide intoxications is a worldwide public health issue that kills about 300 000 people each year, the vast majority of whom are from developing nations.[6,7] All over, 41% of farmers have reported pesticide toxicity in Ethiopia.[8] According to research conducted in Ethiopia, 75.22% of agricultural farmers reported illness following pesticide application.[9] Acute pesticide poisoning at floriculture works was shown to be 56% in an Ethiopian study. The commonest self-reported symptoms of intoxications were nervous system disorder (79%) followed by respiratory and gastrointestinal illness (58%) within the previous 12 months.[22]

Acute pesticide intoxications have been documented as a serious consequence in the farming community. These include allergic reactions, headaches, dizziness, nausea, vomiting, salivation, and sneezing.[7,10-12] Pesticides are also cause chronic health problems, such as carcinogenic and endocrine-disrupting qualities.[13] cardiovascular disease,[14] male reproductive system problems,[15] nervous system impacts[16] hypertension, diabetes,

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and kidney failure.[17] Chronic illnesses have a substantial social and economic impact on affected workers, families, and communities.[18]

According to previous studies, factors contributing to poor handling practice during pesticide application included poor knowledge,[6,7] inadequate supply of PPE,[8-10] absence of pesticide-related training,[5,9,11] and unfavorable attitude toward pesticide.[7,10] The health risk of workers is also higher if there is poor practices during pesticides use.[5] Enhanced production of flowers and profits are an area of concern for the owners, but the labor force employed is mainly unskilled. They are unaware of the exact requirements for safely storing, preparing, applying, and disposing of pesticides, which all employees should follow.[4] Most Ethiopian workers lacked pesticide related training, were ignorant of new pesticide alternatives, lacked a full set of personal protection equipment, and did not shower after work.[1,2,19,20] However, excellent pesticide management techniques and alternate pest management strategies may assist employees in reducing the dangers of pesticide poisoning.

To the best of our knowledge, no study has been conducted to assess the knowledge, attitude, and practices of floriculture workers. Even the existing researches were only focus on knowledge, attitude and practice of agricultural farmers. The type of pesticides that used by agricultural farmers are different from floriculture farm. The exposure times also different. As a result, no one knows the level of KAP toward pesticides use among floriculture workers. So this is the first study of its sort to analyze pesticide use knowledge, attitudes, and practices in the area. This study have a good impact on employers' information since their knowledge harms workers' decisions to safe pesticide use. In addition, it creates good opportunities for government and labor force administrations to gain awareness about workers safety at workplace. After this study workers may search the safe practices that needed during pesticides application. More over this study also used as baseline data for future researcher to investigate further health problems caused by pesticides.

Methods

Study design and setting

An occupational-based cross-sectional study was conducted between February 1 and March 5, 2020, in Bahirdar, Northwest Ethiopia. Floriculture is applicable in Bahirdar city districts in the case of Lake Tana (headwaters of the Blue Nile River). The district has suitable climatic and natural resources like soil, water, investment land, global market, international airport for export, and the availability of cheap labor power.[21] The commonest flowers in Bahirdar city are roses and other flowers species such as Gypsophila, Hypericum, Limonium which are rarely cultivated. The study was conducted in 3 floriculture industries, namely, Tana flora, Ethio-agro safe, and Tall Flory. According to data from Amhara regional labor and social office, floriculture industries have a total of 1445 workers.

Inclusion and exclusion criteria

To ensure pesticide exposure, all workers who had worked for at least 1 year were recruited for this study.[22] Pesticides were used sparingly or not at all by supervisors and administrative staff. They were not included in the study.

