BOOK OF ABSTRACTS

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"*Sustainable Vocational Studies in Business, Engineering and Health for Global Advancement and Competitiveness of the Nation"*

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[HEA 3030]

Blood Cholinesterase Level Based on Pesticide Use among Agricultural Workers

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Abstract. The agricultural sector has an important role in the economic development of Ponorogo Regency. As a main livelihood for most of the villagers, farming could cause various safety and health risks for workers, especially caused by pesticide use. The negative effect of using pesticides is that it can reduced levels of cholinesterase enzymes in the blood. This study aims to determine the effect of Age, Length of Work (LoW), Smoking Habit (Smoking), Duration of Pesticide Use a Week (Duration) and Mixing Activities (Mixing) to Blood Cholinesterase Levels (BCL). The research was conducted at Demangan Villaage of Ponorogo Regency. Thirty (30) farmers who have at least 1 year length of work were involved to be a sample that randomly selected. This research using observational analytics method and cross-sectional design to obtain some information from respondent. Multiple linear regression was used to analyze obtained data. The results show that the level of blood cholinesterase among agricultural workers was all normal. The result shows that the predictor variables significantly reduce blood cholinesterase levels by 2.56. Blood Cholinesterase Levels is decreased by Age, Length of Work (LoW), Smoking Habit (Smoking), Duration of Pesticide Use a Week (Duration) and Mixing Activities (Mixing) by 50.5 % and 49,5 % by remaining factors. Mixing activitiesd have the greatest impact on reducing cholinesterase levels in the blood. It could decreases cholinesterase levels by 1.66..

Key Words: Firefighters, age, years of service, marriage status, stress

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Keywords : *Cholinesterase, Pesticide, Agricultural workers*

1 Introduction

The agricultural sector has an important role in economic development of Ponorogo Regency. Based on the regional statistical data in 2015, the area of agricultural land of Ponorogo Regency is 5,119,905 hectares with agricultural products such as rice, fruit and vegetables. The survey result showed that 27,755 people worked as farmers or 22.6% of the total population [1].

As a main livelihood for most of villagers, farming could cause various safety and health risks for agricultural workers, especially caused by wrong application of pesticide use. The negative effect of pesticides use is reducing levels of cholinesterase enzymes in the blood. Organophosphate is a type of pesticide that is widely used by farmers. It can cause health problems if used incorrectly. Pesticides can enter the body through the respiratory, skin and oral pathways. Pesticide residues are also harmful to the environment and can accumulate in products, plants, agricultural land, waters, poisoning and resistance in insects and animals.

Cholinesterase enzyme activity in the blood can be used to represent level of pesticide poisoning. The lower level of blood cholinesterase, the higher risk of poisoning. Therefore, it is necessary to monitor farmers health status to minimize the negatif effects of pesticide use. Preliminary studies show that farmers have a working period at least 10 years, no Personal Protective Equipment (PPE) equipped while working, and never been have medical check up before. The study shows that the longer periods of pesticides use activity such as spraying and mixing more pesticides are stuck in the body and binding blood cholinesterase [2]. This research tries to determine the effect of pesticide use activity to the blood cholinesterase levels among agricultural workers.

2 Method

In order to obtain some information from sample subject, this study using an observational analytic method and cross-sectional design. The study aims to determine the effect of five (5) predictor variables, such as age of the respondent (Age), Length of Work (LoW), Smoking Habits (Smoking), Duration of Pesticide Use a Week (Duration) and Mixing Activities (Mixing) to the dependent variable which is Blood Cholinesterase Level (BCL). The research design is illustrated in the following figure.

