Farmer Awareness of Using Pesticides in Vegetables and Effects on Human Health

Bishnumani Kafle [a]
[a] Mahendra Ratna Campus, Tahachal, Tribhuvan University
Email: kaflebisnumani@gmail.com

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ABSTRACT: Nowadays pesticides are perceived essential for agriculture and are used extensively throughout the world. It is used for repelling, destroying or controlling pests. The objective of the study was to analyze the farmer awareness in pesticide use and its effects on health in Panchakhal Municipality. Descriptive study design and quantitative data were used. Non-probability purposive sampling method was used to select respondents. 38 farmers were selected as respondents during seven days. Interview schedule were used to collect data. The finding of the study showed that around seventy five percent male were involved to spray pesticides in commercialize vegetables. Among them, most of were young. More than fifty percent farmers were educated but they had no knowledge about proper handling of pesticides. Almost people were involved in agriculture sectors in the study area. Almost farmers used chemical pesticides in their vegetables farms to kill pests in order to increase production. Most pesticides purchasing places were agro-vet and nearby shop. Nobody took advice from agriculture office or JTA. Most of farmers had harvested vegetables just next day after spraying pesticide. Around ninety percent farmer had not taken any types of training for safe handling of pesticides as well as didn't use personal protective equipment (PPE) properly. Farmers, who had taken basic training, almost had no health hazards. Most of them had no knowledge about proper management of empty bottles or packets of pesticides. A few percent farmers gave attention on proper personal hygiene after applying pesticides. Pesticides handling practices were not satisfactory and different health issues were reported.

Introduction

Agricultural sector is one of the most important sectors globally and is the major contributor to the food industries as well as the most prevalent type of employment in the world. Pesticides are widely used throughout the world, especially in agriculture for crops production. According to World Health Organization (WHO), 20 percent of pesticides used in the world,

is focused on developing countries including Nepal. Many indicators illustrate that pesticide use has been increasing at an alarming rate in agricultural sector. About one to five million farm workers are estimated to suffer from pesticides poisoning every year and at least 20 thousands die from the exposure, many of them in developing world (WHO, 2005). Nearly 50 percent of the world labor is employed in agriculture and they carry significant risk for development of pesticide health hazards (Das, 2001).

Pesticides are used to enhance and stabilize crop yield, protect the nutritional integrity of food, facilitate. Storage assures year-round supplies and provides attractive and appealing food products. Farmers have changed the way they produce crops. Among which, the use of pesticides and other chemicals has become a common agricultural practice. The World Health Organization (WHO, 2005) and United Nation Environmental Program have estimated one to five million cases of pesticide poisoning among agricultural workers each year with about 20,000 fatalities, mostly reported from developing countries (Shalaby, 2012).

Agriculture is the major sector of Nepalese economy. It provides employment opportunities to 64.5 percent of the total population and contributes about 33.1 percent in the Gross Domestic Product (GDP). Therefore, the development of agriculture sector is the key to the development of national economy. Agriculture has remained as the main sector of the Nepalese economy since many years. Nepalese agriculture is dominantly characterized by the role of small farmers. Presence of highly diversified geographical area possessing higher crop genetic diversity is the common feature of Nepal (Economic Survey, 2016).

Nepal has an amazing opportunity for producing vegetables as diverse agro-eco-zone favors both season and off season varieties. Due to this advantage, farmers are encouraged to produce vegetables full the national and international demands. Thus, production and productivity of vegetables have been increasing significantly in the last decade (Shrestha, 2010). Farmer use pesticides without full understanding of the impact of human health and environment. They have also lack of the appropriate knowledge on safe handling and use of pesticides (Matthews, 2008). Human come into contact with pesticides in the field, during pesticide application, weeding, harvesting and when collecting fire woods or vegetables (Ngowi, 2007). Storing pesticides may lead to exposure and adverse health consequences. Although inhalation, contact and oral routes of exposure are the most common, pesticide residues in food and water may add to indirect exposure. Misusing pesticides also harm the natural environment as well as human health (Abang, 2013).