Sampling procedures

A floriculture farm consists mostly of 4 departments: greenhouses, packhouse, pesticide spraying, and irrigation.[23] In the greenhouse section, cultivating tasks such as building flowerbeds, applying fertilizers and pesticides, planting, working in flower beds, weeding and cutting, collecting flowers, rising flowerbeds, pruning, and carrying organic waste is carried out. Since workers in the greenhouse are working full day in an enclosed space and pesticides are highly applied in it, they are at a greater risk of pesticides exposure.[23] Pesticides are usually mixed and sprayed manually using spray lances is performed in the spraying department. Manual spraying with spray lances while walking into the spray mist increases pesticide exposure via inhalation and dermal routes.[23]

Post-harvest activities are carried out in the packhouse, where harvested flowers are arranged in the way they would be exported.[24] Workers in the packhouse performed their duties in an enclosed room to protect flower quality, and they may have been exposed to excessive pesticide concentrations. The irrigation department was solely responsible for the mixing of fertilizers, other necessary materials for flower growth, and the monitoring of water lines.[24] In this department, workers mix different ingredients of fertilizers.

So, participants were recruited using a stratified sample technique, based on the idea that workers were exposed to pesticides at varying amounts depending on departments. The proportional to population size (PPS) approach was used to assign a sample population. Based on this approach, about 681 at greenhouse, 316 at the Pack House, 69 at irrigation, and 89 at sprayings were taken per farm. The samples were drawn from each farm using a simple random sampling procedure, with a sampling frame drawn from a list of workers. The required sample size was calculated using a single population proportion formula and by the following assumptions: 73.3% proportion of farmers who used only scarf to protect the uncomfortable smell of pesticides.[25] 95% confidence level, 5% margin of error, 80% power, and 5% estimated non-response rate, the calculated sample farmers were totaled to be 315.

Data collection tools

We set up a face-to-face interview with the employees. A total of 6 data collectors and 2 supervisors were trained on value of confidentiality, respondents' rights, and interview protocols. A standardized and pretested questionnaire was used to collect data. Pretest was conducted in 15 samples in small scale

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floriculture farm at community level in Bahirdar city. After the pretest, necessary changes were made since there were wording problems and a lack of comprehensive measurement of some variables. Based on pretest result, the overall level of good practices, attitude and knowledge were 60% (N = 9), 60% (N = 9). 40% (N = 6) respectively. The questionnaire consisted of 5 sections: The first section contains socio-demographic characteristics including sex, age, residence, educational status, marital status, monthly income, and service year. The second included questions related to the level of knowledge on pesticide use. The third section includes questions related to the attitude of workers toward pesticide usage. The fourth section contained Environmental and institutional factors of safe pesticide practices, which include residence distance of workers, safety symbol in work section, PPE supply, training, and pre-employment medical checkup). The fifth section provided detailed information on practices of pesticide use.

The age data of this study was categorized using the mean age as a cutoff point to avoid small observation. The monthly income was categorized using quartile since the income of most workers were had fixed salary. The service year was categorized based on mean service year as cutoff point. The service years range was 10 years. Educational status was categorized as educated and uneducated. Educated refers, those workers who are able to read and write and at least completed the primary education. Uneducated refers workers who are illiterate and do not attended school.

Knowledge, attitude, and practice scores were computed by taking the mean of the sum of the ranges for each item as a good and poor category,[26] which consisted of 7, 7, and 10 items for knowledge, attitude, and practice, respectively. To assess the level of knowledge, detailed lists of knowledge questions (7 items such as knowledge of pesticides by name, read and understand pesticide labels, the impact of pesticide on the environment, health problem of pesticides, type of health problem due to pesticide exposure, routes of pesticide exposure into the body, place of pesticide residuals exist) were presented. Responses to the questions were coded such that correct answers (Yes) scored 1 and incorrect (No) 0. Knowledge-related questions, such as Environmental impact of pesticides was measured in the following way; "Do you know environmental impact of pesticides" question with "Yes/No" response was asked. Then of those respondents who replied "yes" further asked to mention what it can be affect by open ended question. If they were be able to mention at least one of environmental aspects, such as air, water, soil, and living things, was classified as they know environmental impact of pesticides. Knowledge regarding pesticide health problems was also evaluated by; "Do you know pesticide related health problems" question with "Yes/No" response was asked. Then of those respondents who replied "yes" further asked to select from type of health problem due pesticides that was mentioned. If they were be able to select at least one type of health problems, such as skin difficulties, respiratory problems, neurological problems, and gastrointestinal problems, was classified as they know pesticide related health problems. Workers who knew at least 2 pesticide routes of entry into the body were classified as they knowing pesticide route entry, with the same procedure to knowing health problems of pesticides. If the participants know pesticide residuals exist in the environment, "Do you know pesticide residuals exist in the environment" question with "Yes/No" response was asked. Then of those respondents who replied "yes" further asked to mention where it can exist by open ended question. If they were able to mention either "water, air, soil or living things," it was classified as they know pesticide residuals can exist in the environment.

