

Analysis of Factors Related to Pesticide Poisoning in Rice Farmers in Teweh Selatan Subdistrict, Barito Utara District

Ali Sodikin¹, Ruslan Muhyi², Eko Suhartono³, Husaini³, Lenie Marlinae⁴

¹Barito Utara District Health Office, ²Faculty of Medicine, Lambung Mangkurat University, Indonesia, ³Biochemistry Department, Faculty of Medicine, Lambung Mangkurat University, Indonesia, ⁴Master of Public Health Science Study Program, Faculty of Medicine, Lambung Mangkurat University, Indonesia, ⁵Public Health Study Program, Faculty of Medicine, Lambung Mangkurat University, Indonesia

Abstract

The results of monitoring and examination of farmers in Barito Utara District by examining the cholinesterase enzyme by the Regional Health Laboratory and the District Health Office of Barito Utara in the blood of farmers found 71.19% experienced organopathic pesticide poisoning. This study aims to analyze the risk factors associated with the level of pesticide poisoning in rice farmers in Teweh Selatan Subdistrict, Barito Utara District, namely mixing dosage, spraying time, spraying frequency, spraying duration, working period, wind direction, and use of personal protective equipment. The research design used was observational with cross sectional approach. The number of samples is 55 people taken by simple random sampling. Rice farmers who experienced pesticide poisoning by 56.4%. Chi-Square Test showed four variables had a significant relationship with the incidence of pesticide poisoning and were a risk factor for the occurrence of pesticide poisoning namely mixing dose ($p=0.003$ OR=6.909; 95% CI=2.020-23.627), frequency of spraying ($p=0.004$; OR=6,300; 95% CI=1.913-20.749), working period ($p=0.020$; OR=4.416; 95% CI=1.402-13.906) and wind direction ($p=0.007$; OR=5.714; 95% CI=1.756-18.591). Multiple logistic regression test showed that the most dominant factor related to the incidence of pesticide poisoning was the frequency of spraying. Risk factors associated with the incidence of pesticide poisoning are mixing dosage, frequency of spraying, working period and wind direction.

Keywords: farmer, mixing dose, frequency of spraying, working period, wind direction, poisoning, pesticides

Introduction

An increase in farmer groups that cause a lot of use of pesticides which can ultimately increase the risk of poisoning due to pesticides in Central Kalimantan. The cases of pesticide poisoning in Central Kalimantan in 2016 amounted to 48 cases, while in 2017 there were 56 cases. An increase in poisoning cases due to pesticides is in line with the increase in farmer groups in Central Kalimantan.¹

Factors that can influence the occurrence of pesticide poisoning on farmers are the characteristics of farmers, namely age, sex, nutritional status, level of

education, length of work, behavior of farmers in using pesticides, among others, the number of pesticides used, mixing pesticide doses, frequency of spraying, duration spraying, the use of personal protective equipment (PPE).² Farmers can be contaminated with pesticides when storing and moving pesticides, preparing pesticide solutions, applying pesticides and washing application tools. Applying pesticides when spraying often results in pesticide contamination.³

There was a significant relationship between variable spraying frequency ($p=0.001$) and spraying time ($p=0.000$) with pesticide poisoning in Jati Village, Sawangan Subdistrict, Magelang District.⁴ There is a significant relationship between the frequency of spraying ($p=0.020$), duration of spraying ($p=0.002$), wind direction ($p=0.020$) and the use of personal protective equipment ($p=0.002$) with cholinesterase activity blood in farmers in Naman Teran Subdistrict Karo District, as

Corresponding Author:

Yetro Sinseng

No.3 Muara Teweh 73812, Kalimantan Tengah
Indonesia, sodikinali78586@gmail.com

well as according to Suparti S, et.al (2016) which states that there is a significant relationship between frequency of spraying ($p=0.002$), pesticide dose ($p=0.001$), duration of spraying ($p=0.001$), spraying time ($p=0.016$) and wind direction ($p=0.039$) with pesticide poisoning to farmers.⁵

