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INDIVIDUAL RISK FACTORS FOR EXPOSURE TO PESTICIDE AMONG SMALL SCALE COFFEE FARM WORKERS IN KIRINYAGA COUNTY, KENYA

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KeyWords
Farm worker, Individual risk factors, Knowledge, Perceived risk, Pesticide, Pesticide use, Pesticide disposal, Risk, A probable case, The “unlikely/ unknown” case definition,

ABSTRACT

According to the population census of 2019, about 70% of the Kenyan population is rural. Most of whom depend heavily on rain-fed agriculture under unstable climate conditions. This is also the case in Kirinyaga County where majority of the coffee farmers are small scale farmers who rely on the crop for income generation activities that require the use of pesticides to increase yields. The overdependence on pesticides has resulted in overuse and exposures of pesticides and uninformed mixing of pesticides in an effort to manage the low labor costs and meeting output needs and requirements at end of the harvest which has resulted consequently in poor health of farm workers. The main objective of this study was to establish the incidence of occupational acute pesticide toxicities among small scale coffee farm workers in Kirinyaga, determine the levels of perception and behavior of small-scale farmers regarding occupational usage of pesticide and determine the factors associated with occupational acute pesticide toxicities in relation to small scale coffee farm workers. The study utilized a descriptive cross-sectional study design. The study sampled a population of 399 respondents who were randomly selected in the five wards in Kirinyaga central sub county namely Mutira North and South, Kanye-ine, Kirinyaga central and Inoi wards. An electronic based semi-structured questionnaire using KOBO Toolkit, observational checklists and plates were used in data collection. Data analysis was done using the statistical package for social sciences SPSS version 25.0. The relationship between independent and dependent variables was determined using chi-squared tests. Significant risk factors were analyzed using logistic regression and expressed as odds ratios. The study established that the incidence risk for acute pesticide poisoning symptoms was 52.3% with the most common symptoms being headaches (95.7%), diarrhea (98.8%), skin rashes (88%), staggering (81.9%) and dizziness (81.9%). The perception levels that were found significant in line with acute pesticide poisoning were those of effect to human health (p=0.031) and environment (p=0.027). Additionally, perceived failure to use safety equipment increased potential for Acute pesticide Poisoning(p=0.041)(OR= 2.199) .statistically significant individual risk factors identified were worker characteristics of drinking alcohol(OR= 0.033)and eating during pesticide application (OR= 0.537); socio-demographic characteristics of gender(OR=0.035), level of education (OR=0.024) and employment status(OR= 0.011); the safety practices of wearing PPEs(OR= 1.305), taking a systemic shower (OR= 0.537). A farm worker who washed hands was 2.042 times less likely to exhibit symptoms of APP. Hospital staff reported they had no means in terms of equipment and technical expertise to identify pesticide poisoning symptoms. Nevertheless, cases of Acute Pesticide Poisoning were hardly reported at health facilities among farmers because of the common nature of symptoms with other common illnesses. This study concluded that there is a high incidence risk among small-scale farmers for occupational APP. The varying individual risk factors and perceptions are indicative of the need for a multi- disciplined approach to training to help minimize adverse effects associated with pesticide exposure and to encourage approaches already in use that can minimize the harmful effects of pesticide use in coffee production.

INTRODUCTION

The FAO defines pesticide as any substance or mixture of substances intended to prevent, destroy, or control any pests. (Begum et al., 2017). Pesticides have been in use for eons in control of harmful vectors and pests. Despite its large-scale use, pesticides are contributors to accidental and intentional pesticide poisoning in an occupational setting through poor safety practices. However, there have been few inconsistent and unreliable reports on reported pesticide toxicity cases. (Blair et al., 2014). Occupational pesticide poisoning is still a major concern worldwide despite studies and reports done to highlight potential entry points and risk factors. It has been estimated that globally nearly $38 billion is spent on pesticides each year. (Pan-Germany., 2012). Pesticides are supposed to be biodegradable, non-toxic to the target organism and ecofriendly, however most pesticides are non-specific and end up killing off the beneficial organisms such as butterflies and bees. (Begum et al., 2017). Only 0.1% of a pesticide once applied reaches the target organisms the remaining 99.9% is let onto the environment resulting in pollution of water and soil. (Begum et al., 2017; Gill et al., 2017).

