

## RELATIONSHIP BETWEEN LENGTH OF WORK, DURATION OF WORK, USE OF PERSONAL PROTECTIVE EQUIPMENT WITH BLOOD CHOLINESTERASE LEVELS AMONG FARMERS IN MODOINDING DISTRICT

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### ABSTRACT

**Background:** The use of pesticides in agriculture has been perceived as beneficial for increasing production. Pesticides are essential material used to protect crops and agricultural products, livestock, and fish from damage caused by various pests.

**Objective:** This research aims to determine the relationship between length of work, work period, and the use of Personal Protective Equipment (PPE) with blood cholinesterase levels in pesticide sprayers among farmers in Modoinding Subdistrict.

**Method:** This study is of an analytical with a cross-sectional study design. The study population consists of pesticide sprayers among farmers in Modoinding Subdistrict. The research sample was determined using cluster random sampling, where samples were taken from three villages.. From each village, 20 pesticide sprayers were randomly selected, resulting in a total sample size of 60 individuals. Data analysis using logistic regrestion to assess the relationships between variables.

**Results:** The research findings indicate that the majority (87%) of pesticide sprayers are above 20 years of age, and all respondents have a work period of more than 3 (three) years. This suggests that pesticide sprayers have been in contact with pesticides for an extended period. The use of PPE is still not a priority for these workers. All respondents (100%) handle pesticide-containing substances (herbicides, insecticides, fungicides) without using PPE, especially gloves and masks. During spraying, 100% of the respondents wear long-sleeved clothing, long pants, and hats, with 16% using masks. This situation indicates a high risk of pesticide poisoning among these farmers. The results of the blood cholinesterase level relationship test with work period show significant values ( $p=0.012$ ), as do the length of service ( $p=0.00$ ) and the use of PPE ( $p=0.000$ ).

**Conclusion:** There is a significant relationship between length of work, work period, and the use of Personal Protective Equipment (PPE) with blood cholinesterase levels among vegetable farmers in Modoinding Subdistrict, South Minahasa Regency, North Sulawesi.

**Keywords:** Cholinesterase; pestiside; farmers

### INTRODUCTION

The use of pesticides in agriculture has been perceived as beneficial for increasing production. Pesticides are essential material used to protect crops and agricultural products, livestock, and fish from damage caused by various pests. Farmers who apply pesticides are highly susceptible to pesticide poisoning (Rezaei R., Seidi M. 2019). Pesticides can poison humans or livestock through ingestion, skin contact, and inhalation. The World Health Organization (WHO) confirmed that there are about 4,444 cases out of one to five million cases of poisoning worldwide, occurring among 4,444 workers in the agricultural sector

every year, of which about 80% of poisoning cases occur in developing countries with a mortality rate of 5.5% or about 220,000 people.

Some reported cases of pesticide poisoning among farmers in Indonesia include 30 members of a pest control team in Sleman District experiencing pesticide poisoning incidents, with 14 individuals (46.66 percent) displaying poisoning symptoms. In Kulon Progo, there were 210 reported pesticide poisoning cases (Samosir K., Setiani O. 2017). The result of bivariate analysis showed  $p$ -value  $<0.05$  for variable of spraying duration (0.003), spraying action (0.02), and personal hygiene (0.007). There is a significant

relationship between each of these variables and the symptoms of pesticide poisoning in pineapple farmers in Tangkit Baru Village (Herdianti 2018). Pesticide-induced chronic poisoning can be carcinogenic (leading to the formation of cancerous tissues in the body), mutagenic (causing genetic damage in future generations), and teratogenic (resulting in birth defects in children born to poisoned mothers).

The research on the relationship between years of work, duration of work, and the use of personal protective equipment (PPE) with the blood cholinesterase levels of vegetable farmers in the Modoinding sub-district aims to provide insights into Occupational Health and Safety (OHS) in the field of agriculture, especially in the context of pesticide exposure, which poses risks of work-related illnesses associated with pesticide exposure (Rezaei R., Seidi M. 2019), (Graciella, Narwanto, and Jauhani, n.d.)

## METHOD

The research conducted is of an analytical with a cross-sectional study design. The study was carried out directly with farmers in the field through interviews and blood sample examinations to determine the blood cholinesterase levels of the respondents. The population comprised all pesticide spraying farmers in the Modoinding District of South Minahasa Regency. The research sample consisted of pesticide spraying farmers in the villages of Makaanoyen, Palelon, and Wulurmaatus, selected through purposive random sampling. From each of these three villages, 20 respondents were randomly chosen, resulting in a total of 60 respondents. The data analysis employed in this study includes univariate analysis and bivariate analysis using logistic regression.

## RESULT AND DISCUSSION

The research findings indicate that the majority (87%) of pesticide sprayers are aged

above 20 years old, and all respondents have work experience exceeding three years. The duration of contact between farmers and pesticides ranges from preparation/mixing of substances to the completion of spraying, occurring between two to five times per week with a duration of three to six hours. This suggests that pesticide sprayers have had prolonged exposure to pesticides.