Pesticides are designed to kill harmful pets but some pesticides can also cause negative health effects in people and damage ecosystem. Pesticide residues absorbed by inhalation, ingestion and dermal contact can lead to acute and chronic toxicity. Such kinds of toxicity depend on types of pesticides, port of entry, dose, metabolism, accumulation and so on. Acute toxicity is due to short-term exposure and happens with in a relatively short period of time, whereas chronic toxicity is due to repeated or long term exposure and happens over a long period. Mainly it interrupts the metabolic and systemic functions of human body. The chemical compound of pesticide disrupts the neurological function. It is injurious to the immune and endocrine systems as well (Wesseling, 1997).

Pesticide related illness suffered by members of a household may affect the overall performance and the productivity of the farm family, as household normally supply agricultural labor in developing countries like Nepal. The use of pesticides on vegetables and crops in Nepal

has increased dramatically in recent year. Farm chemical are used intensively in the Terai region and in Kathmandu valley as well as its surrounding areas where agriculture, especially vegetable production is significantly commercialized (Jha & Regmi, 2009). Farmers use pesticide without full understanding of the impact on human health and environment. Pesticides use in Nepal started in the early 1950s, especially with use of Dichlorodiphenyltrichloroethane (DDT) for malaria eradication (Manandhar, 2005).

Human health is partly dependent on the environmental condition people live in. Occupational health, which is well researched in developed countries, remains neglected in developing countries (Nuwayhid, 2004). In most of developing countries many farmers suffer from the reduced and unstable crop yield due to pest and disease problem. Yield loss of agricultural products due to insects, pests, disease and weeds is 20-35 percent in Nepal (MOAC, 2007). Use of pesticides in excess amount is a global phenomenon and Nepal is also facing the same problem. Pesticides in agricultural sector were introduced in Nepal is early sixties (Palikhe, 2002). These days, there is excess use of chemical pesticides in many commercially grower area. General problems were controlled by the indigenous techniques. With the development of improved verities, chemical fertilizers and commercialization of agriculture, problems of pest\disease and weeds have been raised (MOAC, 2007). With the advancement of technology and science, the practice of adopting professional vegetables farming and practicing chemical pesticides has been increased all over the Nepal. In this situation this study was to analyze the farmer awareness of pesticide use in vegetables and its effects on human health in the study area. The specific objectives were as follows:

(a) To find out the status of awareness regarding use of chemical pesticides.
(b) To assess the health effects caused by chemical pesticides.

Literature Review

Pesticides can be dangerous to consumers, worker and close bystanders during manufacture, transport or during and after use. The WHO and the UN Environmental Program estimate that each year, 3 million workers in agriculture in developing world experience severe poisoning from pesticides, about 18,000 of whom die (Miller, 2004). 25 million workers in developing countries may suffer mild pesticide poisoning yearly. Organophosphate pesticides have increased in use, because they are less damaging to the environment and they are less persistent than organ chlorine pesticides. Problems for workers that handle the chemicals, such as abdominal pain, dizziness, headache, nausea, vomiting as well as skin and eye problems (Ecobichon, 1996). Additionally, many studies have indicated that pesticide exposure is associated with long-term health problems such as respiratory problems, memory disorder, dermatological conditions, cancer, depression, neurological deficits, miscarriages and birth defects (Engel et al., 2000).