In a study done in Kenya, incidence of pesticide related acute illness has increased by over 70% from the period of 2005-2008 of the study. Headache and sneezing were the main symptoms of toxicity since the number of reports had doubled within the 3-year course of the study. These symptoms were identified to be as a result of poor pesticide handling safety practices such as the poor use of PPEs and poor storage and disposal of pesticide packages. (Macharia, 2015). Occupational exposure for acute pesticide poisoning is low due to under-reporting resulting from the absence of a comprehensive surveillance system as well as misdiagnosis of signs and symptoms of pesticide exposure and some cases can be missed since most farmers do not represent these occurrences to the hospital especially for low less severe poisoning symptoms. (Lekei et al., 2020; Lekei et al., 2017). Risk factors may be external or internal. In the case of individual pesticide poisoning, external risk factors are the most predominant and they include individual worker characteristics such as smoking, eating when handling chemicals, not wearing appropriate PPEs and poor storage and handling of pesticides during the process of application.(Machari, 2015; Wang et al., 2019; Jason et al., 2018). This risk factors may result in either a positive or negative outcome. A positive health effect from proper use of pesticides would be the absence of clinical symptoms and the absence of exposure to the harmful effects of pesticides. Most acute pesticide poisoning symptoms mimic common diseases such as common cold. These symptoms are often misinterpreted and misdiagnosed and thus reporting is inadequately done. Some of this acute toxicity symptoms of pesticide poisoning include dizziness, diarrhea, profuse sweating, sneezing, coughing, fatigue and general body weakness among others. Over years, studies have provided linkages and associations between occupational pesticide use and the occurrence of various illnesses such as cancers, neurological defects, (Bonner et al., 2017; Negatu et al., 2018) Vopham. 2017); Kori et al., 2020),

MATERIALS AND METHODS

2.1 Research design

The research design used in this study was descriptive cross-sectional study design. this design was employed due to its ability to assist the researcher in looking into multiple variables that are being compared with the dependent variable. In this regard a cross sectional study design shall look into the demographics, perception, knowledge and behavior of farmers to find out how they are associated with or influence pesticide exposure. Additionally, the aim of this study was to capture the events of pesticide exposure at that time which mainly focused on acute toxicities (Lee *et al.,* 2019)

2.2 study variables

Individual risk factors were the independent variable and it was categorized into safety practices, individual worker characteristics and socio- demographic characteristics. They are health effects which had positive effect that resulted in absence of adverse effects or negative effects that resulted in clinical pesticide poisoning symptoms. The outcome of pesticide poisoning was dependent on various factors such as safety practices and perceptions.

2.3 study area

The study was conducted in the larger Kirinyaga County in Kenya, with a population of 610,411 people as at the national census of 2019 whose capital is in Kutus town. The area covers an area of 1,205 km² with 0.6591° S, 37.3827° E coordinates. It consists of five Sub Counties namely; Kirinyaga East, Kirinyaga West, Mwea East, Mwea West and Kirinyaga Central with 5 Wards, 12 Divisions, 30 Locations and 81 Sub-Locations. (Kenya National Census, 2019). The socio-economic activities in the region is coffee and rice farming which directly aligns with the study objectives of the study area and depicts the use of pesticides in both coffee and rice farming.

2.4 study population and target population

The study population for this study was coffee farmers in Kirinyaga central who use pesticides who were selected to participate in this study and also who meet the inclusion criteria of this study. The target population constituted approximately 81,612 coffee farmers in Kirinyaga central sub-County (KEBS. 2019). It was assumed that the 95 % of the population uses pesticides on their coffee farms and they were small-scale farmers represented by co-operatives. The unit of analysis was the small-scale coffee farms selected randomly and the unit of observation was the farm worker who was actively involved in daily farm operations.

2.5 inclusion and exclusion criteria

All small-scale coffee farmworkers of legal age -18 years and above who consented to participate in the study. In this study a 2-month minimum exposure period was used to cover any new employed coffee farm worker was included. Another parameter for inclusion was that the respondent had to be a local farm worker resident at the time of study. Large scale coffee farm workers, non- farm workers were excluded.