The workers' attitudes on pesticide use were assessed using a 7-item, 5-range Likert scale (strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, and highly agree = 5). The 7 items was as follows: (i) All pesticides have the same health problem, (ii) Pesticide usage should be discouraged, (iii) our body has resistance to pesticide, (iv) PPE use prevent pesticide exposure, (v) desire to wear and invest in PPE, (vi) good pesticide handling reduce the health problem of pesticides, and (vii) pesticide exposure is a health problem were the 7 items. Lastly, attitude related questions were categorized into 2 categories as "Agree" and "Disagree."

Statistical methods

EPI data version 4.6 was used to enter data, which was then exported into SPSS version 20 software. For continuous data, descriptive statistics such as mean, median, standard deviation, and range were used. Percentage and frequency tables were used for categorical data. The χ^2 test was used to calculate the minimum predicted frequency. Multi-collinearity was tested between selected independent variables through the variance inflation factor (VIF) and none was found. The result from Nagelkerke *R* Square was showed that about 30.1% of the variables in this study could express the outcome variable (practice of workers). A bivariate logistic regression analysis was performed to determine the presence of a crude correlation. Selected candidate variables (with a *P*-value below .25) were included in multivariate logistic regression. In the final model, a *P*-value of less than .05 was used as the cut-off for statistical significance. The model's fitness was tested by Hosmer and Lemeshow and was found fit.

Mathematically, Logistic regression equation between dependent and independent variable was as follows:

$$\text{Logit}\left(\text{P}\right) = \log\left(\frac{p(y=1)}{1-(y=1)}\right) = 0.86 - 0.608\,X_1 - 1.021X_2 - 1.222\,X_3 - 0.634X_4$$

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Table 1. Socio-demographic variables of respondents in Bahirdar city area, North West Ethiopia, March 2020.

CHARACTERISTICS	CATEGORY	FREQUENCY (N = 300)	(%)
Age in years	⩽20	158	52.7
	>20	142	33.3
	Mean age = 20 (SD ± 3.21), SD = standard deviation		
Sex	Male	72	24
	Female	228	76
Residence	Urban	125	41.7
	Rural	175	58.3
Marital status	Unmarried	189	63.0
	Married	111	37.0
Educational level	Uneducated	36	12.0
	Educated	264	88.0
Monthly income	<1250	95	31.7
	1251-1400	56	18.7
	1401-1500	51	17.0
	>1500	98	32.7
Service year	<2	200	66.7
	>2	100	33.3

Hint: to fit the χ^2 test assumption, educational status was divided into 2 groups.

Hint:

p = probability of success
y = Practice of workers (outcome variable)
X_1 = Know the impact of pesticides on the environment
X_2 = Knowing pesticide health problems
X_3 = PPE supply
X_4 = Willingness to invest to personal protective equipment's

Ethical considerations

The Institutional Review Board of the University of Gondar gave its approval. The University of Gondar's institute of public health has written an official letter of support and was given to all farms' floriculture managers and to the regional labor office. The purpose, nature of the research, and the beneficence and maleficent were explained to the workers. Oral consent was obtained from each participant. Moreover, privacy and confidentiality of information were kept properly and names were not recorded.