Based on data from the Barito Utara District Health Laboratory it is known that in 2018 from the results of the examination of 21 farmers, 76.19% of farmers experienced pesticide poisoning. The recapitulation of the District Health Office of Barito Utara states that the average age of farmers is 54 years with an average working period of 23 years, 57.1% of farmers mixing pesticide doses do not match the label stated, 52.4% of farmers used to spray pesticides during the day days and with a frequency of spraying more than twice a week as much as 47.6%. 28.6% of farmers sprayed for more than 3 hours in one spraying and 33.3% of farmers in the technique of spraying downwind, and the average farmer did not use a complete PPE of 61.9%.⁶ Thus, farmers are a group that is vulnerable to exposure to pesticides

that have an impact on pesticide poisoning. However, not many studies have revealed the factors that cause pesticide poisoning, especially in lowland rice farmers in Teweh Selatan Subdistrict, Barito Utara District.

Materials and Method

The research design used was a cross sectional approach. The study was conducted in Teweh Selatan Subdistrict, Barito Utara District, considering that the rice farmers group in Teweh Selatan Subdistrict was the farmer group that used the most pesticides assisted by the Agriculture Office Program of Barito Utara District and had never done any research on the factors related to pesticide poisoning in rice farmers. The study was conducted in March - June 2019. The population in this study were all rice farmers who sprayed with pesticides in Teweh Selatan District as many as 240 people. The number of samples was 55 respondents. The dependent variable in this study was pesticide poisoning of rice farmers (measured by the cholinesterase enzyme level $<75\%$).

Findings and Discussion

Table 1. Bivariate Analysis Relationship between Mixing Doses, Spraying Time, Spraying Frequency, Spraying Duration, Working Period, Wind Direction, and PPE Usage with the Occurrence of Pesticide Poisoning in Rice Farmers

Variable	Pesticide poisoning						p value	OR (95% CI)
	Poisoning		Normal		total			
	n	%	n	%	n	%		
Mixing dose								
Not suitable	20	80.0	5	20.0	25	100	0.003	6.909 (2.020-23.627)
Suitable	11	44.1	19	55.9	34	100		
Spraying time								
Bad	22	59.5	15	40.5	37	100	0.708	(0.472-4.555)
Well	9	50.0	9	50.0	18	100		
Spraying frequency								
Often	21	77.8	6	22.2	27	100	0.004	6.300 (1.913-20.749)
Rarely	10	35.7	18	64.3	28	100		
Spraying duration								
> 3 hours a day	17	60.7	11	39.3	28	100	.696	(0.492-4.184)
≤ 3 hours a day	14	51.9	13	48.1	27	100		
Working period								
> 5 years	20	74.1	7	25	27	100	0.020	4.416 (1.402-13.906)
≤ 5 years	11	39.3	17	60.7	28	100		
Wind direction								
Not in same direction	24	72.7	9	27.3	33	100	0.007	5.714 (1.756-18.591)
In same direction	7	31.8	15	68.2	22	100		
PPE usage								
Not eligible	22	55	18	45	40	100	.978	(0.244-2.722)
Eligible	9	60	6	40	15	100		

The Relationship between Mixing Doses and Pesticide Poisoning on Rice Farmers

The results of the analysis stated that there was a relationship between mixing dose with pesticide poisoning on rice farmers in Teweh Selatan Subdistrict, Barito Utara District with p-value $0.003 < \alpha (0.05)$. The OR score of 6.909 means that farmers who mix the dosage incorrectly on the label are 6.9 times at risk of experiencing pesticide poisoning compared to rice farmers who mix pesticides according to the dosage on the label.