2.6 sampling technique

Multi- stage sampling procedure was used in which Kirinyaga central sub-county was purposely selected since it is among the leading coffee producing areas in Kirinyaga County. Stratified random sampling was used to determine number of participants by forming strata from the 5 wards. This enhanced precision and accuracy, recognizing local relevance, and facilitates informed decision-making and policy development tailored to the unique characteristics of each ward. Simple random sampling technique was then used in this study, where the registered small-scale farmers were randomly selected from the sample size. The randomization was made simple by using the farmers register to randomly select them after assigning specific numbers to each farmer in their register. Then equal proportions from each stratum were calculated to come up with an equal proportionate for participation in each ward. This helped reduce redundancies and reduced sampling error.

• **WARD.**	• **Approximate number of coffee farmers.**	• **Proportion per stratum** • **(p)= s/N × n**
• **Kirinyaga central**	• 30,296	• 163
• **Inoi.**	• 19,899	• 107
• **Kanyek-ine.**	• 14,764	• 80
• **Mutira North**	• 9,900	• 53
• **Mutira South**	• 6,746	• 37
• **TOTAL**	• **81,612**	• **440**

Table 1: Sample size table

2.7 sample size determination

The study used the Yamane's formula (Singh and Masuku, 2014) to calculate the sample size as stated;

n=N⁄(1+N 〖(e)〗^2)

Where n was the desired sample size, N was the total study population from which the desired sample size shall be derived, e was the confidence interval at 95%.

n= 81,612⁄ (1+81,612 [(0.05)]2)

n= 399

10% of the total sample population was included to account for the non-returns and non-responses totaling to 439.

2.8 data collection tools

Both qualitative and quantitative approaches were used for data collection. Quantitative approaches involved the researcher-administered questionnaires a semi structured questionnaire was administered among the respondents selected for the study from the local community using pesticides on their coffee farms. To assess farmers' perceptions towards pesticides, use risks, a modified Likert scale with 5 points which included strongly disagree, disagree, neither agree nor disagree, agree, strongly agree was used

2.9 Pretesting

Pre-test questionnaires and observation checklist was dispensed to a sample size in Nduini Sub-location in Kirinyaga central sub-county with a sample of 45 population of 10% of the sample size randomly selected respondents. The location has a diversification of small -scale farms and the ecological conditions of this region were similar to those of the study site, the purpose was to review the language and clarity of survey questions, to further identify and correct likely difficulties associated in the phrasing of the questionnaire.

2.10 data analysis

The KOBO data collection tool was used in the formulation of questionnaire that were administered to the respondent. This ensured completion of the questionnaires. The statistical package for social sciences (SPSS) version 25.0 was used for analysis. Researcher also used both descriptive statistics in deriving conclusive results from the SPSS data set. To determine the cause- effect relationships between the dependent and independent variables, descriptive statistics such as frequency distributions, percentages, modes and means were used. Bivariate statistics of chi-test variables to test the associations between the independent and dependent variables to get the p-values at 95% confidence interval were also applied. Qualitative data collected from the FGDs was done through thematic content analysis under the following themes: use of PPEs appropriately, storage of PPEs, clean up and water availability in the farm. The independent variables that had a significant association to individual risk factors as causes of acute pesticide poisoning of 0.05 or less were subjected to logistical regression analysis and they were expressed as odd ratios. (Thundiyil, et al., 2008). Toxicity symptoms incidence was analyzed using the WHO Acute pesticide poisoning proposed classification tool, (2008).

3.0 Results

3.1 *: Socio-demographic characteristics of respondents*

Table 4.1 presents data on the socio-demographic characteristic of the study participants. Results indicate that majority of the respondents were men (89%), . Majority of the respondents (33.13%) were aged between 30-34 years. The majority (77.6%) had attained at least a primary school education. Most of the respondents (61%) were not married. With regards to the employment status, majority (70%) owned their farms and worked on them themselves. Most of the respondents 46.3% had worked on the farm for less than 2 months

Table 2: Socio-demographic characteristics of respondents.

Socio-demographic	Indicator	Frequency (n=326)	Percentage (%)
Gender	Male	289	89
	Female	37	11
Age Group	18-23	11	3.37
	24-29	40	12.27
	30-34	108	33.13
	35- 39	76	23.31

	40-44	54	16.56
	45- 49	37	11.35
Level of Education	None	73	22.4
	Primary	120	36.5
	Secondary	106	32.5
	College/University	27	8.3
Marital Status	Married	127	39
	Single	199	61
	Total	326	100
Occupation	Employed	98	30
	Self-employed	228	70
Employment status	<2 months	151	46.3
	3-6 months	59	18.1
	More than 1 year	116	35.6

3.2 Incidence risk of Acute Pesticide Toxicities among Small Scale Coffee Farm Workers

Figure 2 presents data on the incidence of acute toxicities due to pesticide exposure. Results indicate that (67.8%) of the respondents agreed they had experienced some if not all of the listed symptoms at some point within the year and after pesticide application while 28.5% of respondents disagreed to having experienced the listed symptoms whereas 3.7% didn't respond. Therefore, the pesticide-specific incidence risk of acute pesticide toxicity symptoms over a period of 3 months was 52.5% cases of acute (n=440).