Results

Respondents' socio-demographic characteristics

The survey received 300 responses, giving it a 95.2% response rate. The non-response in the study was because of interview refusals, which was 1.96%. The mean age of floriculture workers was 20 (SD ± 3.21) years, with a range of 17 to 48 years. The majority of workers (228) were females, and 175 (58.3%) of the workers lived in rural areas. In terms of educational attainment, 36 (12%) of workers were illiterate, while 1 (0.3%) could only read and write. More than half of the 167 workers (55.7%) had completed primary education (grades 1 through 8), while only 26 (8.7%) had a diploma. As a result, the majority of floriculture workers were educated at 264 (88.0%). Floriculture workers earned an average monthly wage of 1432 (SD ± 294.7) Ethiopian birr. Workers' service years range from 1 to 11 years. The results of socio-demographic variables are described in the table below (Table 1).

Knowledge of respondents toward the safe use of pesticides

About 100 (33.3%) of workers had good knowledge. Floriculture workers 259 (86.3%) did not know the name of the pesticide they were using. More than 3-quarters of floriculture workers (81.0%) were unable to read and understand pesticide instructions on pesticide containers. About 256 (85.3%) of respondents know at least one pesticide-related health problem. From this, skin problems (70.0%) and respiratory problems (57.0%) were the most common health issues known by workers. In this study, the most known pesticide route of entry into the body was eyes (72.3%), skin (67.3%), and ingestion (67.0%). The result of knowledge of floriculture workers toward safe use of pesticides is summarized in the table below (Table 2).

The attitude of workers regarding the safe use of pesticides

In this study, the overall positive attitude toward safe pesticides was 44.7% (N = 134). About 32 (10.7%) workers strongly agree in that all pesticides have the same health problem and 44 (14.7%) of the respondents strongly discourage further pesticide use in the farm area. About 26 (8.7%) of workers were strongly disagree to wear and invest in PPE, the reason behind that it was not feasible for them at their current salary status. The result of the attitude of floriculture workers toward the safe use of pesticides is summarized in the table below (Table 3).

The practice of floriculture respondents toward the safe use of pesticides

The overall level of good practices was 61.3% (N = 184). One hundred thirteen (37.7%) workers never used any personal protective equipment. Regarding personal protective equipment, 59.3% of workers wear gowns, 37.7% use gloves, 14.0% wear boots, and only 5.0% of workers use facemasks during pesticide application. From the total respondents, about 197 (65.7%) workers did not follow pesticide label instructions and more than half of workers (64.7%) ate and drank inside the workplace. The result of practices of floriculture workers

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Table 2. Knowledge of respondents regarding the safe use of pesticides in the Bahirdar city area, March 2020.

VARIABLES	CATEGORY	FREQUENCY	%
Knowing pesticides by name	Yes	41	13.7
	No	259	86.3
Read and understand pesticide labels	Yes	57	19.0
	No	243	81.0
Does pesticide has an impact on the environment?	Yes	159	53.0
	No	141	47.0
Do you know pesticide related health problems?	Yes	256	85.3
	No	44	14.7
Health problems related to pesticide exposure	Skin problem	210	70.0
	Respiratory problem	171	57.0
	Neurological problem	64	21.3
	Gastro intestinal problem	67	22.3
	Death	13	4.3
Do you know the action to be taken after pesticide exposure?	Go to the health clinic	238	79.3
	Others[a]	62	20.7
Do you know the routes of pesticide exposure?	Yes	229	76.3
	No	71	23.7
Routes of pesticide exposure	Skin	202	67.3
	Ingestion	201	67.0
	Eye	217	72.3
	Inhalation	105	35.0
	Ear	174	58.0
	Other	39	13.0
Where do pesticide residuals can exist?	Water	110	36.7
	Air	86	28.7
	Soil	63	21.0
	Living things	133	44.3
Overall knowledge	Good	100	33.3
	Poor	200	66.7

[a]Others indicates stopping work and going to traditional medicine.

toward safe use of pesticides is summarized in the table below (Table 4).

