The Influence of Age, Time off and Pesticides Exposure on Haemoglobin Levels on Vegetable Farmers in Landasan Ulin Utara Subdistrict Banjarbaru City

Herry Cahyadi[1], Achmad Rofi'i[2], Eko Suhartono[3], Husaini [4], Meitria Syahadatina Noor[5]

[1] Banjarbaru Health Office, Kalimantan Selatan, Indonesia, [2]Department of Surgery, Faculty of Medicine, Lambung Mangkurat University, [3] Department of Biochemistry, Faculty of Medicine, Lambung Mangkurat University, [4] Master of Public Health Sciences Study Program, Faculty of Medicine, Lambung Mangkurat University, [5] Department of Public Health, Faculty of Medicine, Lambung Mangkurat University

Abstract

Several estimates can occur in the status of blood haemoglobin levels, which can be rated lower or higher than average values. Some previous studies revealed several factors that can affect a person's Hb levels, such as age and level of exposure. Data from the Banjarbaru City Health Office states that 2017 found farmers in Banjarbaru added to anaemia by 25% for the average age of 47 to 67 years. Meanwhile, the average cholinesterase level was 8.36 U / L. In the data it was also found that polycythemia was 13.33% with an average of 48 to 75 years, whereas the average cholinesterase level was 9.33 U / L. This study aim to analyze age, time off and pesticide exposure to hemoglobin levels in vegetable farmers in the Landasan Ulin Utara Sub-District, Banjarbaru City. This type of research is observational analytic with cross-sectional study design. The population in this study were vegetable farmers who used pesticides in the area of Landasan Ulin Utara Sub-District with a sample of 51 people. Based on the results of research related to age and exposure to pesticides or the levels of Acetyl Cholinesterase (AchE) to Hb levels of vegetable farmers in the Landasan Ulin Utara Sub-District, Banjarbaru City. Cholinesterase levels are the most dominant factor.

Keywords*: haemoglobin, age, time off, pesticide, vegetable farmer, acetylcholinesterase*

Introduction

Haemoglobin has two essential roles in the human body, namely the transport of oxygen throughout the body's tissues with red blood cells from respiration organs to peripheral tissues and transport of carbon dioxide from peripheral tissues to respiration organs which are then excreted out.[1]

Several trends can occur in the status of blood haemoglobin levels whose values can be lower or higher than average values. Some previous studies revealed that age factors also influence a person's haemoglobin (Hb) levels. Adult farmers have a greater risk of chronic effects for anaemia due to inadequate oxygen supply and decreased physical ability and decreased endurance.[2] The older a person, the lower of Hb level. The increasing age accompanied by a decrease in health status. There will also be a decrease in lung function which can make it easier for harmful substances to enter through the respiratory system and will be able to enter the lung tissue which then enters the blood vessels that affect the blood levels haemoglobin.[3] The high physical activity but not accompanied sufficient rest can increase a metabolic as well as a decrease in pH, where pH is low will reduce the attractiveness between oxygen and haemoglobin.[4]

Another factor that influences the haemoglobin level of the vegetable farmer is the level of pesticides exposure. The exposure to pesticides could cause the incidence of anaemia in horticultural farmers in Gombong Village, Belik District, Pemalang District, Central Java.[5] The exposure to pesticides in Thailand caused farmers as much as 62% to experience Hb levels.[6]

Data from the Banjarbaru City Health Office states that in 2017, farmers in Banjarbaru found anaemia as much as 25% for the average age of 47 to 67 years. Meanwhile, the average cholesterol level was 8.36 U/L. The data also found 13.33% polycythemia with an average age of 48 to 75 years, while the average cholinesterase level was 9.33 U/L. In the age group of known disorders due to exposure to pesticides haemoglobin form of anaemia was 43.28% from 25% and28% polycythemia findings of 13.33%.[7]

The findings of anaemia and polycythemia in vegetable farmers in the Banjarbaru area most (55.6%) belong to the category of old vegetable farmers, namely between 40 to 67 years of work rest without a procedural schedule.[7] Banjarbaru is one of the cities that has the most significant number of vegetable production in South Kalimantan, which, in its management, uses pesticides.[8] Therefore, this study will reveal the extent of the influence of age, time off and exposure to pesticides on haemoglobin level in vegetable farmers in the Landasan Ulin Utara Subdistrict, Banjarbaru City.