**Table 1.** Duration of Pesticide Exposure to Farmers

Duration Day/Week	Hour/Day			%
	2 - 4	≥ 4 - 6	N	
2 - 3	22	6	28	46,67
4 - 5	17	15	32	53,33
N	39	21	60	
%	65,00	35,00		100,00

The use of Personal Protective Equipment (PPE) has not yet garnered the attention of these farmers during work. All respondents (100%) handle pesticide-containing materials (herbicides, insecticides, fungicides) without using gloves and masks. During spraying, 100% of the respondents wear long-sleeved clothing, long pants, and a hat, while only 16% use masks during spraying. This situation indicates a very high risk of pesticide poisoning among farmers. Statistical analysis results reveal a significant relationship between respondents' blood cholinesterase levels and their years of work ( $p=0.012$ ), as well as with the duration of work ( $p=0.00$ ) and the use of PPE ( $p=0.000$ ).

**Table 2.** Pscial Test

Variables in The Equation				
		Wald	df	sig.
Step1*	Length of Work	4,607	1	0,012
	Duration of Work	5,512	1	0,000
	PPE	5,906	1	0,000

A series of gradual activities, starting from land preparation, planting, weeding, maintenance, and up to the harvesting process, constitutes a crucial sequence of processes in ensuring the quality of vegetables and spices produced by farmers. Within this series of activities, farmers are inevitably exposed to pesticides. Pesticide sprayers are particularly vulnerable to pesticide poisoning. Cases of pesticide poisoning among farmers in Indonesia have been documented, including in the Sleman region, where 30 members of the

pest control staff experienced pesticide poisoning incidents, with 14 individuals (46.66 percent) exhibiting symptoms of poisoning. In Kulon Progo, there were 210 cases of pesticide poisoning (Samosir K., Setiani O. 2017), (Ulva, Rizyana, and Rahmi 2019).

The findings of this research reveal a significant relationship between years of service and blood cholinesterase levels ( $p=0.012$ ). Similarly, the duration of work as pesticide sprayers is also significant ( $p=0.000$ ). This indicates that the longer farmers work as pesticide sprayers, the greater their risk of exposure to cholinesterase levels in their blood (Pasiani et al. 2012), who conducted research on farmers exposed to pesticides in Brazil, reported a significant relationship ( $p=0.001$ ) between work methods and the use of personal protective equipment (PPE) with acetylcholinesterase (AChE) levels. Ten (16.7%) farmers experienced a decrease in acetylcholinesterase (AChE) levels of more than 30% during the exposure period compared to the initial levels (Tutu, Manampiring, and Umboh 2020), (Nurcandra, Mahkota, and Shivalli 2018), (Isnawan 2013), (Budiawan 2014). These research findings align with the results of a study conducted by (Herdianti 2018), which showed a significant relationship between cholinesterase levels and years of service ( $p=0.000$ ) and a significant relationship with the duration of spraying ( $p=0.012$ ). Additionally, (Istinah 2018), demonstrated a significant relationship between years of work ( $p=0.011$ ) and cholinesterase levels in women of childbearing age in the agricultural area of Kersana District, Brebes Regency.

The longer the time of pesticide exposure to a farmer, the greater the decrease in blood cholinesterase in that farmer. Similarly, the length of work, where farmers work as pesticide sprayers with a duration of three - five hours per day which lasts for two - five days per week. This indicates that the longer farmers work as pesticide sprayers, the greater their risk of exposure to blood cholinesterase levels. According to WHO in 1996 for the duration of pesticide spraying it is only recommended to work for five - six hours per day in every one week and must be accompanied by a health check including Cholinesterase levels in the blood.

Pasiani et al. (2012) who conducted research on farmers exposed to pesticides in

Brazil reported a significant relationship ( $p=0.001$ ) between the way of work and the use of personal protective equipment (PPE) with acetylcholinesterase (AChE) levels. Ten (16.7%) farmers experienced a decrease in acetylcholinesterase (AChE) levels of more than 30% during the exposure period compared to baseline levels. The findings of this study are in line with the results of research conducted by Mokoagow et al. (2013), which showed a significant relationship between cholinesterase levels and tenure and significantly related to the length of spraying. In addition, (I.G. 2010) showed a significant relationship between working period and cholinesterase levels in women of childbearing age in the agricultural area of Kersana District, Brebes Regency. The use of PPE by Modoinding farmers shows a very low number, while it is known that one of the effective ways to reduce pesticide exposure is the use of PPE correctly and accurately. Research conducted by (Istinah 2018) shows that farmers who use PPE can reduce pesticide exposure.

## CONSLUSION

There is a significant relationship between length of employment and blood cholinesterase levels. there is a significant relationship between the duration of employment and blood cholinesterase levels, there is a significant relationship between the use of personal protective equipment (PPE) and blood cholinesterase levels among vegetable farmers in the Modoinding District of South Minahasa Regency, North Sulawesi.

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## CONFLICT OF INTEREST

The authors hereby declare that there is no conflict of interest in this research either individually or industrially.

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