Environmental and institutional factors of floriculture workers

In this study, environmental and institutional factors were assessed. From the total floriculture workers about half 150 (50%) of respondents were living in residence distance greater than 5 km from the farm. Because of this workers were getting tired at work to follow all safe pesticide application producers' from our observation. Almost all 285 (95.0%) workers did not take any pesticide-related training before starting their work. Training is the source of formation and helps to follow safe pesticide-related practices at the workplaces. In the other, only 157 (52.3%) respondents were getting PPE supply from the floriculture farm. From this supply, the only gown was containing the highest number which was 49.7% (Table 5).

Factors influencing workers' safety practices toward the safe use of pesticides

In a multivariable regression analysis, 4 characteristics were associated with farmers' pesticide handling practices during pesticide use. These including, knowing the impact of pesticide on environment (AOR, 0.54; 95% CI, 0.30-0.96), Know pesticide health problems, (AOR, 0.36; 95% CI, 0.20-0.63), willingness to wear and invest for PPE (AOR, 0.53; 95% CI, 0.28-0.98) and PPE supply (AOR, 0.29; 95% CI, 0.16-0.51) were significantly associated with workers' practices. Those workers who know the impact of pesticides on the environment were 46% times higher in their pesticide handling practices than their counterparts. In the other, workers who didn't know pesticide health problems were 36% less likely to have a good practice. The likelihood of having good practices among works who disagree to wear and invest on PPE 53% lower than those who agree on it. The likelihood of having good practices

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Table 3. The attitude of workers regarding the safe use of pesticides in Bahirdar city area, March 2020.

CHARACTERISTICS	CATEGORIES	FREQUENCY	%
Do you think all pesticides have the same health problem?	Strongly agree	32	10.7
	Agree	60	20.0
	Disagree	185	61.7
	Strongly disagree	23	7.7
Do you think pesticide use should be discouraged?	Strongly agree	44	14.7
	Agree	76	25.3
	Disagree	161	53.7
	Strongly disagree	19	6.3
Do you think our body has resistance to pesticide?	Strongly agree	16	5.3
	Agree	54	18. 0
	Disagree	91	30.3
	Strongly disagree	139	46.3
Do you think PPE use prevent pesticide exposure?	Strongly agree	81	27.0
	Agree	110	36.7
	Disagree	82	27.3
	Strongly disagree	27	9.0
Do you think wearing and investing in PPE is important?	Strongly agree	78	26.0
	Agree	100	33.3
	Disagree	96	32.0
	Strongly disagree	26	8.7
Do you think good pesticide handling reduce the health problem pesticide?	Strongly agree	70	23.3
	Agree	136	45.3
	Disagree	79	26.3
	Strongly disagree	15	5.0
Do you think an exposure to pesticides does not cause health problem?	Strongly agree	31	10.3
	Agree	39	13.0
	Disagree	198	66.0
	Strongly disagree	32	10.7
Overall attitude	Positive	134	44.7
	Negative	166	55.3

among workers who didn't have any PPE supply was lower than those who had PPE supply with (AOR, 0.29; 95% CI, 0.16-0.51) (Table 6).

Discussion

Pesticide knowledge, attitudes, and practices, as well as the health problems related to pesticide use, have been underlooked among Ethiopian floriculture employees. In this study, only 33.3% with 95% CI (28.5, 38.3) of respondents had good pesticide-related knowledge. This study was lower than in Kelantan (61.1%)[27] and Ethiopia (39.4%),[26] where farmers had moderate knowledge of the pesticide used. The variation might be due to sample size and study setting. Pesticide use knowledge is crucial for workers, and they should be aware to protect themselves.[28-31] In this study, some workers went to traditional medicine after pesticide exposure and it was also recorded from a previous study conducted in Ethiopia,[21] this suggests that workers were less aware of the negative impacts of pesticides. Recognizing early indications of pesticide overexposure, and obtaining first aid at the earliest time is important.[32] According to this finding, workers had a good degree of understanding about pesticide routes of entry, it might be due to majority of them had completed primary and secondary school. This result was consistent with a previous study conducted, where all of the subjects had acquired knowledge on pesticide entry to the body through nose, skin, and mouth.[33] Most respondents in this study were aware of pesticide exposure through eye channels; however, another study conducted in Ethiopia found that awareness of the inhalation exposure route was higher among irrigation farmers.[10] Eyes are particularly sensitive to absorption, and therefore any contact of pesticides with the eye can cause injury, blindness, or sometimes even death. Eye protection is always a prerequisite when measuring or mixing toxic pesticides.[2] Knowledge on pesticide route of entry made workers to follow safe procedures during pesticide use including wearing personal protective equipment.

