discontinue 30/10 2020 . [signature]

IJICC_INTERNASIONAL

by Yusrizal Yusrizal

Submission date: 18-Aug-2022 12:56PM (UTC+0700)
Submission ID: 1883838263
File name: JURNAL_IJICC_INTERNASIONAL.pdf (428.7K)
Word count: 5295
Character count: 30395

International Journal of Innovation, Creativity and Change. www.ijicc.net
Special Edition: Safe Communities, 2020

Content Overview of Workers *Cholinesterase* Enzyme at PT. Great Giant Pineapple Plantation, Kabupaten East Lampung

Yusrizal[a], **Eka Sulistyaningsih**[b], [a,b] Health Analyst, Poltekkes Kemenkes Tanjung Karang, Sumatera, Indonesia, Email: [a]yusrizal chaniago08@gmail.com

Blood *cholinesterase* levels are the number of active *cholinesterase* enzymes in blood plasma and red blood cells. Early detection of pesticide poisoning is achieved by checking the *cholinesterase* enzyme in the blood. The purpose of this study was to determine the description of the level of the enzyme *cholinesterase* in plantation workers of PT. Great Giant Pineapple, East Lampung Regency and to find out the percentages by sex and age of workers. This study design was cross-sectional with a sample of 599 workers. The variable of this study is the level of the *cholinesterase* enzyme. Measuring instruments of this study are secondary data from blood tests and secondary data related to age and sex. The results of this study found that the number who took the examination was 599 workers. The frequency distribution of the *cholinesterase* enzyme was 4 workers (5.6%) for the low *cholinesterase* enzyme activity category while 595 workers (94.4%) were for the normal *cholinesterase* enzyme activity category. Pesticides are the last choice used after the method of 'back to nature' was proclaimed by the Ministry of Health in 2000, which is to maintain predatory animals in pest control, then the management has also to conduct periodic checks related to the level of the enzyme *cholinesterase* to workers associated with the use of pesticides. As for the affected workers, immediate further treatment is provided by the company's integrated clinic.

Keywords: *Cholinesterase* Enzyme Levels, Pesticides

Introduction

Blood *cholinesterase* levels are the number of active *cholinesterase* enzymes in blood plasma and red blood cells that play a role in maintaining the balance of the nervous system. These

[4] blood *cholinesterase* levels can be used as an indicator of pesticide poisoning. Early detection of pesticide poisoning by *cholinesterase* examination is carried out to prevent the onset of chronic and deadly health problems (Entianopa & Santoso, 2016).

Enzyme inhibition process *asetikolinesterase* (ACHe), which is the basis of the pesticide, is a substance that is needed by our nervous system to function normally. Pesticides that enter the body will act as inhibitors in the action of ACHe. Normally *neutransmitterasolinolin* (Ach) is released at *synapses*. Once the impulse nerve is distributed, Ach is released in hydrolysis by ACHe as *acetic acid* and *choline* in that place. When exposed to pesticides, ACHe is inhibited so that the Ach accumulates. Ach is accumulated in the central nervous system and will induce tremors, uncoordination, convulsions and even death in humans (Prasetya, 2010).
Based on several studies in 2008 in Ngawi District, the results of blood *cholinesterase* examination were obtained on 320 spraying farmers with the result of severe exposure to 52% and moderate exposure, 7% (Entianopa & Santoso, 2016). Then in the Campang Village, Tanggamus District, Tanggamus Regency, Lampung, a study was conducted by Rustia (2009) about the level of *cholinesterase* in farmers, which showed a 71.4%. decrease.

In a study in B[27]ng Ponorogo District, Ponorogo Regency, 90.0% of farmers experienced mild poisoning and there was a connection between the description of the spraying method and the level of the *cholinesterase* enzyme. Then based on the results of research in Pesi[22] Timur District, Bolaang Mangodow Regency (Raini, 2012), the pesticide user farmers found that there was a significant relationship between the level of *cholinesterase* with the use of self-protection equipment, with 20% of respondents who had abnormal levels of *cholinesterase* were not using complete personal protective equipment daily (Raini, 2007).

Based on Budiawan (2013), in Semaran[32] was stated that Low *Cholinesterase* Risk Factors in Farmers is a relationship between frequency of spraying, use of personal protective equipment, health status, attitudes and knowledge with levels of the enzyme *cholinesterase*, and there is no relationship between the duration of spraying and personal hygiene in farmers with *cholinesterase* enzyme levels.

Based on the results of a survey on[23] Great Giant Pineapple in East Lampung, pesticides are used to control pests in fruit plants. Based on the description above, it is necessary to do further research on the Description of *Cholinesterase* Enzyme Levels in Workers in PT Great Giant Pineapple Plantations.

Literature Review

Cholinesterase

Understanding *Cholinesterase*

Acetylcholinesterase of *cholinesterase* (ChE) is an enzyme that functions to hydrolyse *Acetylcholine. Cholinesterase* or also called enzyme *Acetylcholinesterase* is an enzyme found in nerve terminal cell membranes as *cholinergic* as well as other membranes, such as in blood plasma, placental cells that function as catalysts to hydrolyse *Acetylcholine* into *choline* and acetate (Marselina, 2011).