A field study was conducted to evaluate knowledge, practice of pesticides among thirty commercial vegetable growers in Dhading district of Nepal. It was found that, around fifty percent of growers were literate and majority of them had only primary education. Forty percent work hard daily about 5-9 hours in the vegetable field. Almost all farmers applied pesticides to vegetables. This showed that in the current year the use of pesticides in vegetables has increased and is in rising trend. Nearly 50 percent apply pesticides 5-6 times, whereas nearly one-fourth use it 3-4 times depending on severity of paste problems in vegetables. It

indicates that there is a high frequency of pesticides use in the vegetable that are possibly to increase toxic residue in the vegetable that might pose higher risk to vegetable growers and consumers. More than one-sixth pesticides used were extremely hazardous, which were barred for general agriculture use. Waiting period is less than four days for nearly two third growers. More than three-forth know the adverse effect of pesticides and nearly half experienced symptoms of health hazards. Majority did not receive any official training on pesticides and nearly one-third doesn't read information available in pesticide level. Nearly half were not using Personal Protective Equipment (PPE) during pesticide application. Nearly two-third throw pesticide container anywhere after using it. (Shrestha et al., 2010).

This study was conducted in Kavrepananchowk district on 403 sample household. It was found that local farmers underestimate the risk of pesticide exposure. They also believe that such risk of pesticide exposures are a part of daily farm life. Furthermore, it is uncommon that individual adopt adequate safety precautions while applying pesticides. Farmers in the study area would be likely to increase pesticide application in vegetable farming with minimal safety precaution for better livelihoods; but they are at high risk of exposure and are reluctant to comprehend the pesticide risk unless they observe the risk are real. Community level integrated pest management could reduce pesticide expanse, health and environmental effects and also enhance capability of local people for decision making, thus integrated pest management (IPM) as an alternative to chemical pesticides along with education and awareness on the safe use and handling of pesticide is of great importance. Farmers training at regular intervals focusing on sustainable management of the agro-ecosystem, emphasizing local understanding of pesticide risk of exposure to human and environmental resources along with safety measures are highly recommended (Atreya et al., 2013).

This study carried out with the objective of knowing the pesticides use pattern in commercial vegetable cultivation in the pocket area in vegetable production of eastern Chitwan, Nepal. The study reveals that farmers have very little knowledge or have no knowledge about safe use of chemical pesticides. Meanwhile, they are not aware of waiting period, environmental and health hazards and all those accidents led by misuse of chemical pesticide. Pesticides use in commercial farming and freshly marketable commodities appears excessively uncontrolled and without consideration of health of consumers (Ghimire et al., 2001).

Methods and Materials

Descriptive research designed was conducted based on quantitative data, including farmer respondents of ward no.3 and 4, who have farming field in ward no.4, 'Khatabesi' of Panchkhal Municipality of Kavrepalanchowk district. Non-probability purposive sampling method was used. The farmers were spraying pesticide in the vegetable farm in ward no. 4, were the respondents of the study. The farmers who were interested to participate in the study were included in the sample. Data were collected during a week through open ended, closed and mixed type, self-administered interview schedule. Data collection tool was developed based on the review of related literatures, journals and research reports. Data collection tool was pre-test in Baluwa, ward no.12 of the same Municipality. Five farmers were taken as pre-test, which were to be 13 percent of total respondents of similar characteristics farmers to identify the practicability and determine validity and objectivity. According to feedback of the

pre-test, some modification was done for finalization of the interview schedule. Each respondent took approximately an hour to response the interview schedule. The same previous respondent was not included again for interview as a sample. The collected data had been verified and tabulated in different groups. Descriptive version and simple mathematical interpretation procedure has been adopted in this study.

Results and Discussion

Nepal is an agricultural country. Most of the both gender and different age group of people are involving in agricultural field. In the study area, age and sex wise distribution of people, who were spraying pesticides in vegetables farm were studied. This data are presented in table 1.