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Table 4. The practice of floriculture respondents toward safe use of pesticides in Bahirdar City floriculture farm, Northwest Ethiopia, March 2020.

VARIABLES	CATEGORIES	FREQUENCY	%
Use personal protective equipment	Never	113	37.7
	Sometimes	106	35.3
	Always	81	27.0
Type of personal protective equipment used	Facemask	15	5.0
	Eye Google	20	6.7
	Gloves	113	37.7
	Cap	20	6.7
	Gawn	178	59.3
	Boots	42	14.0
	Pants	21	7.0
Compliance with pesticide concentration	Yes	104	34.7
	No	196	65.3
Take bath after pesticide application	Yes	218	72.7
	No	82	27.7
Changing cloth before going home	Yes	167	55.7
	No	133	44.3
Follow pesticide label of instruction	Yes	103	34.3
	No	197	65.7
Safe pesticide container storage	Yes	102	34.0
	No	198	66.0
Eat and drink inside the workplace	Yes	194	64.7
	No	106	35.3
Considering wind direction during pesticide application	Yes	106	35.3
	No	194	64.7
Cigarette smoking	Yes	1	0.3
	No	299	99.7
Alcohol drinking	Yes	8	2.7
	No	292	97.3
Overall practices	Good	184	61.3
	Poor	116	38.7

Abbreviation: SD, standard deviation.
Mean practices = 0.38 (SD ± 0.48).

In this study, 44.7% with 95% CI (39.0, 50.0) of respondents reported a positive attitude regarding pesticide handling practices. A similar level was recorded in Ethiopia (49.1%),[26] Kelantan 43.7%,[27] and Thailand 46.5%,[34] where farmers were concerned about pesticide use or exposure. Half of workers in this study had misconceived regarding pesticide use and it also decrease in their practice. In this finding, workers believed that their body has resistance to pesticides. But in Gaza Strip, where 67.6% of farm workers believed that their body has developed resistance to pesticides.[35] The variation might due to sample size difference. In addition, in our case workers were face different health problems at the work place.

In this study, only 38.7% with 95% CI (33.3%, 44.4%) of the respondents had good pesticide handling practices. The overall level of good practice in the current study was greater than in prior studies conducted in Kenya,[9] in Tanzania (21%),[19] Kelantan 21.5%.[27] This disparity could be attributed to differences in socioeconomic variables, research setting, and educational level of study individuals. Furthermore, most floriculture workers in this study may be more aware of the health risks of pesticides due to education and through media exposure. In addition, floriculture farms may use more pesticides than other agricultural farm. So, knowing the level of risk in the workplace caused workers to practice more. In contrast, the current pesticide-related practice was lower than studies conducted in Ethiopian 63.8%[26] and Thailand 85%,[34] where farmers demonstrated a fair level of proper practice. The difference might be that in our situation, floriculture workers lack pesticide usage training, lack of safety symbol in each working area, lack of sufficient personal protective equipment supply, and low

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Table 5. Environmental and institutional factors of floriculture workers in Bahir Dar, Northwest Ethiopia, in 2020 (N = 300).