Calculating incidence risk.

Numerator = 231 self-reported pesticide toxicity reported by farm workers.

Denominator = 440 exposed coffee farm workers.

10n = 102 = 100

Risk = (231 / 440) × 100 = 52.5%

The table below gives a summary of the independent t-test used to analyze the statistical difference the health insurance coverage has on the economic burden of SCI at NSIH.

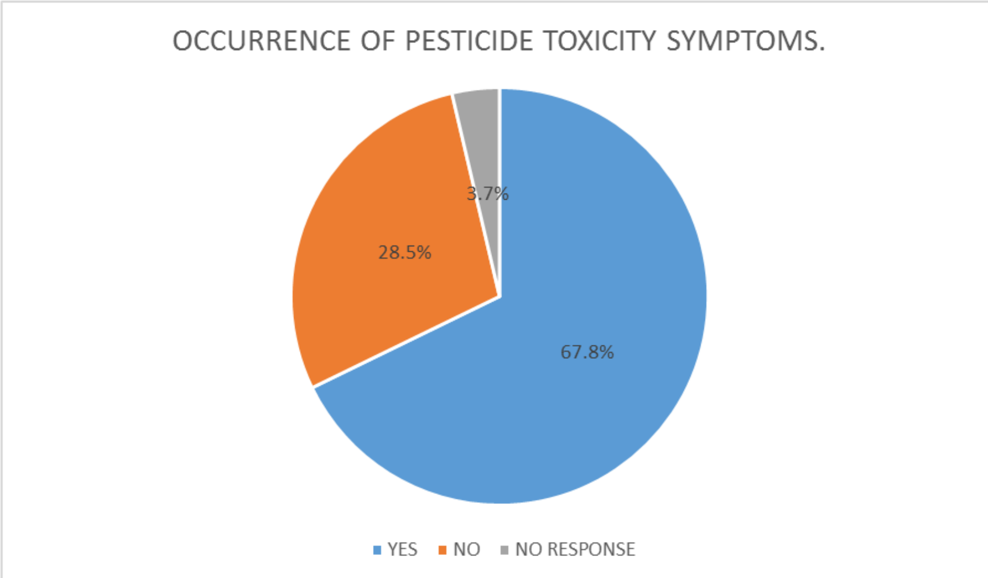

Figure 4: Occurrence of pesticide toxicity symptoms.

The figure below presents data on the incidence risk of acute pesticide toxicities among small scale coffee farm workers. Results indicate that majority of the respondents experienced symptoms similar to pesticide poisoning with little or no knowledge of its cause. Diarrhea was sighted as the symptom most manifested among the 322 respondents of the 326 respondents. Teary and bloodshot eyes were the least likely symptom observed with 320 of the 326 reporting to have not experienced this symptom. The chart below shows frequency distribution of symptoms of pesticide poisoning.