Table 1: *Age and sex wise distribution of the respondents*

Age group	No. of male	% of male	No. of female	% of Female	Total number	Total percent
15-25 Years	5	13.16	2	5.27	7	18.43
26-35 Years	9	23.69	4	10.52	13	34.21
36-45 Years	7	18.42	3	7.89	10	26.31
46-55 Years	6	15.81	1	2.62	7	18.43
Above 56 Years	1	2.62	0	0.00	1	2.62
Total	28	73.66	10	26.29	38	100.00

Table 1 shows that, among total 38 respondents, 73.69 percent respondents were male and 26.31 percent respondents were female. Among them 13.16 percent male and 5.27 percent female were on 15-25 years age group, 23.69 percent male and 10.52 percent female were on 26-35 years age group, 18.42 percent male and 7.89 percent female were on 36-45 year age group, 15.81 percent male and 2.62 percent female were on age group of 46-55 and only 2.62 percent male were above 56 years. It shows that most of them (34.21 percent total male and female) were 26-35 years age group had spread pesticides in vegetable farm in the study area. The age group of pesticides user on vegetables were matched by the result of the study conducted in Palpa district, Palung Mainadi VDC, where 34.14 percent pesticides user on vegetables were on age group 26-35 years (Nepal, 2017).

In the study area, 68.42 percent respondents were in joint family structure and rest of them 31.58 percent respondent were in single family structure. Education enhances the ability and capability of human being to judge right and wrong. It also plays vital role in farmer awareness on the use of pesticides in vegetables. In this study 5.26 percent respondents were illiterate, 7.89 percent were only literate, 63.15 percent had completed the secondary level of education and remaining 23.68 percent respondents had completed higher education. This data show that most of the respondents had completed secondary level of education, which is consistent with the study conducted in Palpa district, Palung Mainadi (Nepal, 2017). According to collected data, 84.21 percent respondent's main occupation was totally agriculture, 13.16

percent had service/job and rest of them 2.63 percent had business as main occupation. Most of the people's main occupation was agriculture in the study area, which was supported by the study in Palpa district, where 78 percent people's main occupation was agriculture as well as this result was matched by the result of other places of Nepal, where 57.2 percent people's main occupation was agriculture (Thapa et al., 2021).

Land is the basic need to cultivate vegetables for farmers as well as land should be fertile and irrigation should be available. In the study area, 15.79 percent farmer had used less than two 'ropani', 23.69 percent had used 2 to 4 'ropani' likewise 47.37 percent 5 to 8 'ropani' and 13.15 percent farmers had used more than 9 'ropani' land for vegetables cultivation as well as 2.63 percent farmers had produced crops and vegetables two times in a year. Such as 86.85 percent produced three times and 10.52 percent farmers had produced crops and vegetables four times in each year. The main agricultural products of 39.49 percent farmers, were rice, potato and tomato, 18.42 percent farmers produced rice, cucumber, bitter guard, tomato and remaining 13.15 percent farmer's main agricultural products were cauliflower, cabbage, tomato and bottle guard. Agriculture is the main occupation in Nepal. According to the national agricultural census 2011, 78 percent people were working in agricultural field. They spend lot of years in agricultural work to product crops and vegetables in traditional way. Nowadays, farmers use chemical fertilizer, pesticides to product large amount of crops and vegetables. In the study area, 7.90 percent farmers were cultivating vegetables as cash crops for less than five years, 5.26 percent were cultivating vegetables since 6 to 10 years likewise 13.15 percent since 11 to 15 years and remaining 73.68 percent farmers had been cultivating different types of vegetables for more than 16 years. Media is most important source to aware the people for providing the knowledge. People gain information and knowledge through different media such as radio, television, newspaper, mobile, internet etc. In the study area, mainly 44.74 percent farmers took agricultural information through television, 47.36 percent gained through mobile, 5.26 percent took through radio and remaining 2.63 percent farmer's information source was newspaper.