Materials and Method

The type of this research is observational analytic with a cross-sectional design. Population in this study were vegetable farmers who use pesticides that are in the region of Landasan Ulin Utara Subdistrict. This village has the most number of farmers from all villages in Liang Anggang District and even from all villages in Banjarbaru City, which is equal to 80 vegetable farmers. The number of samples is calculated using the formula Lameshow (1997), which is 51 people.

Findings and Discussion

Table 1. Bivariate Analysis The Influence of Age, Time Off, Cholinesterase and Haemoglobin Levels of Vegetable Farmer in Landasan Ulin Utara Subdistrict, Banjarbaru City

Dependent variable	Independent variable	p-value	β	R2
Haemoglobin level	Age	0.034	- 0.274	0.075
	Time off	0.571	0.075	0.06
	Acetylcholinestrase (AchE)	0.002	0.396	0.157

The Influence of Age on Haemoglobin

Based on the results that the p-value of 0.034 (p-value <0.05, which means that there is the influence of age on Hb). The value of β = -0.274, which means that the more age, the lower Hb level will be. The strength of the influence of age on haemoglobin levels of haemoglobin. The value of R^2 = 7.5%, which means that age affects Hb levels of 7.5%, the remaining 92.5% is influenced by other factors.

In general, the older a person is, the lower the Hb level. With increasing age and decreasing health status, there is a decrease in the function of various organs, including lung function. Decreased lung function makes it easy to organophosphate entering through the respiratory system will be able to enter into the lung tissue further into the blood vessels and affects the haemoglobin concentration in the blood.[3]

At old age, there is a change in the blood which is a decrease in the Total Body Water so that the blood volume decreases and the number of red blood cells (Haemoglobin and Haematocrit) decreases.[3] There is a tendency for the older age of vegetable farmers, the lower the cholinesterase activity in their blood. Cholinesterase is a blood enzyme that is needed so that the nerve can function properly. When cholinesterase is bound, enzymes cannot carry out their duties in the body, especially continuing orders to certain muscles in the body, so that the muscles always move without being able to be controlled.[9]

Old-age farmers have cholinesterase activity which is relatively faster than the age of the respondent especially if it is affected by exposure or exposure to pesticides so

that it can aggravate the occurrence of poisoning.[10] A study conducted by Reddy PB and Jagdish Kanojia in 2012 in India where they found changes in haemoglobin levels, especially a decrease in these levels. The level of haemoglobin is because pesticides reduce production or increase the destruction of red blood cells. It makes the formation of methemoglobin in red blood cells, causing haemoglobin to become abnormal and unable to carry out its function in delivering oxygen.[11]

The Influence of Time Off on Haemoglobin

The results show that p-value is 0.571 (p-value> 0.05, there is no influence of time off on Hb levels). B value = 0.075, which means that the longer the rest period, the higher the Hb level of a person. The strength of the influence of time off is very weak against Hb levels. The value of R^2 = 0.6%, which means a break affecting haemoglobin level of 0.6%, the remaining 99.4% is influenced by other factors. It means that statistically, there is no significant relationship between work breaks and impaired haemoglobin levels in vegetable farmers.

Break time does not affect the haemoglobin level because the use of pesticides in a short time can cause poisoning to farmers. Symptoms of chronic organophosphate poisoning arise from inhibition of cholinesterase and will persist for 2 - 6 weeks, resembling mild acute poisoning. However, if exposed again in small amounts, severe symptoms can arise. For carbamate groups, cholinesterase bonds will be temporary and will be re-released in a few hours (reversible), so that chronic poisoning will not arise.[12]

Farmers' time off from spraying using pesticides is a time estimated that the cholinesterase level would return to normal to 7 days after spraying and no later than 14 days later the cholinesterase level is estimated to increase.[13] If farmers stop using pesticides for a long time, then poisoning due to pesticides will disappear by itself, because the pesticide bonds in the blood will be re-released.

