



Determinants of Unsafe Behavior in Pesticide Usage among Horticulture Farmer

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Abstract

BACKGROUND: The pesticide use is one of the agriculture intensifications which have advantages in production but given the negative impact on health like pesticide toxicity. The pesticide usage that improper and not accordance with the procedure is in line with the number of toxicity among farmers.

AIM: This study aimed to analyze the determinants of unsafe behavior in pesticide usage among horticulture farmers at Sumber Mufakat village.

METHODS: This research used a mixed-method with 505 farmers as population. The quantitative and qualitative data given from 83 horticulture farmer as sample size and reached by simple random sampling technique. The sample is distributed representative on nine hamlets that divided into two main areas Sumbul and Berhala. Data collected by in-depth interview and focus group discussion based on behavioral determinants according to predisposing factor, enabling factor, and reinforcing factor. The qualitative data were analyzed in the domain of Lawrence Green's concept and quantitatively analyzed using the Chi-square test.

RESULTS: The results found that the predisposing factors of knowledge, attitude, habit, culture, and social status are significance with unsafe behavior although some farmers show the negative action that not suitable with the attitude. There is a significant association between enabling factor in available of personal protection equipment and pesticides, working tools, and health facilities with unsafe behavior. Even though the farmers rarely being used the health facilities cause using traditional medicine to treat their symptoms of toxicity. The reinforcing factor such as supporting of the community leader, partner, and stakeholders has significantly associated with unsafe behavior even though the observations showed the lack of socialization and supervision in pesticide usage.

CONCLUSION: It concluded that unsafe behavior in pesticide use caused by the lack of knowledge of farmers, the lack of supervision, and support from related parties. Farmers have their own decisions on pesticide use and no sustain supervision among the farmer. It recommended to empowering the community to increase the collaboration between farmers and government with the same vision to solve the toxicity of pesticide risk in social movement formed.

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Introduction

Population growth is in line with horticultural commodities demand and enhancement. The efforts to intensify agriculture by various technologies are encouraged to optimize the agricultural product, through pesticide use. The increasing use of pesticides is certainly followed by higher pesticide exposure and toxicity for agricultural workers, especially pesticide sprayers [1], [2], [3].

The act of processing, mixing, and spraying of pesticide might bring several health problems. Farmer's orientation in pesticides use is generally just focused on controlling the crop pests. Pesticide use in daily makes farmer's in ignore their safety and environment aspect, also assume that the pesticide as harmless things. It shows from the worse pesticide behavior such as seldom wear the personal protection equipment (PPE), smoking while spraying, littering the pesticide package,

and others so that the contact with pesticide often happens [4], [5], [6].

The World Health Organization (WHO) estimates that around 108,000 deaths occur due to poisoning and pesticide in one of the reasons. The number also relatively high in poor and developing countries. Pesticide poisoning is ranked in the top five nationally in Indonesia. Based on the research in Indonesia, there are 168 poisoning cases and 96 cases lead to death. The pesticide poisoning cases that happen in Indonesia were not reported accurately, so the amount is higher than the number reported. Based on the pesticide toxicity examination in Karo District, it was found that there were 69.13% pesticide toxicity at farmers in Deram Village, Merdeka sub-district, 63.09% in Barung Kersap Village, Munte sub-district, approximately 91.25% in Kacinimbun village, Tiga Panah sub-district, 55.26% in Paribun village, Barusjahe sub-district, and 91.25% in Sugihen village, Dolat Rakyat sub-district [7], [8], [9], [10].

Sumber Mufakat is the village that farmers produce lots of horticulture crops are quite frequent of pesticide use because these plants are very vulnerable to pest attack. Based on the preliminary survey, it is found 6 farmers from 55 who examined that have a level of enzyme cholinesterase close to the allowed limit value. There are 51 farmers showed the symptoms of mild to moderate poisoning. Smoking habits are very high in Sumber Mufakat village community where the majority of 35 peasants smoke 5–50 cigarettes a day. Smoking habits are also often done while spraying pesticides so that the risk of inhalation is very likely to occur, added without using personal protection [11].

Actually, in pesticide application, there were no farmers improper with the procedure and it gives the high potential risk of toxicity. The purpose of this study is to analyze the determinants of unsafe behavior in pesticide usage among horticultural farmers.

Methods

This study used a mixed-method that conducted in Sumber Mufakat Village, Kabanjahe sub-district, Karo Regency. The majority of farmers use the pesticide in improper procedures. This phenomenon increased the risk of toxicity with a high impact on occupational health and needs to be prevented. Ethical clearance has been proposed and used by fulfilling the factor of autonomy, beneficence, and non-maleficence or does not harm and confidentiality of the ethical institutions.

