



Study of Poisoning Factors in Fogging Operator's PT Pestindo Central Optima

Hendrika Puspita Sari^{1,2}, Suhartono³ and Mursid Raharjo³

¹ Program Study of Environmental Health Masters, Universitas Diponegoro, Semarang, Central Java, Indonesia

² PT Pestindo Central Optima, Semarang, Central Java, Indonesia

³ Faculty of Public Health, Universitas Diponegoro, Semarang, Central Java, Indonesia
hendrikapussar@gmail.com

Abstract. The Pest Control service business in Indonesia has 750 companies registered as active members in the Indonesian Pest Control Entrepreneurs Association in 2023, one of which is PT Pestindo Central Optima, a company engaged in pest control services with 128 employees in 2022 consisting of 21 staff and 107 people engaged in the service department or what is usually called operators. One of the disease vector control efforts carried out by PT Pestindo Central Optima is fogging. One of the materials used for fogging comes from the organophosphat group. Organophosphat pesticides, if not used properly, can cause poisoning. In addition, several factors that may support the occurrence of poisoning are the length of spraying, working period, frequency of fogging, officer behaviour, use of personal protective equipment for pest control operators. The method used in this research is analytical survey with cross sectional design. Data analysis used the Spearman correlation test followed by the correlation coefficient test to determine the strength of the relationship between each variable. The variable of working period, spraying frequency and operator behaviour on cholinesterase levels was found to have a significant relationship, but the variable of PPE use and length of work on the cholinesterase level of fogging officers was found to have no significant relationship between the two variables.

Keywords: Cholinesterasi Level, Fogging, Operator Pest Control, Pest Control, Organophosphate

1 Introduction

The Pest Control service business in Indonesia has 750 companies registered as active members in the Indonesian Pest Control Entrepreneurs Association in 2023, one of which is PT Pestindo Central Optima with 128 employees in 2022 consisting of 21 staff and 107 people engaged in the service department or what are usually called operators[35]. The method used by Pest Control services is treatment, where the implementation of treatment will not be separated from the use of pesticides[4, 6, 7, 14, 16, 34]. Pesticides have an important role in controlling disease vectors and disease-carrying animals, the use of pesticides in its implementation will have both negative and positive

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impacts[2, 10, 12, 15, 18, 21, 24, 30, 31]. Pesticides used for fumigation include organophosphates or carbamate class insecticides where the active ingredients have an effect on the human body. Organophosphat compounds are toxic to groups that have a spine including humans where in this study humans who are at risk of poisoning are humans exposed to pesticides when smoking because they can affect the nervous system by inhibiting the activity of the enzyme cholinesterase in the body[2, 10, 15, 21]. Exposure due to pesticides used can begin to be exposed starting from the process of mixing pesticides, carrying out fogging and after completion of fogging, especially when cleaning tools. Based on the degradation period in the environment (in tropical countries) which is about 1 - 2 months depending on temperature, sunlight, and the presence of microorganisms that can increase the risk for fogging operators [3, 8] .

PT Pestindo Central Optima is a company engaged in pest control services which was established on 8 December 2010 which currently has 13 branches throughout Indonesia with 180 employees in 2022, but for operators who specifically use organophosphate pesticides, there are 107 people and they already have training certificates from the health department and asphami. Operators who are exposed to pesticides with Organophosphate types are operators who work on feedmill customers or animal feed factories, hotels, hospitals and other industries with varying frequency of fogging in one month, there are customers whose frequency of fogging in 1 month starts from 1 time - 12 times per month. Preliminary tests have been carried out on 3 operators at PT Pestindo Central Optima and obtained the results of 2 fogging operators with cholinesterase levels in the mild poisoning category and 1 operator with normal cholinesterase levels.

In addition, from the results of preliminary observations when officers were fogging, several problems were found that occurred during the implementation of fogging, namely fogging officers did not use complete Personal Protective Equipment (PPE) such as boots, protective glasses, and gloves when using pesticides when mixing and implementing fogging and when cleaning tools. The fogging operators consider that the pesticide has no impact on their health so that the fogging operators ignore using complete personal protective equipment. Fogging operators said that they were more comfortable if they did not use PPE, they felt short of breath because the mask used was a respirator mask which when used for a long time and carrying a rather heavy tool could feel short of breath. After finishing fogging, fogging operators do not wash their hands and clean their bodies but they immediately eat, drink or smoke. This behaviour can also cause fogging operators to experience pesticide poisoning.