VARIABLES	CATEGORY	FREQUENCY	%
Residence distance from the Flory farm	Within 5 km	150	50
	More than 5 km	150	50
Safety symbol in each working area	Yes	46	15.3
	No	254	84.7
Pre-training	Yes	15	5.0
	No	285	95.0
Pre-employment medical Checkup	Yes	16	5.3
	No	284	94.7
Periodic medical checkup	Yes	24	8.0
	No	276	92.0
PPE supply	Yes	157	52.3
	No	143	47.7
Type of PPE supplied	Facemask	13	4.3
	Cap	30	10.0
	Eye Google	15	5.0
	Gown	149	49.7
	Gloves	92	30.7
	Boots	32	10.7

overall knowledge of workers, even though the majority of workers were educated.

Those workers who did know the impact of pesticides on the environment were 46% times higher in their pesticide handling practices than those who did not know the negative impact on the environment. This study is supported by Greek,[36] where farmers' knowledge of the potential damage of pesticides on the environment is very important in preventing pesticide exposure. Indeed, farmers have been reported to be inadequately informed about environmental hazards which leads to unsafe practices of pesticides.[37]

In this study, knowledge about pesticide-related health problems was significantly associated with workers' practices. Similarly in another study, pesticide handlers who were aware of pesticide health hazards performed better practice during pesticide handling.[38] In addition the finding is also supported by numerous other studies done in Nepal,[39] Palestine,[32] and Ethiopia,[26] where pesticide knowledge was significantly associated with farmer's practices in the field. It indicates the need for various programs to increase the knowledge of farmers about the safe practice of pesticides. Workers' knowledge of dangers is critical for the prevention of acute and chronic poisoning, and poor understanding reduces workers' ability to protect themselves.

The likelihood of having good practices among works who disagree to wear and invest on PPE 53% lower than their counter parts. There were no studies which supporting this finding. This might be due to others studies may use overall attitude as independent variable in regression analysis but not in our case. The reason for this finding might be that, most workers are reluctant to wear PPE in hot weather and also PPE is uncomfortable to perform their duties.[40] In addition, the high cost of PPE was mentioned as an important factor to invest and limited use of PPE.[34] Because of it cost, workers may obliged to use a traditional work shirt and nonstandard personal protective equipment's.

The likelihood of having good practices among workers who didn't have any PPE supply was lower than those who had PPE supply with (AOR, 0.35; 95% CI, 0.20-0.56). The use of appropriate personal protection equipment (PPE) was found to be very vital to protect against pesticide exposure in this study. Hence, the provision of appropriate protective clothing to employees was a critical area to be addressed by the farms.[41] In our study, 47.7% with 95% CI (42.3%, 54.5%) of workers were lack a supply of personal protective equipment. This finding was lower than the study conducted by Kelantan which was 61.8%.[27] This could be due to differences in research settings, as well as individual farmer's ability in Kelantan to invest on PPE. Farm workers who use pesticides without protective precautions may be exposed to pesticides at levels high enough to cause acute health problems.[32] Furthermore, field workers who did not take adequate protective equipment may have been exposed to greater intoxication risks.[32] Moreover, the cost of PPE has been identified as a key influence in farmers' pesticide use in the absence of PPE.[42] Despite the fact that employers were responsible to provide full protection equipment, the workers in this floriculture farm lack basic PPE supplies. In this study, gown was the only PPE provided by the employer during employment and is quite outdated. Most other types of PPE that described were invested by workers themselves. As a result, workers have been reported to be dissatisfied with the delivery of personal

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Table 6. Multivariate analysis of parameters related to pesticide handling practices among floriculture employees in Bahir Dar, Northwest Ethiopia, in 2020 (N = 300).