Acetylcholine is an agent found in the nerve endings fraction of the nervous system that will inhibit the spread of impulses from neurons postganglionic. *Acetylcholine* is a nerve stimulant (*neurotransmitter*) that is synthesised in the ends of motor nerve fibres through the process of *acetylacillin* extracellular and *coenzymes* that require the enzyme *acetyltransferase. Acetylcholine* is stored in a bag or storehouse called *vesicles. Neurotransmitters* are chemical messengers that carry electrical information from one neuron to other neurons (effector cells) (Abdilah, 2013).

Acetylcholine produced by nerve endings (axons) that have received impulses is transmitted to other nerve cells or effectors (eg muscles) to pass on as nerve impulses. However, before the second impulse can be emitted through synapses, *acetylcholine* produced after the first impulse must be hydrolysed by *acetylcholinesterase* at nerve cell connections. The decomposition products *acetylcholine* by *acetylcholinesterase* are acetate and choline and do not have transmitter levels (Marselina, 2011; Tawakkalni et al., 2019).

Cholinesterase is synthesised in the liver, and is contained in synapses, blood plasma, and red blood cells. There are at least 3 main types of *cholinesterase*, namely the enzyme *cholinesterase* found in synapses, *cholinesterase* in plasma, and *cholinesterase* in red blood cells. *Cholinesterase* red blood cell is an enzyme found in the nervous system, whereas *cholinesterase* plasma is produced in the liver. *Cholinesterase* in the blood is generally used as a parameter for pesticide poisoning because this method is easier than measuring *cholinesterase* in synapses (Abdilah, 2013).

Types of *Cholinesterase*

There are two types of *cholinesterase* in the body, namely *cholinesterase* I or *cholinesterase* true and *cholinesterase* II or *pseudocholinesterase.* This second enzyme is also referred to as *acetylcholine* acyl hydrolase or *benzoylcholinesterase*. This enzyme is found in red blood cells, lungs, nerve endings, motor plates in the connection of skeletal muscle nerves, spleen, and grey matter from the brain. In the body, this enzyme quickly breaks down *acetylcholine* into acetate and choline. This process is very important in the delivery of nerve impulses through nerve connections or synapses. *Cholinesterase* II is found in the liver, heart, pancreas, white substance of the brain and serum. Although the function of this enzyme in physiology is unknown, the measurement of this enzyme is clinically useful. It is a little difficult to distinguish between these two types of *cholinesterase* because they both can hydrolyse the substrate synthesis of *acetylcholine* bromide into acetate ions (Supriatna,Ade, 2002).

These two enzymes are also equally competitively inhibited by *prostigminalkaloids* and *physostigmine*. Both alkaloids, like *acetylcholine*, have quaternary amino acids. In addition, these two enzymes both require serine-OH groups in their catalytic sites in order to function, because they belong to serine hydrolases. As a result, both can be inhibited by phosphorylation of this group by using organic phosphate compounds such as DPFP (*diisopropyl fluorophosphate*). In addition, the same various inhibiting compounds can inhibit the levels of these two enzymes (Kesumaningtyas, Soebagyo, & Harsono, 2020; Supriatna, Ade, 2002).

Kadar *Cholinesterase* in serum

Levels of *cholinesterase* in serum are often called *pseudocholinesterase* (CHS), to distinguish it from *Acetylcholinesterase* (AcCHS) "true", found in dieritosit and nerve endings. *Acetylcholine* is a transmitter that is released in the endplate of motor neurons by electrical impulses that travel from nerve endings to the muscles. *Acetylcholine* diffuses from the muscle nerve endings and causes electrical depolarisation of the cells, followed by contraction of the muscles. *Acetylcholine* is then quickly broken down into acetate and choline by AcCHS in the post synapse to stop the process. Failure to activate *acetylcholine* causes muscle paralysis (Sacher,R.A, 2004).

Serum *pseudocholinesterase* (CHS) is synthesised in *hepatocytes*. AcCHS and CHS are different enzymes, which can be identified in the laboratory based on their catalytic properties. AcCHS has a narrow range of substrate specificity, while CHS is able to work on a variety of *choline esters*. In addition, active AcCHS is optimum at low concentrations of *acetylcholine* and is inhibited by high concentrations, while CHS is active at high or low substrate concentrations. Both AcCHS and CHS are inhibited by *organophosphate* compounds such as insecticides commonly used in agriculture (Sacher,R.A, 2004).

Examination of *Cholinesterase* enzymes

The measurement of this enzyme is a sensitive clue to see liver function. If there is a decrease in serum levels (not an increase), this is an indication of a decrease in liver function, especially the synthesis function. There are several methods in the examination of *cholinesterase*, namely:

a) Examination of *cholinesterase* with the tintometer kit working principle is the testing of blood containing the enzyme *cholinesterase* of liberating acetic acid *acetylcholine* so that it will change the pH of the solution (mixture) of blood and indicators.

b) Examination of *Cholinesterase* with a photometer
Methods used in the examination of *cholinesterase* enzyme is a photometric method. The principle of a photometer is a device used to measure the level of absorption of light energy by a chemical system as a function of wavelength. Inside the tool there are programs, wavelengths, and factors for each type of examination, so the tool will measure the sample according to the type of examination. Samples that have been added to the reagent are aspirated by a special pipe. The testing process is done semi-automatically and the readings are converted to the final quantitative results (Gandasoebrata, 2001).

