

Herbicide Exposure Relation to Hypertension Disorders to Oil Palm Weed Spray Farmers in the Village of Lembah Kuamang Pelepat Ilirm District Bungo Jambi Indonesia

Rasmanto¹, Nur Endah Wahyuningsih², Suhartono²

¹ Faculty of Public Health Diponegoro University of Semarang

² Lecturer Faculty of Public Health, Diponegoro University Semarang

email : rasmantoabimayu461@gmail.com

Abstract

Aspects of herbicide use that are not in accordance with the provisions on packaged containers by farmers in Pelepat Ilir District Bungo Jambi is a very serious problem and important to follow up, especially the application of herbicides that neglect aspects of farmers' safety and health that can lead to health problems both directly or indirectly. One of the long-term effects caused by herbicide exposure is blood pressure disorder (hypertension). This study undertaken to determine the effect of herbicide exposure on the incidence of hypertension in weed-spray farmers in Pelepat Ilir District Bungo Jambi. This was an observational analytic study with cross sectional study design conducted in Lembah Kuamang, Pelepat Ilir District, Bungo with 72 people selected proportional stratified random sampling. Data collection through interview, observation and measurement of peasant blood pressure using sfigmomanometer. Data analysis used chi-square test and logistic regression. The results showed that there was a significant correlation between the length of work (p value = 0.040), working period (p value = 0.009), Herbicide dose (p value = 0.025), use of personal protective equipment (p value = 0.048) and herbicide management (p value = 0,037), to the happening of hypertension, then there is no relation between spraying method (p value = 0,455) with hypertension occurrence. Farmers with inappropriate doses of herbicide dosage on bad packaging labels and herbicide management have a probability of having a hypertension event of 47.5%. Based on the research and the result of blood pressure measurement found as many as 56.9% of respondents suffer from hypertension disorder. Efforts to prevent adverse effects caused by the use of herbicides by farmers, need to use the complete PPE before spraying and use the appropriate dose on the herbicide packaging.

Keywords: Herbicide, Hypertension, Farmer

I. INTRODUCTION

Pesticides have been widely used in agricultural and plantation fields in an effort to increase agricultural and plantation production. Pesticides are used in the form of chemicals, to eradicate plant-disturbing organisms and disease vectors selectively and to avoid minimizing losses occurring in non-target organism (Priyanto: 2010).

The use of organic chemical pesticides extends almost all over the world and is used by large and small agricultural companies even to small farmers in rural areas also using pesticides. The use of pesticides becomes a dilemma because on one hand pesticides can control or kill harmful pests, but on the other hand pesticides can endanger human health and pollute the environment of water, soil and air. Almost 90% of farmers in Indonesia are still using pesticides, especially insecticides and herbicides in controlling pests and weeds (Sembel DT: 2015).

The widespread use of herbicides needs to consider the negative impacts to farmers, the environment, non-target organisms, biodiversity and weed resistance to herbicides (Adnan, Hasanuddin, Manfarizah: 2012). Glyphosate and paraquat herbicides are the active ingredients of herbicides used to eradicate weeds in plants, glyphosate is widely used in agricultural and plantation areas. Glyphosate enters the environment at the time of application in farms, glyphosate particles will be carried by the wind, and some enter into the ground and attached to the plant. The presence of glyphosate can be detected at the depth of the soil up to 1 m (Pan L, Xu M, Yang D, Wang B, Zhao Q, Ding E-M, et al; 2017).

Research on the association of glyphosate applications in corn and soybean farms in the United States in 2009 showed that there was an increase in hypertensive deaths of 5.1 per 100,000 population due to agricultural activities using glyphosate as a weed killer (Swanson NL, Leu A, Abrahamson J, Wallet B: 2014).

Glyphosate herbicides interfere with the cytochrome P450 / Cytochrome P450 (CYP) enzyme activity in the liver, cytochrome enzymes have many effects on liver function including interfering with the ability to

detoxify other toxic chemicals. cytochrome enzyme (CYP) also acts to activate vitamin D in the liver and kidneys, disruption of CYP enzyme activity causes vitamin D deficiency. The content of glyphosate in the body has the effect of inhibiting the activity of CYP enzymes, because retinoic acid is metabolized by CYP enzymes. Excessive retinoic acid and is not metabolized by the CYP enzyme results in effects on the cardiovascular system, including arrhythmias, hypotension, increased heart rate, pericarditis (heart conditions characterized by inflammation of the sac around the heart, pulmonary hypertension, and heart enlargement (Stephanie Seneff , Anthony Samsel and Gregory Benne).