The population is 505 farmers that found from farmer's group in Sumber Mufakat villages [12]. The sample size of the population is 83 farmers who use pesticides. It distributed representative on nine hamlets that divided into two main areas Sumbul and Berhala. Data collected by in-depth interview and focus group discussion based on behavioral determinants according to predisposing factor, enabling factor, and reinforcing factor.

The analytical study was carried out in qualitative and quantitative. The qualitative data were analyzed by domain of Lawrence Green's concept and quantitatively analyzed using the Chi-square test [13], [14], [15], [16], [17], [18].

Results and Discussion

Kabanjahe as sub-district in Karo District, North Sumatra Province, located in tropical climate and consists of 13 villages including Sumber Mufakat village. Majority of people in this Sumber Mufakat village

work as farmers. Most farmers grow a horticultural plant such as broccoli, potatoes, carrots, beans, chillies, and tomatoes. The dominant plant was flower chrysanthemum and cabbage in their field. The intercropping method in horticulture farming making farmers tends to use various types of pesticides. The crops that they growth also classified as pest vulnerable plant making farmers use pesticides in high frequency with various type of pesticide which bring the risk for their health. Farmers have also exposed pesticides for a long time. Based on the interview, the farmers told that most of them have contact with pesticide from childhood caused they help parents in the field. The characteristic of farmer as the sample found in this research could be seen in Table 1.

Table 1: Frequency distribution of characteristics of horticultural farmers in Sumber Mufakat village

Variable	Frequency	Percentage
Age (years old)		
<30	14	16.9
30 – 39	32	38.6
40 – 49	14	16.9
50 – 59	12	14.5
>59	11	13.3
Sex		
Female	28	33.7
Male	55	66.3
Education		
Elementary school	15	18.1
Junior high school	25	30.1
Senior high school	39	47
Diploma	4	4.8
Duration as a farmers (years)		
<10	14	16.9
10 – 19	36	43.4
20 – 29	14	16.9
>29	19	22.9
Total	83	100.0

Based on the research, the farmer has good experience in pesticide use. Most farmers have to use pesticide in 10–19 years amount of 36 farmers (43.4%) even 19 farmers (22.9%) have use pesticide for more than 29 years (Table 1). Dependence on pesticides could not be avoided and has become hereditary in this community. Although they have high education or working in government, all of the community have the field and use the pesticide in daily activity.

Therefore, farmers rarely use pesticide incorrectly caused that they assume the pesticide did not give the direct impact for them. Based on the in-depth interview, farmers said that they feel dizziness and headache, itchy, and hot at the skin. However, the symptoms will disappear and farmers felt accustomed to the symptom and ignored it.

The longer pesticide exposure will bring the health effect and generally as a chronic toxicity. It more difficult to detect caused, it is not immediately felt, does not cause symptoms and giving the specific sign. The health problem as chronic toxicity that often associated with pesticide uses among farmers are irritation, cancer, miscarriage, defect in babies, nervous symptom, heart, kidney, and respiratory system. Based on literary study, the effect of pesticide use could cause multiple myeloma, sarcoma, prostate cancer and pancreas, cervix cancer, breast cancer, neurobehavioral, and Hodgkin [19], [20], [21], [22].

The pesticide use in this community categorized as unsafe behavior on 48 farmers (57.8%) of 83 as a sample. The safety indicator included the improper behavior of farmers like direct contact when mixing the pesticide, callibration of spraying hoes, and spraying risk behavior. The unavoidable of exposure usually caused by splattered when spraying, unfollowed the wind direction and inhalation of pesticide drops. The other behaviors have to concern that is the lack of farmer aware to save pesticide disposal. The farmer usually littering around fields or into ravines and leaving the remaining pesticide in the spraying tools to be reused the next day. This phenomenon implied the high risk of pesticide exposure cause it can polluted the environment and improved the symptom of toxicity due to direct exposure even more never use the PPE while spraying. It means the pesticides are considered the greatest danger at their work. Farm workers appear to be a closed community with a high disease burden. Farmers of Sumber Mufakat were exposed to highly hazardous, restricted, and banned pesticides, with insufficient protection [23], [24], [25].

The domain of predisposing factor in pesticide unsafe behaviors

The predisposing determinant that pushed the improperly used in this research is knowledge, attitude, habit, culture value, and social status. According to the research, the farmers have poor knowledge in 47 farmers (48.7%) and show the unsafe pesticide use in 48 farmers (57.8%). It has a significant association between knowledge and pesticide use ($p = 0.000$). Cognitive is an important domain to create the action of farmers. It self-shaping a person's positive or negative attitudes toward something. A person's attitude means weather they support or against the specific things [26], [27].