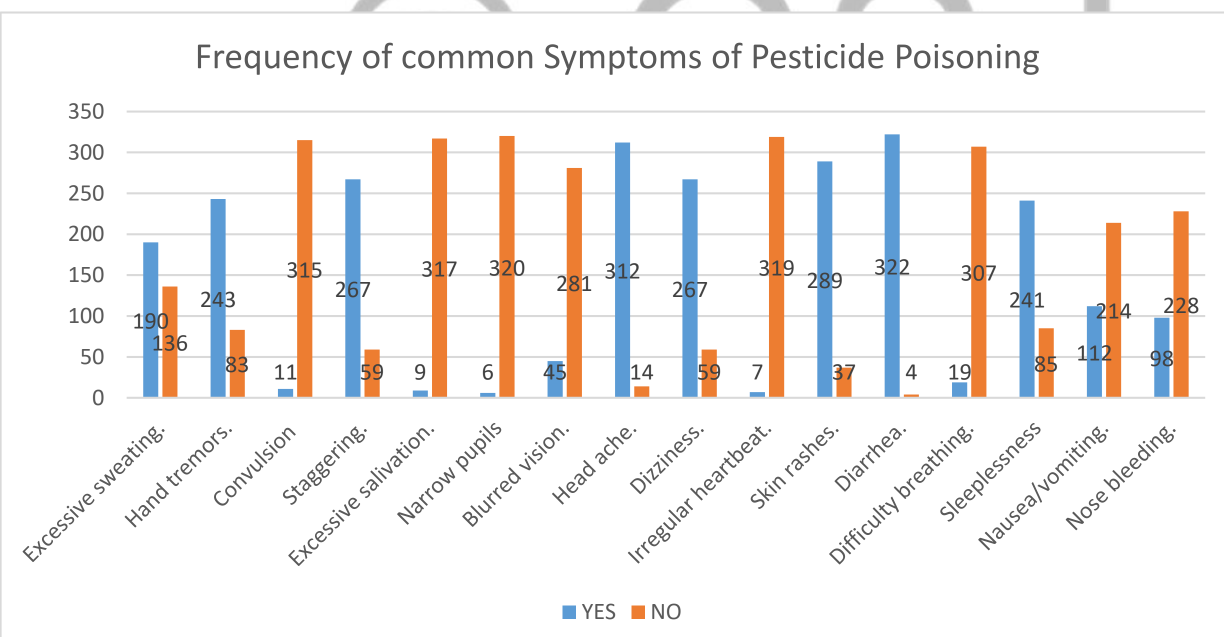

Figure 1: Common pesticide poisoning symptoms identified by respondents.

The confounder variables were minimized by restriction. Most of the participants were in the age group of 30-45, and had no previous medical conditions.

3.3 Risk Factors for Acute Pesticide Poisoning

Table 4.4 represents the results on individual worker high risk characteristics of the study participants. Of the total sampled population, 6.4% of the respondents had smoked before in their lives, while (3.37%) were still smoking at the time of the interview.

TABLE 3: HIGH RISK BEHAVIORS CHARACTERISTICS.

High risk behaviors Characteristics	Indicator	Frequency (n=326)	Percentage (%)
Smoked before	Yes	21	6.44
	No	304	93.25
	No response	1	0.31
Currently smoking cigarettes or marijuana	**Yes**	11	3.37
	No	315	96.63
Currently taking alcohol	Yes	254	77.91
	No	72	22.09
Rate of drinking	Once or twice a day	244	96.06
	Three times a day	7	2.76
	All the time	3	1.18
Quantity per sitting	1-3 bottles	208	81.89
	4-6 bottles	36	14.17
	Over 7 bottles	10	3.94
Time of drinking	Just before work	12	4.72
	During work	43	16.93
	After work	199	78.35
Drink or eat during spraying or preparation of pesticide	Yes	13	5.12
	No	241	94.88

From the table above, majority of the respondents (77.91%) were taking alcohol, of which; majority of those who take alcohol (96%) took alcohol once in a day. Majority of the respondents 81.89% took about 1 to 3 bottles. Of those who consumed alcohol, most (78.35%)) always drank after work. Majority of the respondents (94.88%) did not eat nor drinking during preparation and spraying of pesticides.

Good Safety Practices for Pesticide Use.

Table 4.5 represents the study findings on the safety practices before and after use of pesticide. The results indicated that most of the respondents mixed the pesticides the right way (99.69%) but also mixing several pesticides together (98.4%). Majority did not wear PPEs (96.32%), did not read pesticide labels (99.08%) and they did not read the pesticide safety instructions (89.57%) prior to application.

Table 4: Safety practices for pesticide use

Safety Practice Before Pesticide Application.	Frequency (n=326)	Percentage (%)
Wear personal protective equipment.	12	3.68
Did not wear PPEs	314	96.32
Read pesticide label.	3	0.92
Did not read pesticide label	323	99.08
Mix pesticides away from water sources.	325	99.69
Did not mix pesticides away from water sources	1	0.31
Reading pesticide safety instructions.	34	10.43
Did not read pesticide safety instructions	292	89.57
Mixing different pesticides	321	98.47
Did not mix different pesticides	5	1.53
Safety Practice After Pesticide Application.	**Frequency(n=326)**	**Percentage (%)**
Wash hands with soap.	211	64.72
Did not wash hands with soap	115	35.28
Take a systemic shower.	321	98.47
Did not take a shower	5	1.53
Wash your pump.	325	99.69
Did not wash the pump	1	0.31
Launder your work clothes.	32	9.82
Did not wash work clothes.	294	90.18

Majority of the respondents (99.69%), washed pumps and (98.47%) took shower after pesticide application, 64.72%) washed their hands post- pesticide application and (90.18%) did not clean their clothes after spraying.