Pelepat Ilir is one of the subdistricts in District Bungo with extensive plantation area, 29,176 people and 8 villages. The majority of residents in Pelepat Ilir have livelihoods of smallholder farmers (Kuamang Kuning Primary Health Care Unit: 2016). The area of plantation in Pelepat Ilir District of Bungo is 16,031 Ha (Oil palm plantation), while the commodity produced by the plantation is Palm palm fruit. Utilization of herbicide by oil palm plantation farmers in Pelepat Ilir conducted since 1990s. Herbicides are considered to be the most effective toxic toxins by farmers in weed control and plant diseases. The inappropriate use of herbicides during pre-plant period and post-weed growth will play a role in aggravating the situation of farmers and communities around the environment due to the toxic effects (Suryani L: 2015).

According to the report of Pelepat Ilir Primary health care unit in 2016 that the number of outpatient visits with hypertension is 1,269 people (51,16%) from 2480 patient visit, hypertension is ranked first based on data of 10 biggest degenerative diseases obtained from Pelepat Ilir Primary health care unit (Kuamang Kuning Primary Health Care Unit: 2016).

Based on preliminary study and blood pressure measurement conducted on 7 farmer oil palm weed farmer, as many as 4 peasants have blood pressure with hypertension category and 2 people pre hypertension category. Most farmers do the spraying once in two weeks but when the rainy season is often done repetition spraying to eradicate the growth of weeds again. Incomplete use of PPE, and the discovery of more than one type of pesticide used and the behavior of farmers who do mixing and spraying without personal protective equipment, will cause health problems for farmers, especially hypertensive disorders. On the basis of these problems, the authors conducted a study on the relationship of herbicide exposure to the incidence of hypertension in oil palm weed farmers in Lembah Kuamang Pelepat Ilir District Bungo Jambi.

II. MATERIALS AND METHODS

This research used analytic observational research design with cross sectional design (cross section). The dependent variable in this research is the incidence of hypertension, the independent variable is the length of work / day, the length of work, the use of PPE, the dose of Herbicide, the management of Herbicide and the way of spraying. The population is all farmers doing Herbicide spraying activity in Lembah Kuamang, Pelepat Ilir District Bungo Jambi. The sample in this research is 72 people taken with technique of Proportional Stratified Sampling. By using inclusion criteria that is aged 20-55 years old, has been working as a farmer for at least 1 year and for female farmer not in pregnant condition, while exclusion criterion that is in the period of treatment of hypertension disease and health condition of farmer which not possible to be interviewed or checked at research. Data collection through interview, observation and blood pressure examination using sfigmomanometer. Data analysis used chi square test and logistic regression. This study has been stated to meet the ethical requirements by the Commission of Health Research Ethics Faculty of Public Health Diponegoro University of Semarang with a description of ethical feasibility No.024 / EC / FKM / 2018.

III. RESULTS AND DISCUSSION

Based on the results of the research, the age distribution of respondents ranged from 24 - 55 years, with the average age of respondents is 44 years. The lowest age is 24 years and the highest is 55 years with a standard deviation of 8.451 years. The sexes of farmers in this study were the same, men were 36 people (50%) and women were 36 (50%). Most of the education of the respondents who finished primary school (SD) as many as 57 people (79.2%)

The results of the research in table 1 show that respondents who do spraying > 5 hours / day as many as 39 people (54.2%). Respondents mostly have a working period of > 5 years ie as many as 50 people (69.4%). Respondents who do not use the complete PPE are as many as 34 people (47.2%). Respondents mostly use

Herbicide not according to the dosage listed on the label that is as many as 33 people (45.8%). Respondents who perform poor Herbicide management are as many as 50 people (69.4%). Respondents who have a way of spraying the opposite direction of wind are as many as 35 people (48.6%).