The rice farmers mix the dosage with pesticide insecticides mixed with three different brands of pesticides namely Winder, Selden and Spontan. The pesticide when it enters the body of rice farmers can inhibit and reduce the production of the enzyme cholinesterase in the body. This situation will cause nervous system disorders in the form of cholinergic activity continuously due to acetylcholine (AChE) not hydrolyzed. This disorder is known as signs or symptoms of poisoning such as dizziness, headaches, and nausea.⁷

The Relationship between Spraying Time and Pesticide Poisoning on Rice Farmers

Based on the results of the analysis showed that there was no significant relationship between the time of spraying with pesticide poisoning on rice farmers in Teweh Selatan Subdistrict, Barito Utara District with p-value $(0.708) > \alpha (0.05)$. The rice farmers spend more time during the day and poisoning ie at 11:00 to 13:00 at 31.82%. As for farmers who work at noon. 11.00-15.00 pm but the blood cholinesterase level is classified as normal at 46.67%. Normal levels of cholinesterase in the blood due to the spraying time range between 2:00 pm to 3:00 pm there is a decrease in air temperature so that the rate of expansion is also reduced. In addition, it is supported by an infrequent spraying frequency of ≤ 2 times a week by 80%.

The habit of spraying rice farmers in the afternoon when the sun is hot will make it easier for pesticides to evaporate, break down and negatively impact farmers by causing poisoning of pesticides on their hands and backs a lot, exposure through the skin will harm farmers because many pesticides are lost due to evaporation. A farmer who sprays must pay attention to the good time to spray, to minimize the incidence of pesticide poisoning.⁸

A good time to spray pesticides is in the morning at 07.00-10.00 and in the afternoon at 15.00 - 18.00. When spraying in the morning and evening is quite good because the air still contains a lot of water vapor so that the spray granules will be mixed with the water vapor so that the concentration of pesticide formulations and pesticide killing power also decreases. In addition, the presence of water vapor inhibits the rate of spray droplets to reach the target. Morning humidity is around $> 80\%$.

The Relationship between Frequency of Spraying and Pesticide Poisoning on Rice Farmers

The results showed that the frequency of spraying carried out by rice farmers was > 2 times a week and experienced pesticide poisoning by 77.8%. The average frequency of farmers spraying pesticides 3 times a week is 100%. The more often farmers spray using pesticides, the greater the possibility of poisoning. Exposure to pesticides with frequent frequency and with short time intervals causes pesticide residues in the human body to be higher.

Statistical analysis showed that there was a significant relationship between the frequency of spraying with pesticide poisoning on rice farmers in Teweh Selatan Subdistrict, Barito Utara District with a p-value $(0.004) < \alpha (0.05)$. OR results of 6.300, meaning that farmers who do frequent spraying frequency > 2 times a week have a risk of 6.3 times experiencing pesticide poisoning compared to farmers who spray pesticides as much as ≤ 2 times a week.

The Relationship between Spraying Duration and Pesticide Poisoning on Rice Farmers

Chi-square test results with a 95% confidence level to see the relationship between spraying duration and the incidence of pesticide poisoning in rice farmers obtained p-value 0.696 ($p > 0.05$) which states that there is no relationship between spraying duration and the incidence of pesticide poisoning. in lowland rice farmers in Teweh Subdistrict.

The results of the analysis showed that the rice farmers who did the spraying duration > 3 hours but the normal blood cholinesterase level was 20%. Spraying duration depends on wide area of land worked by farmers. The area of rice fields that farmers have influenced the incidence of pesticide poisoning. The longer time the spraying is, the more pesticides are exposed. This can affect the body's exposure or entry

of pesticides so that it can cause poisoning. However, the normal level of cholinesterase in the blood occurs because the farmer mixes the dosage according to the label and the working period of the new rice farmers is ≤ 5 years as much as 63.6%.⁹

The Relationship between Working Period and Pesticide Poisoning on Rice Farmers

Based on the results of the analysis showed that farmers who worked more than 5 years more experienced pesticide poisoning which was 74.1% compared to respondents who worked ≤ 5 years ie 39.2%. In addition, the age of rice farmers who have worked for more than 5 years is classified as at risk by 92.6%. Naturally, human endurance will decrease with age, while the emergence of pesticide poisoning is strongly influenced by human endurance factors. There is a tendency for older farmers to have lower blood cholinesterase activity.¹⁰

The number of farmers who have a long working period allows farmers to experience longer exposure to pesticides so that the levels of pesticides in their blood are higher and bioaccumulation will occur in the body. This has the potential to cause chronic poisoning to pesticide spraying farmers. If the longer the farmer works and spraying, the longer the contact with pesticides so the risk of exposure to pesticides is higher.¹¹

The Relationship between Wind Direction and Pesticide Poisoning on Rice Farmers

Based on the results of the analysis states there is a relationship between the direction of the wind with pesticide poisoning on rice farmers in Teweh Selatan Subdistrict, Barito Utara District with p-value (0.007) $< \alpha$ (0.05). The OR results of 5.714 means that farmers who spray not in the direction of the wind are 5.7 times at risk of experiencing pesticide poisoning compared to rice farmers who spray in the direction of the wind.