The majority of farmers who use pesticide unsafety are the one who shows the negative attitude for 35 farmers (42.2%). Statistical analysis found a significant relationship between farmer's knowledge that contributed in unsafe pesticide used. It correlates with observation where most farmers who show a positive attitude with pesticide dependence make unsafe behavior. It formed related to education basic and incorrectly knowledge about the risk of pesticide use. It means that the farmer has no care although the training has given to create them aware of pesticide hazard [1], [9], [28], [29].

The habit in pesticide is poor and unsafe around 56 farmers (67.5%). Continuously habit could create a poor culture in pesticide use that shown at this village (Table 2). Habit and culture have a significant correlation ($p = 0.000$). In general, the habit as risk potential of toxicity happens caused by poor knowledge among farmer that usually followed their partner's experience when used the pesticide. In other hand, the

farmer believes that the higher price of pesticide more pays attention rather than the effects of a chemical that will be experienced.

Table 2: The domain of unsafe behavior determinants in pesticide usage among farmers

Variable	Pesticide usage				Total		Sig-p
	Safe		Less		n	%	
	n	%	n	%			
Domain predisposing factor							
Knowledge							
Good	19	22.9	7	8.4	26	68.7	0.000
Less	16	19.3	41	49.4	57	31.3	
Attitude							
Positive	19	22.9	13	15.7	32	38.6	0.022
Negative	16	19.3	35	42.2	51	61.4	
Habit							
Good	19	22.9	8	9.6	27	32.5	0.000
Less	16	19.3	40	48.2	56	67.5	
Culture factors							
Good	20	24.1	8	9.6	28	37.7	0.000
Less	15	18.1	40	48.2	55	66.3	
Social status							
Good	17	20.5	8	9.6	25	30.1	0.003
Less	18	21.7	40	48.2	58	69.9	
Domain enabling factor							
Availability of personal protection equipment							
Good	18	21.7	4	4.8	22	26.5	0.000
Less	17	20.5	44	53.0	61	73.5	
Working tools							
Good	21	25.3	3	3.6	24	28.9	0.000
Less	14	16.9	45	54.2	59	71.1	
Health facilities							
Good	22	26.5	17	20.5	39	47.0	0.016
Less	13	15.7	31	37.3	44	53.0	
Availability of pesticide							
Good	21	25.3	9	10.8	30	36.1	0.000
Less	14	16.9	39	47.0	53	63.9	
Domain reinforcing factor							
Community support							
Good	18	21.7	9	10.8	27	32.5	0.002
Less	17	20.5	39	47.0	56	67.5	
Partner support							
Good	12	14.5	4	4.8	16	19.3	0.004
Less	23	27.7	44	53.0	67	80.7	
Agriculture provider support							
Good	18	21.7	8	9.6	26	31.3	0.002
Less	17	20.5	40	48.2	57	68.7	
Health provider support							
Good	27	32.5	13	15.7	40	48.2	0.000
Less	8	9.6	35	42.2	43	51.8	
Total	35	42.2	48	57.8	83	100.0	

It formed the assumption which the expensive pesticide better than the cheapest one even has the same content. This habit potential makes the farmer increased the dose and frequency of spraying. Hence, the amount of toxicity risk depends on the type of pesticide. Based on observation, the farmers always use the pesticide to exceed the safe limit allowed [5], [28], [29], [30].

The unwise of pesticide use bring negative impacts on health. It depends on many factors such as the type of pesticide, dose and frequency of spraying, work period as a sprayer, duration of spraying, PPE, pesticide method, last contact with pesticide, plant height, temperature, sprayed time, and wind direction [5], [31], [32], [33], [34]. The combination with inadequate knowledge and practice among the farmers has posed a danger of acute intoxications, chronic health problems, and environmental pollution [35].

The domain of enabling factor in pesticide unsafe behaviors

The enabling factor that contributed to unsafe pesticide use analyzed based on availability PPE and

pesticide, working tools, and health facilities in the village. In generally, PPE does not need in applicable standards. Farmers more prefer to use hats and boots when using pesticide in daily. Sometimes, they do not use any shoe and use a sarong hat for coverage. These habits show the original character of the people in this village (Figure 1).