Based on the result of blood pressure test by using sfigmomanometer, it is known from 72 respondents, most of them have hypertension, 41 respondents (56,9%), while those without hypertension are 31 people (43,1%). Detailed description of research variables can be seen in table 1 below:

Table 1. Distribution of Respondents' Answer Based on the Aspect of Spray Practice

No	Variabel	n = 72	%
1	Length of Work / day		
	a. > 5 hours / day	39	54,2
	b. ≤ 5 hours / day	33	45,8
2	Years of service		
	a. > 5 years	50	69,4
	b. ≤ 5 years	22	30,6
3	Use of PPE		
	a. Incomplete	34	47,2
	b. Complete	38	52,8
4	Dose of Herbicide		
	a. Not labeled	33	45,8
	b. Corresponding label	39	54,2
5	Herbicide Management		
	a. Bad	50	69,4
	b. Good	22	30,6
6	How to Spray		
	a. Contrary to wind direction	35	48,6
	b. Following the wind	37	51,4
7	Hypertension		
	a. There is interference	41	56,9
	b. No interruption (normal)	31	43,1

Herbicides are chemicals, chemicals, or other bioactive substances. Basically this herbicide is toxic. Every potentially harmful toxin, if farmers act less wisely in the use of planted herbicides, can have a negative impact, especially for users who are able to directly contaminate, the consequences of acute or chronic toxicity. Acute poisoning by herbicides causes, dizziness, nausea, stomach cramps, pupils to shrink, increased pulse rate and cause death. While chronic poisoning is more difficult to detect because it does not cause specific symptoms and signs but also cause significant health problems such as eye irritation, skin, cancer, miscarriage, defects in infants, liver, kidney and respiratory disorders, and nervous system disorders (Djojsumarto P: 2008).

Disorders of the nervous system due to the entry of herbicides especially the organophosphates into the human body, causing inhibition of cholinesterase enzyme activity in the sympathetic ganglion which will increase sympathetic nerve stimulation with clinical manifestations of midriasis, tachycardia and hypertension (Timothy C.Marrs: 2004).

Chi-square test results obtained significance value of 0.040, it shows that there is a significant relationship between the lengths of spraying work with the incidence of hypertension in weed-spray farmers in Pelepat Ilir District Bungo Jambi. The result value of $RP = 3.054$ with Confidence Interval (CI) 95% = 1,159 - 8,047. So from the results can be said that farmers with a working duration > 5 hours per day will give 3 times more risk for the occurrence of hypertension compared with the working time ≤ 5 hours per day.

Length of spraying work related to Hypertension because most of the frequency of respondents doing spraying activity Herbicide > 5 hours / day that is equal to 54,2%. The bioaccumulation properties of pesticides when entering in the body have an impact on spraying farmers if the longer hours of spraying farmers work, the more the amount of pesticide accumulation in the body which can lead to various health problems, one of them is high blood pressure disorder (hypertension). According to WHO, it is stated that

the number of farmers working in the workplace at risk of pesticide poisoning is 5 hours per day or 30 hours per week (Suma'mur: 1994).

Intensity of exposure Herbicides can be illustrated by the length of time a farmer sprayed Herbicide in a day. The longer the time of exposure to Herbicides that occur then the more the amount of Herbicide absorbed into the body of farmers who perform spraying activities. Herbicide exposure to farmers is also affected by the time of spraying, spraying Herbicides should be done in the morning or afternoon because if spraying is done during the day when hot weather will contribute to Herbicide poisoning. In hot weather it will facilitate the evaporation of water droplets from sprayed Herbicides which will increase the risk of poisoning (Djojsumarto P: 2008).

The result of chi-square statistic test obtained value of significance equal to 0,009 which mean value of $p < 0,05$, hence there is correlation between work period with Hypertension to farmer in Lembah kuamang Pelepat Ilir. The result value of $RP = 4.554$ with Confidence Interval (CI) 95% = 1,552 - 13,356. So from the results can be said that farmers with a working period > 5 years have a greater risk chances 4,554 times to experience Hypertension compared with farmers with a working period of ≤ 5 years.

This is because the exposure of herbicides to farmers is directly proportional to the peasants' working period of spraying. One of the adverse effects of Herbicide exposure to the body is a disorder of the central nervous system which can lead to one of them being hypertension, because the herbicide is accumulative in the body. Accumulation of Herbicide in the body will be directly proportional to the working period of every farmer doing Herbicide spraying activity. Excessive Herbicide content will be toxic to the body if it is in excessive amount (Priyanto: 2010).