Rice rice farmers who did the spraying technique were not unidirectional and experienced 72.7%

poisoning. The observations showed that farmers sprayed without regard to the wind direction, but with alternating directions according to the rows of plants. Actually farmers know that a good spraying direction is in accordance with the direction of the wind but they consider spraying with attention to the direction of the wind more troublesome and time-consuming. Farmers who do not follow the direction of the wind will risk being exposed to pesticides such as being splashed or exposed directly to body parts and clothing due to gusts of wind that turn towards the body of the sprayer. More risky if pesticides are sprayed directly on the eye that is not protected with protective glasses.

The Relationship between The Use of PPE and Pesticide Poisoning on Rice Farmers

Based on the results of statistical analysis, there was no significant relationship between the use of PPE and pesticide poisoning on rice farmers in Teweh Selatan Subdistrict, Barito Utara District with a p-value of 0.978 (> 0.05). The results of the analysis stated that the majority of rice farmers did not use PPE as much as 72.7% greater than those using PPE that met the requirements. Only 27.3% of rice farmers who use PPE are eligible. This causes the use of PPE that there is no meaningful relationship. There is no relationship between the completeness of personal protective equipment (PPE) with the pesticide poisoning in farmers with p-value = 0.355.¹²

PPE is used to protect farmers from exposure to pesticides ranging from headgear/hats, masks, long sleeve clothes, gloves, glasses and shoes. Based on field research, it was found that the type of PPE that farmers usually use when spraying is 45.5%, boots 49.1%, long sleeves 29.1% and gloves 27.3%. The interview results showed that the awareness of farmers to wear a head cover in the form of a hat by 70% on the grounds not because of the dangers of pesticides but farmers to protect their heads from the sun's heat.

Table 2. Multivariate Relationship Analysis

Variable	p-value	OR	95% CI	
			Lower	Upper
Mixing dose	0.007	8,472	1,801	39,851
Spraying frequency	0.003	11,081	2,326	52,799
Working period	0.053	4,195	0.985	17,871

Based on the results of multiple logistic regression analysis of four independent variables that are significantly related to pesticide poisoning on rice farmers there are two variables that are most related to pesticide poisoning, namely the frequency of spraying and mixing dose. Based on p-value <0.05 in the second stage of multiple logistic regression analysis, from the two variables it was concluded that the most dominant variable was related to pesticide poisoning on rice farmers, namely the frequency of spraying because it had the highest OR (OR = 11.081) and a p-value of 0.007 states that there is a significant relationship on rice farmers who spray more than 2 times a week having a risk of 11.08 times experiencing pesticide poisoning compared with paddy farmers who spray ≤ 2 times a week.

The frequency of spraying more than 2 times a week can increase the risk of poisoning because it allows an increased risk of exposure to insecticides and the risk of poisoning. The more often farmers spray, the higher the risk of poisoning. Spraying should be done in accordance with the provisions. The time needed to be in contact with pesticides is a maximum of 5 hours per day.¹³

The exposure to pesticides on the human body with frequent frequency and with short time intervals causes pesticide residues in the human body to be higher, indirectly the activities of farmers who reduce the frequency of spraying can reduce the exposure of these farmers by pesticides.⁷

Conclusion

Risk factors associated with the incidence of pesticide poisoning are mixing the dose, frequency of spraying, working period and wind direction. The dominant factor associated with the incidence of pesticide poisoning in lowland rice farmers is the frequency of spraying.

Ethical Clearance: This research has gone ethical feasibility testing by the Ethical Research from Faculty of Medicine, Lambung Mangkurat University.

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Conflict of Interest: The authors declare that they have no conflict interests.

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