Pesticide is necessary to eradicate pests in order to produce good quality and increase quantity of crops and vegetables. In the study area, 78.95 percent farmers used only chemical pesticides, 2.63 percent farmers used only natural homemade pesticides, which was made by using urine of animals, ash, liquid by squeezing 'Nim', 'Titepati', 'Banmara', 'Siudi', 'Sisnu' etc. and remaining 18.42 percent farmers used both chemical and natural homemade pesticide to kill pests. Most of the pesticide user said that they had no sufficient knowledge about using pesticides. The main reason of why the farmers used pesticides on vegetables farming. They had different views in the study area. 76.31 percent pesticides users believed that pesticides kill the harmful pests of vegetables, 13.15 percent user's view was on quality production, 5.27 percent farmers believed on increase production and remaining 5.27 percent pesticides user used pesticides by imitation of other pesticides user. Farmers were asked, from where you purchased chemical pesticides. 57.90 percent farmers purchased from Agro-vet, 42.10 percent farmers purchased from nearby general shop. This result was not matched by the study conducted in Palpa district, Palung Mainadi, where all the farmers purchased pesticides in

Agro-vet (Nepal, 2017). The data which represents the advisor for pesticides use of the study area, which are presented in table 2.

Table 2. *Advisor for pesticides use*

S.N.	Advisors	Number	Percent
1.	Agro- vet seller	16	42.10
2.	Pesticide seller/shopkeeper	10	26.31
3.	Neighbors	8	21.05
4.	Imitation	2	5.27
5.	Pesticide's manual	2	5.27
6.	JTA/Office of agricultural	0	0.00
	Total	38	100.00

Table 2 shows that, nobody had gone to take suggestion and advice from Junior Technical Assistant (JTA) or governmental department of agriculture in the study area, which is situated nearby around 15 minutes. Respondents were enquired about the advice they received on the types and amount of pesticides and its procedure for proper use. 42.10 percent respondent reflection were on Agro-vet seller, 26.31 percent respondents reflection were on pesticide seller/ shopkeeper, 21.05 percent respondents answer were on suggested by neighbors , 5.27 percent respondents answer were on imitation by other farmers, who used pesticides and 5.27 percent respondents used pesticide using pesticide's manual.

In the study area, farmers were asked on normal interval of spraying pesticides in vegetables. 28.95 percent farmer responded on every two days, 52.63 percent answered on every four days and 18.42 percent answered on every seven days. Although almost all of the farmers said that, however, it depends on violence of pests. The effect of pesticides remain for some days (depends on types of pesticides) after spraying pesticide on vegetables. So farmers should be aware while harvesting vegetables from their farm. In the study area, 5.27 percent farmers had picked vegetables just next day after spraying pesticide, 18.42 percent farmers had harvested after two days, 50.00 percent farmers had harvested after four days, 15.79 percent farmers had harvested after six days and remaining 10.52 percent farmers had harvested vegetables after spraying pesticides more than six days. Most of the farmers had agreed that harvesting of vegetables depends on the price of the market.

Training is very important for farmers to handle chemical pesticides safely. If chemical pesticides are not used properly and safely, it may be dangerous to human beings as well as other living creatures. 7.90 percent pesticide user had taken basic training of safe handling of chemical pesticides. This result was supported by the study that was conducted in Palpa (Nepal, 2017), and also supported by the study conducted in other places of Nepal (Thapa, et al., 2012). In the study area, 92.10 percent pesticides user had not taken any types of basic training of safe handling of chemical pesticides. It means that almost all of the farmers had no knowledge for safe handling of chemical pesticides. That's why 7.90 percent pesticides user had perfectly used PPE and 92.10 percent pesticides user had not properly used safety measure of equipment. The farmers were asked what types of safety equipment they used while using or spraying chemical pesticides. 36.85 percent farmers usually used shoes and masks, 13.15 percent

farmers used shoes, masks and gloves, 7.90 percent farmers always used shoes, masks, gloves, track and goggle and 42.10 percent farmers did not use any type safety measure equipment, while using or spraying chemical pesticides. The same result was found in other places of Nepal, where the use of PPE properly was very low (Thapa et al., 2021). It proves that, people who took basic training of safe handling of pesticides, only they used PPE properly in the study area.