3.4 Correlation between High Risk Behavior Characteristics across Gender

The study findings revealed a significant difference in the high-risk behavior characteristics across gender, all variables were statistically significant. The variables were: Smoked before, currently smoking cigarettes or marijuana, currently taking alcohol, Rate of drinking, Quantity per sitting, Time of drinking, Drink or eat during, spraying or preparation of pesticide. Chi-square statistics was used in testing the associations between variables since the variables under association were of categorical variables.

Table 5: Relationship between individual risk factors and Gender.

High risk behaviors Characteristics	Male	Female	P Value
Smoked before			
Yes	12	9	df = 3; χ^2 = 68; p = **0.012**
No	102	202	
Currently smoking cigarettes or marijuana			
Yes	8	3	df = 3; χ^2 = 97; p = **0.011**
No	115	200	

Currently taking alcohol			
Yes	201	53	df = 3; χ^2 = 113; p = **0.023**
No	16	56	
Rate of drinking			
Once or twice a day	134	110	df = 5; χ^2 = 95; p = **0.029**
Three times a day	7	0	
All the time	3	0	
Quantity per sitting		0	
1-3 bottles	187	21	df = 5; χ^2 = 123; p = **0.032**
4-6 bottles	35	1	
Over 7 bottles	10	0	
Time of drinking		0	
Just before work	6	6	df = 5; χ^2 = 132; p = **0.043**
During work	43	0	
After work	160	39	
Drink or eat during spraying or preparation of pesticide		0	
Yes	8	5	df = 3; χ^2 = 201; p = **0.029**
No	221	20	

Note: p values were calculated using Chi-square test. The significant factors are in bold. P is significant if $p<0.05$

3.5 Association between High Risk Behavior Characteristics and incidences of SELF- REPORTED symptoms.

Table 4.6 below via chi square tests as a method to determine the P values of the variables. It revealed that individual characteristics of smoking (p=0.013), alcohol consumption (p=0.046); (p=0.0361) and eating and drinking during application (p=0.0247) were statistically significant to the incidences of symptoms reported. The table illustrates this by comparing the incidences reported and participants' high-risk behavior. The participants who reported high incidences of symptoms also had high risk behavior characteristics.

TABLE 6: RELATIONSHIP BETWEEN HIGH- RISK BEHAVIOR AND INCIDENCE OF SELF-REPORTED TOXICITY SYMPTOMS.

High risk behaviors Characteristics	**Incidences of symptoms reported**		**df**	**X^2**	**P Value**
Smoked before	**Yes (%)**	**No (%)**	1	13.7	
Yes	35	31			0.075
No	15	19			
Currently smoking cigarettes or marijuana					
Yes	39	23	**1**	24.03	**0.013**
No	11	9			
Currently taking alcohol					
Yes	3.6	6.4	**1**	**5.86**	**0.046**

No	46	33			
Rate of drinking					
1-3 bottles	3.3	12.2	**2**	**4.93**	**0.0361**
4-6 bottles	2.4	33.7			
Over 7 bottles	3.1	44.4			
Quantity per sitting					
1-3 bottles	8.7	11.3	2	3.43	0.651
4-6 bottles	12.4	22.6			
Over 7 bottles	15.5	24.5			
Time of drinking					
Just before work	16	27	**2**	**35.94**	**0.0352**
During work	43	4.4			
After work	1.6	11.4			
Drink or eat during spraying or reparation of pesticide					
Yes	8.8	13.5	**1**	**23.11**	**0.0247**
No	34.6	43.1			