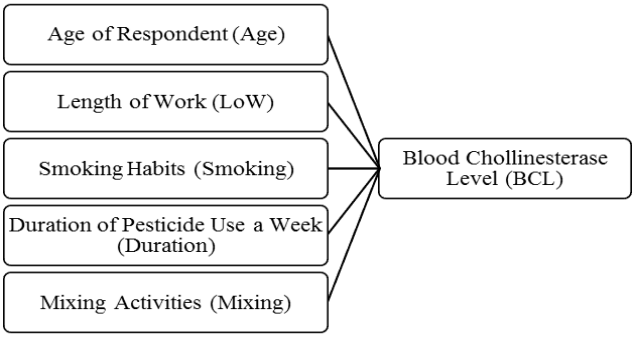

Figure 1. Research Design

This research was conducted for 4 months involving all agricultural workers in the Demangan village, Siman Ponorogo as a population. Thirty (30) farmers were randomly selected as a respondent whose at least 1 year period of works and directly using pesticides while working. Checklist and questionnaire are used as interview guides to obtain respondent data and identify research variables. Blood sampling took directly by laboratory workers to obtain data of blood cholinesterase level. The blinded method is used to avoid bias where the subject is given a number as an identity. Data collection and analysis are carried out by different person.

The data analysis model used is multiple linear regression, it will be used if the number of independent variables at least two (2) variables [3], with the regression equation as follows:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e \quad (1)$$

This analysis will also display an equation model that can be used to predict the value of dependent variable based on the value of predictor variables.

3 Result and Discussions

3.1 Result

Data collection showed that there were no data missing in this study. The results of measurements of cholinesterase levels in farmers' blood are presented in the following table:

Table 1. Chollinesterase level of agricultural workers

N	**30**
Mean	8.60
Minimum	5.72
Maximum	12.81
Std. Deviasi	1.642906943
Range	7.09

Based on *cobast* method, the normal standard of cholinesterase levels in the blood is 5.72 to 12.81. Even though, normal standard of each test method applied of clinical laboratory could be various. Table 1 shows that the average of blood cholinesterase levels in agricultural workers is 8.60 (normal level). However, farmers have a high risk of decreased blood cholinesterase levels. Observation and interviews showed that respondents frequently experienced nausea and dizziness right after using pesticides. Based on the results of previous studies, nausea and dizziness are the most common symptom felt by farmers who have pesticides exposure [4].

Blood cholinesterase decrease probably caused by unsafe working habits promoted by self desires to have rapid knockdown of pests and increase income. The farmers realized about the risk of pesticides use, but they still using pesticide incorrectly. They do pesticide spraying activities using short clothes many times that not washed immediately, tie clothes in the mouth like a mask, do not use glasses, hats and chemical resistance shoes. The farmers said that they have taken a bath at home and washing contaminated clothes after pesticide use. It can causes pesticide contamination to family members and the environment due to shared laundry. The habit of using pesticides incorrectly would increase the risk of decreasing cholinesterase levels in the blood [4].

The table below showed the results of ANOVA and multiple linier regression statictic with enter method:

Table 2. Anova test

Model		Sum of Squares	df	Mean Square	F	Sig.
1.	Regression	40.890	5	8.178	4.903	.003[b]
	Residual	40.033	24	1.668		
	Total	80.923	29			

a. Dependent Variable: BCL

b. Predictors: (Constant), Mixing, Age, LoW, Duration, Smoking

Anova test results above shows the information about the correlation of independent variables simultaneously to the dependent variable with the significant level obtained was 0.03. Based on cut of point by 0,05, it can be concluded that the variables Mixing, Age, LoW, Frequency and Smoking significantly affect the blood cholinesterase levels.

Based to the results of multiple linear regression test, R square obtained is 5,05. It means that the predictor variable has an effect to the blood cholinesterase levels by 50,5 % and the remaining 49,50% by other factors.

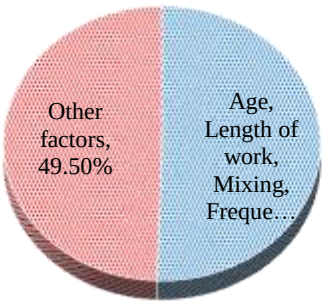

Figure 2. Cholinesterase level by predictors variables and other factors.

Although predictor variables simultaneously have a significant effect on the dependent variable, the partial analysis shows that not all predictor variables have a significant effect[5].