The result of analysis with Chi-Square test shows that there is a significant correlation between the use of PPE to blood pressure on weed spray farmer (p -value = 0,048) The result of $RP = 2,965$ 95% Confidence Interval $CI = 1,117-7,870$, the use of PPE with the incidence of hypertension in farmers in the village of Lembah Kuamang Pelepat Ilir District Bungo Jambi. Farmers who do not use the complete PPE when spraying pesticides have a risk almost 3 times to experience hypertensive disorders compared with farmers who use the complete PPE during spraying activities.

Based on the results of interviews and observations in the field it is known that many farmers in spraying activities do not use a complete PPE, especially PPE that serves to protect the parts of the body at risk of exposure to herbicides. Of the 72 respondents, there are 76.4% who do not use mask during spraying activity, this becomes one of the causes of exposure of herbicides entering through the respiratory tract causing the impact of disturbances in the circulatory system that will disrupt the stability of peasant blood pressure. In addition farmers do not use PPE with uncomfortable reasons and some farmers think Herbicide is not a dangerous material.

A study conducted by Damalas on 148 peasants in the rural areas of northern Pieria (Eginio and Methoni) in northern Greece is known that statistical test results obtained p value = 0.010, meaning there is a significant relationship between farmers perceptions about Herbicide on the use of PPE at work (Damalas CA, Abdollahzadeh G : 2016). According to MarcFarlane the use of PPE can reduce Herbicide exposure for workers, in addition the effectiveness of the use of PPE also varies according to the type of PPE itself and how to use by workers such as care and use of the correct PPE (Macfarlane E, Carey R, Keegel T, El-Zaemay S, Fritschi L: 2013).

The result of chi-square statistic test obtained by significance value 0,025 which means p value $< 0,05$, hence there is relation between dose of herbicide with incidence of hypertension at farmer in Lembah Kuamang Pelepat Ilir District Bungoi. The result value of $RP = 3,451$ with Confidence Interval (CI) 95% = 1,278 - 9,322. Therefore, it can be concluded that farmers who use herbicide doses not in accordance with the rules of the packaging containers have a greater chance of risk 3,451 times to experience hypertension compared with farmers who use herbicide doses according to the rules of the packaging.

Based on the information from farmers at the time of the study most farmers use the dosage with their own estimation without looking at the use instructions contained on herbicide packing label, there are also farmers who assume that the doses listed on the label is not effective to eradicate weeds. So that the farmers as they like to do dose determination in the use of herbicide in the hope that weeds can be immediately eradicated with a short time. The use of herbicides such as these can lead to the doses used can exceed the doses contained on the packaging label so that the use of herbicides cause adverse effects to the health of farmers. Dosage Herbicides used in herbicide spraying can affect herbicide poisoning rates in farmers. The

higher the doses used, the higher the risk for Herbicide poisoning in farmers (Dosemeci M, Alavanja MCR, Rowland AS, Mage D, Zahm SH: 2002).

Chi-Square statistical test results obtained p value = 0.037 smaller than α (0.05). shows that there is a significant relationship between pesticide management with Hypertension occurrence on oil palm farmers in Lembah Kuamang, with RP = 3,397; 95% CI = 1,192 - 9,682, meaning that workers who perform pesticide management poorly and not in accordance with the rules have a risk almost 3 times higher for the occurrence of hypertension disorder compared with workers who do pesticide management well and according to the rules that have been set.

Research conducted by Lekei on farmers in Tanzania indicates that unsafe herbicide management practices (home Herbicide storage, washing equipment near water sources, safety practices especially disposal of Herbicide packaging and not using PPE at work) are potential Herbicide exposure which is high in farmers and causes adverse health effects for farmers (Lekei EE, Ngowi A V., London L: 2014).

Good herbicide management is an important way to prevent Herbicide poisoning such as avoiding hot weather and wind direction during spraying activities, full use of PPE, proper mixing practices and not polluting water, changing clothes after spraying, using special equipment when mixing Herbicides washing hands after using Herbicides, not eating and drinking when using Herbicides and not storing food near Herbicide containers (Mekonnen Y, Agonafir T: 2002).