CHARACTERISTICS	CATEGORY	PRACTICES		*P*-VALUE	COR (95% CI)	AOR (95% CI)
		GOOD	POOR			
Sex	Male	55 (44%)	70 (56%)	.897	1.00	1.00
	Female	61 (34.9%)	114 (65.1%)		0.68 (0.43 -1.09)	0.96 (0.55-1.68)
Understand pesticide levels	Yes	46 (51.1%)	44 (48.9%)	.596	1.00	1.00
	No	70 (33.3%)	140 (66.7%)		0.47(0.29-0.79)	0.85 (0.47-1.55)
Know actions taken after pesticide exposure	Go to a health clinic	101 (42.4%)	137 (57.6%)	.094	1.00	1.00
	Others[a]	15 (24.2%)	47 (75.8%)		2.31(1.23-4.36)	1.86 (0.89-3.88)
Know the impact of pesticides on the environment	Yes	84 (49.1%)	87 (50.9%)	.038	1.00	1.00
	No	32 (24.8%)	97 (75.2%)		0.34 (0.20-0.56)	0.54 (0.30-0.96)*
Know pesticide health problems	Yes	103 (40.2%)	153 (59.8%)	.000	1.00	1.00
	No	13 (29.5%)	31 (70.5%)		3.80 (2.31-6.25)	0.36 (0.20-0.63)*
Believe that wearing PPE prevent pesticide exposure	Agree	85 (44.5%)	106 (55.5%)	.146	1.00	1.00
	Disagree	31 (28.4%)	78 (71.6%)		0.49 (0.29-0.82)	0.63 (0.34-1.17)
Willingness to wear and invest for PPE	Agree	81 (45.5%)	97 (54.5%)	.043	1.00	1.00
	Disagree	35 (28.7%)	87 (71.3%)		0.48 (0.29-0.78)	0.53 (0.28-0.98)*
Believe that good handling reduce pesticide exposure	Agree	90 (43.7%)	116 (56.3%)	.557	1.00	1.00
	Disagree	26 (27.7%)	68 (72.3%)		0.49 (0.29-0.84)	0.82 (0.44-1.56)
PPE supply	Yes	83 (52.9%)	74 (47.1%)	.000	1.00	1.00
	No	33 (23.1%)	110 (76.9%)		0.26(0.16-0.44)	0.29 (0.16-0.51)*
Presence safety symbol at workplace	Yes	15 (32.6%)	31 (67.4%)	.563	1.00	1.00
	No	101 (39.8%)	153 (60.2%)		1.36(0.70-2.66)	1.25 (0.58-2.71)

Abbreviations: AOR, adjusted odds ratio; COR, crude odds ratio; PPE, personal protective equipment.
[a]Others indicates stopping work and going to traditional medicine.
*Significant at *P*-value <.05.

protective equipment (PPE). During the data collection period, we observed that the employers were not accountable for the health and safety of its employees but instead focused solely on their business. Furthermore, due to the hot temperature and working conditions, the majority of workers did not feel comfortable using the provided PPE. As a recommendation, farms should provide a full set of personal protective equipment, particularly for those who cannot afford to invest in PPE. More comprehensive and continuous pesticide training programs for workers could be implemented. Aside from that, an interventional study is recommended for future research to predict the pattern of KAP level.

Study Limitations

There are some drawbacks to this study, such as that, the name of each pesticide used was not documented because of security issues. The sample size was also too small since the study area was a business center and we could not incorporate large numbers. In addition, the current study did not examine pesticide-related health problems.

Conclusion

In this study, the overall knowledge, attitude and practices of floriculture workers were very low. The majority of the workers were aware of pesticide exposure routes, including ocular and ingestion contact. But there is scarce knowledge on the most common exposure routes such as dermal and inhalation routes. More than half of the workers were found to have unfavorable attitudes toward the harmful effects of pesticides. Most workers never use personal PPE during pesticide application. Knowledge about impact of pesticides on the environment, knowledge of pesticide health problems, attitude to wear and invest PPE and supply of PPE had a significant association with the workers' practices toward safe use of pesticides.

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Author Contributions

The study was conceptualized and designed by ME, AD. ME was in charge of data analysis and the original draft of the manuscript. ME, AD, and MG all agreed with the findings and conclusions in the manuscript. ME, AD, and MG collaborated on the paper's current structure.

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