Equation models, coefficients and correlations of each predictor variable to blood cholinesterase levels show in the following table.

Table 3. Coefficient of predictors variables

Dependent variables	Beta coeficient	Sig.
(constant)	12.313	.000
LoW	-.051	.057
Age	-.001	.938
Smoking	-.777	.284
Duration	-.107	.079
Mixing	-1.660	.019

Table 3 shows information about the significance level of each variable (Sig.) with a cutt off value of 0.05. It can be seen that the mixing activities have a significant effect on blood cholinesterase levels (Sig. <0.05). The beta coefficient in table 3 is the coefficient of each predictor variable so that we can predict the blood cholinesterase level of the predictor variable by the following equation:

$$BCL\ (y) = 12{,}313 - 0{,}051LoW - 0{,}001Age - 0{,}777Smoking - 0{,}107Frequency - 0{,}1{,}660Mixing \quad (1)$$

Based on the equation 1, it can be concluded that :

1. If the Length of Work (LoW) increases by 1 unit, cholinesterase levels in the blood will decrease by 0.05 or 5 % (if other variables are constant).
2. Enhancement 1 point of Age will cause risk of reducing cholinesterase levels in the blood by 0,001 or 0,1 % (if other variables are constant).
3. Smoking will increase a risk of blood cholinesterase reduction by 0.05 or 5 % (if other variables are constant)
4. Enhancement 1 point of duration will increase risk of reducing blood cholinesterase levels by 0,001 or 0,1 % (if other variables are constant).
5. Pesticide mixing activities will increase a risk of reducing cholinesterase levels in the blood by 1.66 (if other variables are constant)

Based on equation 1 above, it can be seen the linear relationship of each predictor variable to the variable cholinesterase levels which can be described by followed figure:

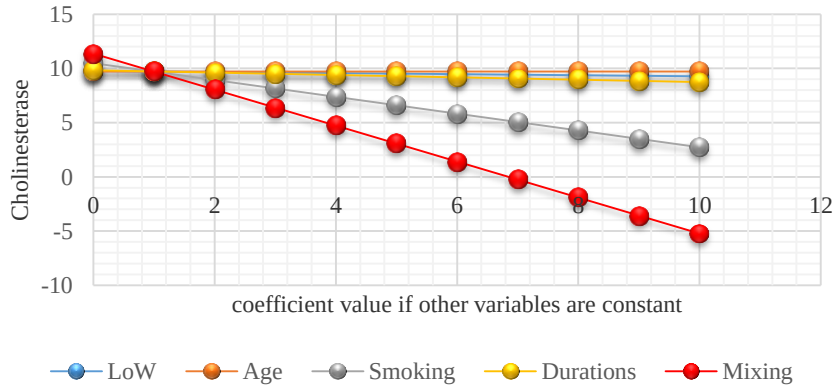

Figure 6. linear correlation between cholinesterase level and predictor variables

Linear lines with connecting points indicate the direction of the relationship of enhancement each predictor variable to the dependent variable if the other variables are constant. Figure 7 shows that the slope of the largest line is on the mixing variable. It means that the mixing variable has the greatest influence on the reduction in cholinesterase levels in the blood. We can also seen on coefficient point of table 3 that mixing activities has the greatest coefficient than other variables.

3.2 Discussions

3.2.1 Length of work

Theoretically the longer duration of pesticides use the longer contact with body and the higher risk of pesticide poisoning. Pesticides absorbtion of the body could bind cholinesterase in the blood so it could reduce blood cholinesterase levels and poisoning occurs. Symptoms that can be seen are nausea and dizziness felt by farmers after spraying activities [6].

Based on observation, the agricultural sectors is the main source of livelihood for the community. They usually start in the morning for the day and continuous in the afternoon.

The binding cholinesterase by pesticides is reversible, so it can back to normal. The decreasing of plasma cholinesterase can get normal on 3 weeks, while need 2 weeks for the blood without an exposure. It is depends on new synthesis enzym of liver.