The result of chi-square statistic test obtained significance value of 0.455 which means $p > 0,05$, hence there is no correlation between spraying with hypertension occurrence at farmer of Lembah Kuamang Pelepat Ilir, District Bungo Jambi.

The results of this study are not in accordance with research conducted by Nancy L in United State of America 2014, from the results of correlation coefficient test between the way of glyphosate application in corn and soybean farming against the occurrence of hypertension with high significance ($<10^{-5}$) and value (R = 0.923), has a very strong correlation. This suggests there is a relationship between exposure to gliposate herbicides in agricultural areas to the incidence of hypertension (Swanson NL, Leu A, Abrahamson J, Walle B: 2004).

Spraying is an aspect that farmers need to pay attention to avoid the negative impact of pesticide use. One of the factors to watch out for during spraying is the weather. If the wind blows fast then drift Herbicide can be flown can be flown wind elsewhere and about people or animals that are close to where Herbicide is applied. Another thing to note also is that do not spray opposite to the wind direction because the spray fluid can be about the farmer (Djojsumarto P: 2008).

Table 2. The results of statistical analysis of the relationship of independent variables with the incidence of hypertension in farmers in the village of Lembah Kuamang Pelepat Ilir District Bungo Jambi in 2018

No	Variabels	Hipertension		p-value	RP	95 % CI	
		There is interference	No interference			Lower	Upper
		e	e				

1.	Length of working						
	> 5 hours / day	27 (69,2%)	12 (30,8%)	0,017	3,640	1,359	9,751
	≤ 5 hours / day	14 (42,4%)	19 (57,6%)				
2.	Years of service						
	> 5 years	34 (68,0%)	16 (32,0%)	0,009*	4,554	1,552	13,356
	≤ 5 years	7 (31,8%)	15 (68,2%)				
3.	Use of PPE						
	Incomplete	24 (70,6%)	10 (29,4%)	0,048*	2,965	1,117	7,870
	Complete	17 (44,7%)	21 (55,3%)				
4.	Dose of Herbicide						
	No Match label	24 (72,7%)	9 (27,3%)	0,025*	3,451	1,278	9,322
	Corresponding label	17 (43,6%)	22 (56,4%)				
5.	Herbicide Management						
	Bad	33 (66,0%)	17 (34,0%)	0,037*	3,397	1,192	9,682
	Good	8 (36,4%)	14 (63,6%)				
6.	How to Spray						
	Contrary to wind direction	22 (62,9%)	13 (37,1%)	0,455	1,603	0,626	4,109
	Appropriate wind direction	19 (51,4%)	18 (48,6%)				

Ket : * (significant)

Based on table 3 multivariate test results logistic regression is known that the variables that affect Hypertension is the working period, Herbicide dose and smoking habits. Based on the calculation of probabilities that aims to see the effect of jointly between variables that affect hypertension can be seen that peasants with a working period > 5 years, farmers who use doses Herbicide does not match the packaging listed on the label, farmers who have smoking habits have the probability of experiencing Hypertension of 95.6%.

Table 3 Results of logistic regression analysis between Herbicide exposure with Hypertension at farmers in the village of Lembah Kuamang Pelepat Ilir District Bungo

Variabels	B	Sig	Exp (B) /OR	Nilai 95% CI	
				Lower	Upper
Dose of herbicide	2,046	0,004	7,738	1,911	31,337
Management of herbicides	1,520	0,038	4,574	1,085	19,285
Constants	-4,261				

IV. CONCLUSION

1. The result of measurement of systolic and diastolic blood pressure at weed-spray farmer in Village of Lembah Kuamang Pelepat Ilir District Bungo , that the farmers who have blood pressure with category of hypertension is 41 people (56,9%) higher, compared to farmers who have pressure normal blood counted 31 people (43,1%).
2. There is a relationship between the length of work (P-value = 0.025), use of PPE (p-value = 0.048), herbicide management (p-value = 0.040) value = 0.037), with the incidence of hypertension in farmers in the village of Lembah Kuamang Pelepat Ilir District Bungo Jambi. Dosage Herbicides that do not fit the label on the packaging and pesticide management efforts that are not in accordance with the rules, have a probability for the occurrence of hypertension of 47.5%.

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