Operators who are exposed to pesticides with Organophosphat types are operators who work on feedmill customers or animal feed factories and commercials with a frequency of fogging in one month varying, there are customers whose frequency of fogging in 1 month starts from 1 time - 8 times per month. The frequency of fogging is also very influential on the cholinesterase levels of fogging operators in addition to seeing the working period of the operator. The frequency of fogging is also different for each factory depending on the contract given from the sales of PT Pestindo Central Optima to the customer. With the difference in the frequency of fogging and the coverage of different areas for each customer, it can also be a factor that can cause insecticide poisoning. The more frequent fogging, the greater the risk of poisoning. The impact of

continuous exposure to organophosphates with high pesticide concentrations will be more quickly seen in fogging operators, which is usually known as acute exposure. Meanwhile, chronic exposure is often ignored because the intensity of severity is lower and is often detected as another systematic disease because it occurs a long time after exposure. From the background, it is necessary to monitor or check cholinesterase levels in PT Pestindo Central Optima pest control fogging operators to determine the health status of fogging operators.

2 Method

The type of research used is observational research with a cross sectional method [13, 23, 41]. The population in this study were 107 pest control operators who performed fogging at PT Pestindo Central Optima (Fig. 1). The sample selection used a nonprobability sampling approach, while the technique used for sample collection was purposive sampling [5, 29, 40]. The inclusion criteria in this study were pest control operators who had a scope of work fogging using pesticides and were willing to participate as research samples. The sample size in this study was calculated using the Slovin formula Eq. (1), which is as follows:

$$n=107/[(1+107.(0,01))]^2 \quad (1)$$

$$n=51,69 \sim 52 \text{ person}$$

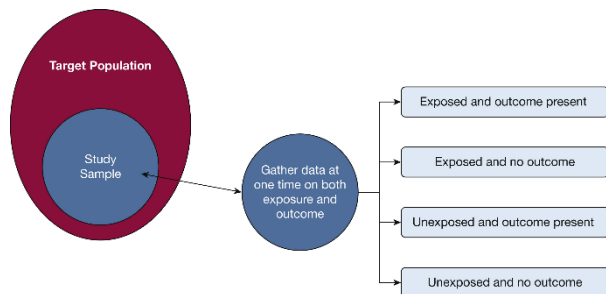


Fig. 1. A schematic representation of a typical cross sectional study

The independent variables in this study are the length of spraying, length of service, frequency of fogging, officer behavior (when mixing raw materials, during fogging and after fogging) and the use of Personal Protective Equipment. The dependent variable was the officer's cholinesterase level. The observed confounding variables were age and education level. The research tools used were checklists, cameras and materials used for cholinesterase examination. Primary data collection is observing the behavior of officers, the use of personal protective equipment and measuring the cholinesterase levels of pest control operators and secondary data obtained from PT Pestindo Central Optima regarding length of work, frequency of fumigation, age and education level. Data analysis in this study used two analyses, namely descriptive analysis to describe the results of the study and statistical analysis to determine the relationship between

variables. Statistical analysis using Pearson correlation test which further analyzed the strength of the relationship using the correlation coefficient on a computer program.

3 Results and Discussion

This study was conducted to determine the use of Personal Protective Equipment, frequency of fogging, length of work and behavior of fogging officers on the level of poisoning in PT Pestindo Central Optima pest control operators in 2022. Research implementation activities include checking cholinesterase levels carried out after pest control operators carry out fogging and observing pest control operators when carrying out fogging preparations, during fogging and after fogging. The results of the study can be described through a table containing data on the examination of cholinesterase levels Table 1.

Table 1. Frequency distribution of respondent's cholinesterase levels at PT Pestindo Central Optima in 2022

Cholinesterase Level	F	%
Normal	46	88.5%
Toxicity	6	11.5%
Number	52	100.0%

Table 2. Relationship between spraying duration, working period, fogging frequency, staff behavior, use of Personal Protective Equipment and Cholinesterase Levels of Pest Control Operators