In the condition of empty bottle or packets of pesticides after using, there is still some amount of pesticides remaining in the bottle or packets so it must be managed carefully and properly otherwise it will be harmful. In this context the farmers were asked how to manage empty bottle or packets of pesticides after using. 78.95 percent farmers threw off empty bottles or packets of pesticides anywhere, 7.90.percent farmers used burying method and remaining 13.15 percent farmers threw on garbage. This data shows that almost all the farmers did not manage of the pesticides empty bottle or packets properly.

Farmers are regularly exposed to a variety of health hazards during farm work, particularly with respect to agricultural intensification and associated pesticide use. Many studies have shown that overuse of pesticides in agricultural farms has adverse health consequences such as headache, skin irritation, respiratory and throat discomfort etc. (Beshwari, 2004). In the study area, farmers were asked if health hazards arose from spraying chemical pesticides. 84.21 percent chemical pesticides user responses were 'Yes'. This result was matched by the result of conducted other places of Nepal (Sharma et al., 2012). 15.79 percent pesticides user responses were 'No'. 84.21 percent respondents who had health hazards of spraying pesticides in vegetable in the study area, the health hazards are presented in table 3.

Table 3. *Main health hazards of pesticides*

S.N.	Hazards	No. of responses	Percent
1.	Headache	18	56.25
2.	Skin irritation	3	9.38
3.	Eye irritation	2	6.25
4.	Dizziness	8	25.00
5.	Vomiting	1	3.12
	Total	32	100.00

Table 3 shows that, 56.25 percent responses were on headache, 9.38 percent responses were on skin irritation, 6.25 percent responses were on eye irritation, 25.00 percent responses were on dizziness and remaining 3.12 percent responses were on vomiting. It is concluded that, more than 50 percent farmers faced headache in the study area which is inconsistent with the study conducted in Palpa, where most of the farmers faced skin irritation problem.

After spraying pesticides, farmers must give attention on personal hygiene. Farmers spraying pesticides were asked on personal hygiene after applying pesticides. Cent percent respondents agreed. It means that all of the farmers spraying pesticides take care about personal hygiene after applying pesticides. But, among them 15.79 percent took bath with soap and water, 28.94 percent washed hands and legs only water and remaining 55.27 percent pesticide sprayer washed face, hands and legs with soap and water after spraying or applying pesticides

in vegetables farm in the study area. It is concluded that although all of the farmers response was positive on the take care of personal hygiene after spraying pesticides but among them 15.79 percent farmer took care personal hygiene properly, Which was not supported by the study conducted in Palpa where 73.00 percent farmers took personal hygiene properly after spraying pesticides (Nepal, 2017).

Conclusion

In the study area, almost farmers spraying pesticides on vegetables were male. Among them, most were young (26-35 years) age group. Most of the pesticides user on vegetable farm, who were completed secondary level of education. Most of them had main occupation was agriculture. And their main agriculture products were rice, potato and tomato. Most of farmers who were using pesticides in farms, their knowledge information sources were news, facebook, YouTube etc. on mobile device. Almost all farmers used chemical pesticides in their vegetable farms to kill pests. The main reasons of using pesticides were to kill pests, increase and quality production as well as imitation of other farmers. Almost all farmers have been using pesticides for more than 16 years. Most of farmer's pesticides purchasing location was Agro-vet and nearby shop. Around 50 percent farmers took advice from Agro-vet seller and nobody had gone to take advice for using pesticides in the office of agriculture or JTA.

It is found that almost all farmers had passed secondary level of education although they did not know how to properly use pesticides. Most of the farmers had harvested vegetables next day after spraying pesticides. The farmers who had taken basic training for safe handling of pesticides, they had properly used PPE and normally did not have health hazards but its percentage was very low as well as they had managed the empty bottles or packets of pesticides properly. And a few percent farmers had given attention on personal hygiene properly after applying pesticides. The study shows that, farmers should be provided training of properly handling of pesticides. It helps farmers to be free from health hazards and can promote the health status of farmers. This study was conducted in small area and sample size was small too. That's why it will be better to take large area and big sample size for further research.

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