Figure 1: Personal protection showed the characteristic of community

There are no special clothes for spraying caused the farmers usually used the layered clothing to suit with the mountain cool air temperature. Statistical analyzed that PPE and pesticide availability, working tools, and health facilities have a significant correlation with pesticide use. In actually, all facilities have available in good condition but that is still unsafe using by the farmers. Pesticide availability could be quite free and lack of government-controlled. In here, the farmers could act as a seller of pesticide with promoting the pesticide in their field with direct application cause the bonus promotion from distributor. In other hands, even the farmer has the PPE, they always forgot to use it. The farmer has a good working tools caused it is to be their needed, but it concludes that sometimes the farmer careless and not discipline to save their health and it showed by careless of the pesticide risk and effect.

The PPE negligence behavior is one of the determinants who will cause unavaoidable exposure of pesticide directly to the port of the entry such as skin, mouth, and respiratory system. Furthermore, exposure mostly happens when mixing and spraying the pesticide [5], [36], [37], [38].

Based on observation, the farmer more used the organophospat and paraquat type of pesticide. To throw away the grass in land preparation, the farmer using Gramoxon with organochlorin content that has the high risk to exposure. It is possible to pesticide polluted the field and influence the productivity of horticulture plant. The effect of pesticide giving the symptom such as allergy and fatigue. Some hazard giving the short effect such as irritation, headaches, dizziness, and nausea to chronic impacts such as cancer, diabetes, heart disease, and asthma. The risks are difficult to elucidate due to the involvement of various factors. In addition, the risk of pesticide exposure is strongly associated with farmers' behavior when working with pesticides. The WHO has

recommended that access to highly toxic pesticides be restricted. Need to know the farmers in this village usually used a compound of pesticide. They can mixed three or more pesticide for one sprayed depend on the kind of organism attack. Interaction of the compound could be giving the strongest effect or others such as resulting estrogenic effects. The promotion of organophosphate induced delayed polyneuropathy. It is shown by fatigue symptom and stunting syndrome [39], [40], [41], [42].

The availability of health facilities (Puskesmas) has a significant relationship with pesticide use ($p = 0.016$). It describes that farmers rarely use the health facilities. The farmers more concerned with agricultural facilities and technology to support their cultivation. Even though farmers exposure to pesticides, they rarely use health facilities. They assume that symptoms are reversible and temporary so require no further treatment.

This complexity problem depends on the government program to reduce the toxicity at the farmer community. Cause awareness to use PPE was depend on the character of the community to protect their health from pesticide exposure. Risk perception was strongly associated with behavior; farmers concerned about specific health problems were much more likely to use protective equipment [43].

Rather than simply focusing on knowledge-based strategies, comprehensive interventions are needed to reduce both exposure and health risks, including training, improvements in labeling, measures to reduce cost barriers to the adoption of safe behaviors, promotion of control measures other than PPE, and support for integrated pest management [35].

The domain of reinforcing factor in pesticide unsafe behaviors

The reinforcing factor as unsafe behavior determinant in pesticides used analyzed base on the support of community leaders, partners, agricultural providers, and health providers. These factors have a significant correlation with the pesticide use behavior where the factors giving the special role in pesticide use by farmers. Community leaders have a role in reminding the safe pesticide use. It is possible to community leader caused they also have the same profession as farmers and sometimes act like partners of farmers. Agriculture and health providers generally play a role in socialized safety and health security in pesticides use. Thus, both of them have to support and create the safety behavior of pesticide use.

This study showed that there is a lack of support that is mentioned above, leads to unsafe behavior while using the pesticide. It causes the support provided is not carried out continuously. The farmers tend to return to their daily habit. The lack of supervision while using pesticides also makes farmers stick to their

own decisions when using pesticides. As a result, the danger caused using pesticide not in accordance to safety procedure become high and significant.

Therefore, it is necessary to evaluate a policy which generally shows that it has not been effective and efficiency to satisfying the farmer's group as pesticides user [44]. It requires the revitalization of the supervisor's role in carrying out the policies contained regarding pesticide control which must be realized to protect human health and safety, preserve nature and the environment, guarantee the quality and effectiveness of pesticides, and provide protection to procedures, pesticide dealer, and user [45].

Conclusions

Based on the research, it concludes that unsafe behavior in pesticide use among farmer caused by a lack of farmer's knowledge about pesticide's hazard. It happens cause the low of concerned and supported stakeholder for risk in pesticide use. The farmer has own decided in pesticide use and there was no controlling in continuously. They are free for use and act in unsafe behavior. To solve this, it needs collaboration and community participation to eliminate the risk of pesticide toxicity with empowering the community in safe behavior of pesticide use, informed of the community movement.

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