Variable		Cholinesterase Level				p	Corr.
		Normal		Toxicity			
		n	%	n	%		
Duration of spraying	0 - 60	42	93	6	85	0.133	0.211
	61 - 120	3	7	1	15		
Length of Service	0 - 72	43	95	5	71	0.294	0.148
	73 - 144	2	5	2	29		
Frequency of fogging	0 - 10	43	95	1	14	0.001	0.456
	11 - 20	2	5	6	86		
Behavior	Good	23	51	0	0	0.000	-0.609
	Not Good	22	49	7	100		
Use of PPE	1 - 5	0	0	0	0	0,64	-
	6 - 10	45	100	7	100		

The results showed that the cholinesterase levels of some officers involved in insecticide poisoning, out of 52 fogging operators who experienced insecticide poisoning

were 7 people (13.5%) (Table 2). The low level of poisoning in PT Pestindo Central Optima is due to the fact that at the time of taking blood samples for cholinesterase examination when operator is not in the fogging period so that exposure or exposure to pesticides is reduced. Cholinesterase will drop at the time of exposure and increase as soon as the exposure stops. Insecticide exposure to staff does not only occur during fogging, exposure to insecticides can occur from the preparation of raw materials, fogging, filling the swing fog with insecticides and transporting the insecticides from the place used for compounding to the intended location.

3.1 Relationship between the Use of Personal Protective Equipment and Cholinesterase Levels.

The results of the calculation between the use of PPE and Cholinesterase levels when viewed from figure 4. obtained a p-value of 0.641 which means that there is no significant relationship between the two. The results of the calculation between the use of PPE and Cholinesterase levels when viewed from figure 4. obtained a p-value of 0.641 which can be interpreted that there is no significant relationship between the two because of 52 operators have used PPE which can be said to be complete but from the results of checking from 52 operators there are 7 people who show that the cholinesterase is not the norm (poisoning). Use of Personal Protective Equipment during fogging is very influential on the entry of the number of pesticide particles into the body of the pest control operator. Personal protective equipment that must be used by fogging officers are hats or headgear, masks, gloves, boots, shirts and trousers, and glasses. Trousers, glasses, ear muffs and safety shoes. The use of PPE is said to be incomplete if it uses PPE that can only protect against exposure through one contact, namely the skin. Exposure through 1 contact, namely the skin, if they only use PPE clothes, pants, and goggles. They only use PPE clothes, pants, gloves, and hats, but do not wear masks or hats and hat, but do not wear a mask or goggles that can. That can prevent exposure to pesticides through the eyes, respiratory tract and respiratory tract and digestive tract and said to be complete if using PPE that can protect against exposure through ≥ 2 contacts [39]. The use of Personal Protective Equipment during preparation, fogging is very important to avoid direct contact with organophosphates. At the time of mixing, officers do not wear Personal Protective Equipment at all, they only use the clothes they usually use. Mixing is only done by one person. Officers who have checked their cholinesterase levels after fogging found that 7 (Seven) officers have cholinesterase levels in the poisoning category. This will certainly cause pesticide exposure to officers. Organophosphate pesticides containing the active ingredient malathion can be absorbed by the body through all entry points such as the mouth / digestion, skin, and breathing. Based on Permenkes No 258/Menkes/Per/III/1992 concerning Pesticide Management Requirements, for Personal Protective Equipment that must be used based on the type of work and classification of pesticides [22]. The pesticide used is malathion which is included in the very dangerous pesticide so that personal protective equipment is needed in the form of boots, long-sleeved overalls, hats, face shields, masks and gloves. After observation, there are several things that can affect the occurrence of poisoning in operators even though they have used personal protective equipment. The influential

thing is the use of wear packs that are not in accordance with the standard, operators only use short-sleeved wear packs coupled with hand cuffs, so that when fogging the smoke will still have the potential to enter the skin pores. besides that, it is also influenced by the operator's behavior after fogging, namely by not washing hands with soap in running water and not changing clothes after fogging [26].