4.0 discusions

4.1 Significant Socio-demographic characteristics.

In the findings of this studies, the socio-demographic variables of level of education, gender and employment status were statistically significant to the occurrence of acute pesticide poisoning symptoms. From this findings gender was statistically significant at (OR:1.65,95%CI:1.09-3.12). Therefore, male small-scale farm workers who had worked in coffee farms and had handled pesticides at some point during regular farm activities were 1.65 times more likely to exhibit signs and symptoms of Acute pesticide poisoning. These findings coincide in a much lower ratio to findings from a study done in Benin where male farm workers were 0.19 times more likely to exhibit symptoms of APP (OR: 0.19 95% CI 0.04-0.92) (Vikkey et al., 2017). In that same study, women exhibited more likelihood to show inhibition of ACHE than men. Gender as a risk factor can be explained by the fact that most farm operations especially in African countries are performed by men as highlighted in a study done in Uganda (Pedersen et al., 2017). In African countries it is cited as culturally appropriate for men to handle more strenuous farm operations such as spraying. Furthermore, the likelihood of men exhibiting more symptom could be attributed to the fact that men in African culture are to express no form of weakness. It is supposed that their bringing to attention mild cases of illness symptoms as is characteristic to symptoms associated with APP, this would be a sign and show of weakness and thus contributed not only to negligence but also to lowered risk perception. (Sang &Kimani, 2016). In a study done by Detsouli et al., (2017) He highlighted that males exhibited a higher lethality to pesticide poisoning by 3.20% which was higher than what was witnessed among females. In other studies, though female statistics for APP were higher and this was often attributed to the intentional use of Pesticides often in an attempt at suicide. (Afshin &Kiran et al., 2019). In recent years though these statistics have also been witnessed among males due to heightened societal pressures, high standards of living and increased responsibilities imposed of males resulting in even more cased of attempted suicide. (Ashenafi & Thanasekaran, 2020, Rani et al., 2020).

The level of education has too been found to be statistically significant to the occurrence of APP. (OR:1.81 95% CI; 1.03-2.97). Small scale farm workers who had received any form of education were 1.81 times more likely to exhibit symptoms of APP. This findings are echoed in a study done in China where people aged 36-60 who had received a basic schooling were 0.69 times more likely to show signs of APP.(OR:0.69,95% CI 0.57-0.83) The disparities in this findings subject to the margin identified could be attributed to the different parameters subject to the study population. (Wang et al 2019). In a study done by Rani et al., (2020) the researcher found that illiterate farmers were 2.5 times more likely to show signs of APP. This could be attributed to the fact that illiteracy rendered an individual incapably of reading safety instructions on pesticide containers and in understanding the basic principles on the benefits and uses of PPEs. The researcher can explain the findings of this study with the fact that the more educated an individual is the perception of risk diminishes as a result of ignorance especially in the use of PPE. In a study done in China, the older and more experienced and knowledgeable a farmer was the less likely they are to practice safe pesticide practices due to a diminished perception of risk and a search for greater benefits resulting in overuse. (Jin et al. 2017).

Farm workers were 0.98 times more likely to show symptoms of APP if they owned the farm. (OR:0.98 95% CI 0.94-4.23). Reviewed literature has not tested for the statistical significance of employment status. However in a study done in Ethiopia,commercial farmers utilized appropriate safety parameter in Pesticide use because most workers were employed under corporations that adhere to internationally set standards of practice in pesticide use and crop management. (Negatu et al., 2018). This could be because often times the crops are grown purely for export purposes. Small scale farmers often have no supervisory body on how they handle farm produce and this may result in most of them overlooking the importance of safety in the application of Pesticides since they often police themselves. As identified from this study majority of the farm worker are self-employed (70%). The researcher supposes that based on the nature of ownership of the farms, small-scale farm workers can often be negligent and ignorant to the dangers posed by pesticides.