3.2.2 Age

There is a relationship between blood cholinesterase and the genotoxic effects. Risk factors, such as, age, smoking and year of employment (as farmer) are introduced as covariate which may influence the genotoxic risks in the study population. Both genotoxic effects indicated an inverse relationship with the level of blood cholinesterase. [7].

The age affects blood cholinesterase level with p value 0, 007 [8]. Based on the results of the analysis of previous research using linear regression, r was obtained for 0.194, which means the effect of working length on the decreasing of cholinesterase is only 19% [18].

3.2.3 Smoking Habits

Health status associated with cholinesterase in shallot farmers in Ngurensiti Pati. The disease will make it easier for the poison to react than people who are not sick. If the body's endurance decreases, poisoning also causes more severe disorders [9]. Smoking habits can increase the risk of pesticide poisoning through oral contamination. Based on the results of the interviews obtained data that most farmers are active smokers [10].

3.2.4 Duration of Pesticide Use

Duration of this study is the duration of pesticide use in a week, the longer the use of pesticides, the higher the risk of poisoning that will be experienced by farmers. The ideal time is recommended for for pesticide use is on the morning between 07.00 - 10.00 O'clock and in the afternoon of 15.00 - 18.00 [9]. Pesticide should be used in accordance with the provisions. Duration of Contact with should no longer than 5 hours a day [11].

3.2.5 Mixing Activities

This activity is carried out by farmers with open arms and without using personal protective equipment. The work of mixing, carrying and spraying pesticides is a work stage that is most at risk of reducing cholinesterase levels through pesticide poisoning [4].

Other behaviors, such as limited hand wash-ing and failure to wear long sleeves and long pants, may contribute to pesticide exposure. Pesticide exposure also may reflect environmental conditions of agricultural workers and not just individual behaviors. For example, farm worker housing is subject to contamination through drift from nearby fields[12].

Agricultural pesticide handlers are workers who are involved in the pesticide application process, which includes applying pesticides and related activities, such as mixing and loading pesticides into spray tanks and repairing application equipment. Handlers are generally considered to have higher levels of pesticide exposure than agricultural workers engaged in other tasks. However, relatively few studies have evaluated specific pesticide handling practices and conditions in relation to biological markers of exposure[13]. Agricultural pesticide handlers may be exposed to OP/CBs as a result of dermal contact with pesticides or spray equipment, inhalation,[14] accidental spills or spray equipment malfunction, inadequate use of personal protective equipment (PPE), [15,16] and lack of decontamination facilities[17]. Handlers who reported cleaning spray equipment had an average of 4.4% greater BuChE inhibition than handlers who did not clean spray equipment (P=0.033), and we observed a nine fold increased risk of BuChE depression among handlers who cleaned spray equipment.

Wearing a full-face respirator appeared to protect against BuChE inhibition. Relative to full-face respirator users, handlers who wore half-face respirators had approximately 7.0% greater BuChE inhibition on average (P=0.034). Wearing chemical-resistant footwear was also protective against BuChE inhibition. Handlers who did not wear chemical-resistant footwear had an average of 11.4% greater BuChE inhibition (P=0.041), and an estimated 7.6-fold increased risk of BuChE depression. Relative to handlers who wore nitrile gloves alone, those who wore nitrile gloves with cloth gloves underneath had somewhat less BuChE inhibition, although this difference was not statistically significant (P=0.087). In terms of PPE storage, handlers who reported storing PPE in a locker at work had less BuChE inhibition than handlers who did not use lockers. On average, handlers who did not use lockers for PPE storage had 7.6% greater BuChE inhibition, and were 5.8 times as likely to experience BuChE depression as handlers who did use lockers[13].

4 Conclussion

Based on the result, it was found that the blood cholinesterase levels among agricultural workers was normal, but it have high risk of pesticides poisoning. The factor that most influenced to decreasing the farmer's blood cholinesterase levels was the mixing activiy (p value=0,19). The contribution of

length of work, age, smoking habit, frequency of spraying and mixing factors to decreasing the blood cholinesterase levels is 50,5% and 49,50% by other factors out of this research.

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