3.2 Relationship between Fogging Frequency and Cholinesterase Levels

The results of the analysis of the frequency of fogging with cholinesterase levels can be interpreted that there is a significant relationship between the frequency of fogging with cholinesterase levels of fogging officers. The frequency of fogging was found to have a significant relationship between the frequency of fogging and cholinesterase activity in the blood. Frequent fogging allows the risk of increasing the frequency of exposure to pesticides so that the occurrence of poisoning due to exposure to pesticides is also greater [9, 19, 28, 33, 36]. So it can be said that the more often a worker means the greater the possibility of workers being exposed to pesticides and experiencing pesticide poisoning. Based on the provisions stipulated in the Regulation of the Minister of Labour No. Per-03/Men/1986 Article 2 paragraph 2a states that to maintain undesirable effects, it is recommended that workers who work with pesticides do not exceed 4 (four) hours per day in a consecutive week. The frequency of fogging affects the cholinesterase levels of fogging officers in addition to looking at the officer's working period [9, 19, 28, 33, 36]. The difference in the frequency of fogging and the coverage area of fogging officers can also be one of the factors that can cause insecticide poisoning. The more frequent fogging, the greater or increased risk of poisoning.³³ The impact of exposure to organophosphates is mainly known immediately when acute exposure occurs [2, 10, 15, 21]. Meanwhile, chronic exposure is often ignored because the intensity of severity is lower and is often detected as a systematic fabric disease because it occurs a long time after exposure [19, 20, 25, 27]. The frequency of fogging in respondents was calculated as the number of times the officer carried out fogging at PT Pestindo Central Optima's customers. The fogging operator will do fogging in one month varies, the maximum in one month the operator will do fogging 20 times. When viewed from Figure 4. it can be seen that with a fogging frequency of 0 - 10 times per month there are 43 operators who have normal cholinesterase and 1 person experiencing poisoning, while with a fogging frequency of 11 - 20 times per month there are 2 operators who have normal cholinesterase and 6 people experiencing poisoning.

3.3 Relationship between Length of Service and Cholinesterase Levels

The use of insecticides needs to be taken seriously considering the dangers of insecticides that can cause poisoning, disease, cancer and even death due to poisoning or exposure to the insecticides used. The level of exposure to insecticides is not felt immediately at this time because of its cumulative nature and is affected by the length of work experienced by fogging workers so that in the end pesticide exposure can cause death. The longer the fogging officer fumes using insecticides, it is assumed that the greater the possibility of chemical poisoning in the officer. This phenomenon can be

assumed that the possibility of poisoning in officers determined by length of work does not significantly affect. Because apart from the length of work, there are several factors that influence and play a very large role in the occurrence of poisoning within the time span, the first of which is the frequency of fumigation in one year. The frequency of fumigation is included in the independent variable studied. The longer the officer is exposed to organophosphorus pesticides, the risk of cholinesterase poisoning will also increase [1, 11, 17, 32, 37, 38].

3.4 Relationship between Behavior and Cholinesterase Levels

The results of the analysis of officer behavior with cholinesterase levels using the Spearman correlation test showed no significant relationship between the two variables. The results of measuring cholinesterase levels and observing officer behavior showed that 86% of officer behavior was in the poor category where 22 officers had normal cholinesterase levels and 7 officers had abnormal cholinesterase levels. The behavior was observed using a checklist form for officers before fogging, during fogging and after fogging while for officers. The relatively low level of poisoning among fogging workers could be due to the use of doses that are in accordance with the labels on the packaging of the insecticides used. However, at the time of preparation, officers did not determine the wind direction first so they immediately carried out fogging starting from the far end of the house from the area to be fogged first out of 10 officers did not do all the fogging of each area for about 10 - 15 minutes after which the door was closed by the officer. Officers who carry out fogging must pay attention to the wind direction when fogging, if they do not pay attention to the wind direction when fogging carelessly, the level of pesticide exposure will be greater and will affect the lower blood cholinesterase levels, so that it will worsen the health of fogging officers. When they finish fogging, they will usually rest in one of the places in the customer area. There are some officers who wash their hands first before eating and drinking, but when washing hands, they are only limited to washing their hands using running water and not using hand soap. Meanwhile, there are other officers who immediately smoke, eat and drink without washing their hands first. Even though they already know what the dangers are after using pesticides, they do not wash their hands using soap. However, due to the situation in the field that sometimes there is no tap outside the house and there is no soap available, they do not wash their hands using the soap[26].

4 Conclusion

The poisoning rate of officers after fogging was 14%. Most respondents had an age between 20 to 30 years as much as 55.7%, a high school education level of 96%, length of work in the 0 - 72 category, 92%, while for the frequency of fogging in the 0 - 10 category, 85%, respondent behavior in the good category with 45%, the use of Personal Protective Equipment in the complete category 100%. Variable education category, length of time fogging against nest erase colony levels found no significant relationship.

The variables of age, length of service, frequency of fogging, officer behavior on cholinesterase levels of fogging officers found a significant relationship between the two variables.

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