4.2 high risk worker characteristics

From this study we find that the consumption of alcohol was statistically significant to the respondents exhibiting APP symptoms (OR:0.71 95% CI; 1.21-3.68). This translates that small-scale farm workers who consumed alcohol were 0.71 times more likely to exhibit symptoms of APP. In rural areas the consumption of alcohol is a normal and often practice especially among farm workers. It is supposed that they need it to lessen the hardships associated with strenuous farm work. However, this would not be an ideal situation when applying pesticides. It is common knowledge that the use of drugs and substances impairs judgment and risk perception to up to 80% of an individual conscious. This same principle applies among farm workers who consume alcohol. It can be assumed that the reason for such high stakes can be attributed to the overuse of pesticide inappropriate use or lack thereof to use PPEs during pesticide handling this could be during spraying. Alcohol is known to raise blood pressure and consequently resulting in profuse sweating this may cause the farm worker applying the pesticide to avoid wearing effective PPEs that would prevent exposure. The intoxicated individual may even use an excessive amount on the coffee crop or even cause direct spills on the body due to hand tremors associated with APP or may be unable to read safety instructions on pesticide containers. Furthermore, some of the chemicals used may not interact well with alcohol upon entry into the body through the various forms of entry such us the skin, mouth, nose (Damalas& Abdullahzadeh, 2016; Peter et al., 2018). In a study done by Pupin et al., (2020), drinking of alcohol was found to be statistically significant against gender. Most males consumed alcohol at 51.48% of the total study population. He attributed the high vulnerability to low education level and low risk perception. In a study done in Sri Lanka, the study discovered that 36% of acute pesticide poisoning from the intentional poisoning were under the influence of alcohol at time of admission (Vikkey et al., 2017). In a study by Hannah &Russel (2020), the engagement in risky behavior such as eating, drinking alcohol and smoking during pesticide handling was linked to APP.

From the findings of this study drinking and eating was statistically significant to the occurrence of APP symptoms (OR: 0.537 95% CI 0.66- 2.14). This is to say that a farm worker was 0.537 times more likely to exhibit symptoms of APP if they ate or drank as they sprayed crops. This can be attributed to the direct hand to mouth contact of pesticide. This would explain further the high incidence risk at 96% of diarrhea cases among the respondents. In another study done in Tanzania, the eating and chewing during pesticide application had been directly associated to increased levels of diarrhea. (Manyilizu et al., 2017). We can explain these statistics as a result of ignorance, laziness and low risk perception as well as the poor use of PPEs. As observed from the farms visited most farms had access to taped water within the farm. This would automatically mean that most would take advantage of the easy accessibility to a source of water to practice safety measures but this was not the case. The researcher assumes that most of the respondents felt it was cumbersome or too tasking to walk to the nearest source of water to practice hand washing. In a study done in Gambia, respondents did not eat or drink during pesticide use which was attributed to high training on safety in pesticide handling and increased risk perception among this population (Idowu, 2017).

Smoking was not significant which contradicts findings made by Celvak, (2020) who highlighted that 53.8% of farmers were smokers and of this 39.5% smoked during pesticide handling which would increase pesticide contamination through the mouth. Another study done in Tanzania highlights that smoking during pesticide application was associated with increase in chest pain

(Manyilizu et al., 2017). The disparity in these findings could be explained by the fact that most respondents in this study did not smoke (93.25%) during pesticide application.

5.0 Conclusion

The use of pesticides among the farmers has been growing rapidly over the years. Farmers from across the several agricultural regions in Kenya have embraced the use of pesticide for the production of their crops. In Kirinyaga county coffee farming which is common in the area, also fall under the category of using pesticides. the use of pesticides has seen the occurrence of health effects that affect human health in diverse ways. The health effects are as a result of exposure that arises from various factors as perception and individual characteristics mentioned in this study. In view of the findings of this study, the following conclusions can be drawn.The study concludes that acute pesticide poisoning symptoms are prevalent among small scale coffee farm workers in Kirinyaga county and that various individual risk factors inform the likelihood of development of these symptoms. The first objective was to establish the incidence risk of Self-Reported Acute pesticide poisoning symptoms. These symptoms were common and among the high-ranking symptoms were headaches, diarrhea, skin rash staggering and dizziness. The main exposure routes established for these symptoms were through the skin and the mouth. The symptoms were associated to the poor use of PPEs among the respondentThe second objective sort to ascertain the levels of perception among the small-scale coffee farm workers. The perception on the harmfulness of pesticides on human and environmental health, perception on the behavior towards safety and perception on safety training aired on the more extreme level on the scale. These perceptions influenced farmer behavior and thus were in support of the theory of planned behavior. Socio-demographic characteristics of gender, level of education and employment status proved significant; risky behaviors of drinking alcohol and eating and drinking during spraying increased risk; safety practices of wearing PPEs, mixing pesticides away from water sources; washing hands with soap and taking a systemic shower after pesticide application were statistically significant to occurrence of APP Symptoms and perceptions on safety training, harmfulness of pesticide on human and environmental health and behavior towards safety in pesticide use were significant risk factors. They increased the odds of developing acute pesticide poisoning symptoms.

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