The results of this study are that there is no influence on Hb levels because when taking blood, farmers are not in the period of spraying pesticides so that exposure or exposure to pesticides decreases. As is known that vegetable farmers exposed to anticholinesterase pesticides from the organophosphate group can be repaired. Organophosphate group pesticides can reduce cholinesterase levels in blood serum and erythrocytes. Cholinesterase activity can recover in two weeks without working (spraying) in 1-2 weeks.[14]

The symptoms of organophosphate and carbamate pesticide poisoning usually occur after 4 hours of contact but can occur after 12 hours. The result of the farmer in the village Tejosari shows that the average - average respondent spraying for 2 hours and as much as 76 respondents (97.4%) spraying <4 hours in every practice spraying.[15]

Based on the provisions stipulated in Permenaker No.Per-03/Men/1986 article 2 paragraph 2a states that in order to maintain unwanted effects, it is recommended that it does not exceed four hours per day in a week in a row when using pesticides. Workers who manage pesticides should not experience exposure more than 5 hours a day and 30 hours a week. While WHO (1996) stipulates the length of spraying of pesticide exposure when working for 5-6 hours per day and every week health tests must be carried out, including blood cholinesterase levels.[16,17] So it can be said that the more often someone works, the more likely it is to be exposed to pesticides and pesticide poisoning.

Work scheduling and work breaks are work patterns that usually exceed conventional working hours, which are 8 hours a day. Jobs that exceed 8 hours are more at risk for health problems than workers with regular rest periods.[8]

The influence of Acetylcholinesterase (AChE) on Haemoglobin

It was found that the p-value was 0.002 (p-value <0.05, there was an influence of AchE level on Hb levels). B value = 0.396, which means that the higher the AchE level, the higher the Hb level of a person. The value of R^2 = 15.7%, which means that the AchE level affects the Hb level by 15.7% has a weak influence; other factors influence the remaining 84.3%. It means there is a statistically significant relationship between exposure to pesticides and the incidence of anaemia in vegetable farmers.

Exposure to pesticides can cause a decrease in oxygen in the tissues. It reduced oxygen being inhaled so that the production of haemoglobin will increase. Every situation that causes a decrease in the transport of the amount of oxygen to the tissue will usually increase the speed of production of red blood cells as compensation for the amount of oxygen transported to the tissues is lacking, the production of red blood cells increases.[11]

The farmer that poisoned by pesticide can be seen by reduced levels cholinesterase in the blood. The cholinesterase will bind class of organophosphate pesticides.[16] The reaction between organophosphate and cholinesterase is called phosphorylase. In the condition of AchE, phosphorylase can no longer be hydrolyzed, which results in AchE buried in receptor sites.[18]

The Influence of Age, Time Off, Cholinesterase and Haemoglobin Levels of Vegetable Farmers in the Landasan Ulin Utara Subdistrict, Banjarbaru City

Table 2. Multivariate Analysis

Variable	Coefficient of regression	Sig.	R2
Age	-0.270	0.036	0.222
Time off	-0.059	0.644	
AchE	0.385	0.002	

The results showed that the three independent variables, namely age, time off and AchE levels had an influence on overall Hb levels but the value was only 22.2% while 77.8% was influenced by other factors. Based on the three variables that measured the value of β greatest is 0.385 which levels of AChE means that pesticide poisoning effect on haemoglobin levels where the higher levels of cholinesterase of a person, the higher the haemoglobin level.

Farmers who are poisoned by pesticides are characterised by decreased levels of cholinesterase in the blood because cholinesterase will bind to organophosphate pesticides.[16] Increasing age and declining health status, then a decline in the function of various organs, including lung function. Decreased lung function makes it easy to organophosphate entering through the respiratory tract system will be able to enter into the lung tissue further into the blood vessels and affects the haemoglobin concentration in the blood.[3]

The older the age of the farmer, the more likely direct contact with pesticides.[10] There is a tendency for the older age of vegetable farmers, the lower the cholinesterase activity in their blood. Older farmers have a relatively faster cholinesterase activity compared to younger age respondents, especially if it is influenced by exposure or exposure to pesticides so that it can aggravate poisoning.

Symptoms of organophosphate and carbamate pesticide poisoning usually occur after 4 hours of contact, but can occur after 12 hours. So that the break does not affect the Hb level. Besides, farmers who stop using pesticides for a long time, then poisoning due to pesticides will disappear by itself, because the pesticide bonds in the blood will be rereleased.[15]

Low levels of poisoning in vegetable farmers can occur because, at the time of blood collection, farmers are not in the period of spraying pesticides so that exposure to pesticides decreases. As is known that vegetable farmers exposed to anticholinesterase pesticides from the organophosphate group can be repaired. Organophosphate group pesticides can reduce cholinesterase levels in blood serum and erythrocytes. Cholinesterase activity can recover in two weeks without working (spraying) in 1-2 weeks.[14]

Therefore, repairs can occur if the sprayer is rested for several weeks so that the body can synthesise the cholinesterase enzyme again so that its activity returns to rise. Cholinesterase in plasma takes weeks to return to normal, while in red blood cells, it takes 2 weeks.[13]

Conclusion

There is an influence of age on the haemoglobin of vegetable farmer in the Landasan Ulin Utara Banjarbaru. There was no effect of time off on Hb levels of vegetable farmers in the Landasan Ulin Utara Banjarbaru City. There is an influence of pesticide exposure or AchE level on Hb levels of vegetable farmers Landasan Ulin Utara Banjarbaru City. Pesticide exposure Levels of cholinesterase were the most dominant factor influencing for Hb levels of vegetable farmers in the Landasan Ulin Utara Banjarbaru City.

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

Source Funding: This study was done by self-funding from the authors.

Conflict of Interest

The authors declare that they have no conflict interests.

References

[1] Murray RK, Granner DK, Rodwell VW. *Biochemistry Harper 25th Edition.* Jakarta: Medical Book Publishers EGC. 2003.

[2] Arwin NM, Suyud. Pesticide Exposure and Anemia Occurrence in Horticultural Farmers in Cikajang District, Garut Regency in 2016. *Public Medicine News*, 2016. 32 (7): 245-250.

[3] Rizkiawati A. Factors related to hemoglobin levels in the blood of pedicab drivers at Mranggen Market Demak. *Journal of Public Health,* 2016; 1 (2): 663-669

[4] Laura K., Fadil O., Amel Y. Relation of Physical Activity to Hemoglobin Levels in Students of Pandekar UKM of Andalas University. *Andalas Health Journal* 2013; 3 (2): 178-181

[5] Kurniasih SA, Onny S, Sri AN. Factors Related to Pesticide Exposure and Its Relationship to Anemia in Horticultural Farmers in Gombong Village, Belik District, Pemalang District, Central Java. *Indonesian Environmental Health Journal*, 2013; 12 (2): 132-137.

[6] Aroonvilairat S, Wannapa K, Thiwaree S, Papada C, Taweeratana S, Kavi R. Effect of Pesticide Exposure on Immunological, Hematological and Biochemical Parameters in Thai Orchid Farmers - A Cross Sectional Study. *Int J Environ Res Public Health*, 2015; 12 (6): 5846-5861.

[7] Banjarbaru City Health Office. *Banjarbaru K3 & Environmental Health Program Annual Report*. Banjarbaru City Health Office. 2017.

[8] Central Bureau of Statistics. Percentage of population aged 15 years and over by type of work, 2009-2011.

[9] Panut J. *Pesticides and their applications*. Jakarta: PT. Agromedia Library. 1992.

[10] Isnawan, RM. Factors Related to Pesticide Poisoning in Red Onion Farmers in Kedunguter Village, Brebes District, Brebes Regency. *Journal of Public Health*, 2013; 2 (1) : 1-11.

[11] Rangan AA, Siantan S, Joice NE. Hemoglobin Levels in Pesticide Exposed Farmers in Rurukan Sub-District, East Tomohon District . *Journal of e-Biomedicine*, 2014; 2 (1): 1-7.

[12] Sartono. *Poison and poisoning* . Jakarta: Widya Medika. 2001.

[13] Rustia HN, Bambang W, Dewi S, Fitra N, Luthfiah. Organophosphate Exposure Time to Decrease in Cholinesterase Enzyme Activity in Vegetable Farmers' Blood. *Makara Kesehatan* 2010; 14 (2): 95-101.

[14] Raini M, Dwiprahasto I, Sukasediati N. Effect of rest on Cholinesterase activity of farmers spraying organophosphate pesticides in Pacet District, West Java. *Health Research Bulletin* 2004; 32 (3): 105–111 .

[15] Prabu. *Cholinesterase Inhibiting Pesticides* . Available from: http: // putraprabu. wordpress.com/2008/10/27/pestisida-penghambat-kholisterase/, accessed June 1, 2019.

[16] WHO. *Organophosphorus Insectisides: A General Introduction to Environmental Health Criteria* . Geneva: WHO. 1986.

[17] Department of Manpower. *Permenaker No. Per-03/Men/1986 concerning Occupational Safety and Health at Workplaces that Manage Pesticides*. Depok: Leskofi (Institute for Pharmacology Study and Consultation); 2009.

[18] Sugiartoto A, Lolit, Warsono. *Pesticides are Dangerous to Health*. Solo: Duta Awam Foundation. 1999.