Principle of checking *cholinesterase*

Cholinesterase (CHE) catalyses the *hydrolysis* and *butyricyltiocolin* to *thiocolin* to *butyric acid*. Concentrations of *tiokolin* and *butyric acid* are determined from measurements of the amount of *hexacyanoferrate* (III) at a wavelength of 405 nm.

Butyryl-tiokolin + H2O CHE ⟶ tiokolin + butyric acid
2tiokolin + 2OH + 2 heksasiano ⟶ feratdithiobis (choline) + 2 heksasianoferat

Effects of levels of *Cholinesterase* on Farmers

Excessive and uncontrolled use of pesticides often presents a risk of pesticide poisoning for farmers. The risk of pesticide poisoning is due to the use of pesticides on agricultural land, especially vegetables and fruits. The World Health Organisation (WHO) estimates that every year 1-5 million cases of pesticide poisoning occur in agricultural workers, with a death rate reaching 220,000. Approximately 80% of poisoning is reported to occur in developing countries (Mariana Raini, 2004).

Especially dangerous are pesticides affecting enzymes in the blood that function to regulate the nerves, namely *cholinesterase*. *Cholinesterase* is a blood enzyme that is needed for nerves to function properly. When a person is poisoned by pesticides, the level of *cholinesterase* will drop.

When *cholinesterase* is bound, enzymes cannot carry out their duties in the body, especially forwarding commands to certain muscles in the body, so that the muscles are constantly moving out of control (Mariana Raini, 2004). With exposure at low doses, signs, and symptoms are generally associated with the stimulation of muscarinic peripheral receptors. Greater doses also affect nicotinic receptors and central muscarinic receptors. This level will then decrease – within 2-4 weeks in plasma and 4 weeks to several months for erythrocytes. According to the World Health Organisation (WHO), a reduction in levels of *cholinesterase* by 30% from normal has been declared as poisoning. Whereas the State of California stipulates a decrease in *cholinesterase* levels in red blood grains by 30%, and 40% in the plasma as poisoning.

Pesticides

Definition of Pesticides

Pesticides are chemicals or natural ingredients that can reduce pest populations, especially by killing pest organisms, such as insects, diseases, weeds or animals (MB Colovic, 2013).

The definition of pesticides in the Ministry of Agriculture in 2011 and Permenkes RI No.258/Menkes/Per/III/1992 are all chemicals and other materials as well as microorganisms and viruses used to:

1. Control or prevent pests and diseases that damage crops, parts of plants or agricultural products.
2. Grass control.
3. Regulate or stimulate unwanted growth.
4. Control of external pests in pets.
5. Control/ prevent water pests.
6. Control of animals and microorganisms in household buildings, transportation equipment, and agricultural equipment.
7. Control of animals that can cause disease.
8. According to (PP No 6, 1995) in (Soemirat, 2003), pesticides are also defined as substances or chemical compounds, body regulatory substances and body stimulants, other materials, as well as microorganisms or viruses that are used for plant protection.

Pesticides Group

According to the target organism pesticides can be classified as follows:

a. Insecticides function to kill or control
b. Herbicides function to kill weeds
c. Fungicides function to kill fungi or algae
d. Algasida function to kill algae
e. Avisida function to kill birds and control the bird population
f. Akarisida function to kill mites
g. Bactericide used to kill or fight bacterial
h. Larvicides used to kill the larva
i. Moluskasida used to kill snails

j. Nematisida used to kill worms
k. Ovicidal serves to kill eggs
l. Pedikulisida function to kill lice or fleas
m. Piscisida function to kill fish
n. Rodenticide used to kill rodents
o. Predisida used to kill predators or predators
p. Thermicidefunction to kill termites (Pawitra, 2012; Soemirat, 2003).

Based on chemical elements

Based on the structure or chemical group, pesticides can be managed in 2 (two) groups:

a) Pesticides, organic chemical compounds containing chlorine (organochlorine group). Organochlorine pesticides are generally stomach poisons and effective contact poisons against larvae and adult insects. The danger for humans is especially absorption through the skin and there is an accumulation in the body. Organochlorine pesticide poisoning can be through inhalation by mouth and skin. Organochlorine pesticides include halo-benzene derivatives and analogues, benzene hexachloride, toxaphene.
b) Organic chemical pesticides that work as *cholinesterase* inhibitors or called *cholinesterase* inhibitors.
   Cholinesterase inhibitor pesticides generally used in agriculture to reduce or control soft-bodied insects consist of organophosphate groups and carbamate groups (Sartono, 2002).

Organophosphate Groups

According to (Sartono, 2002) organophosphate groups are increasingly being used because of their profitable nature. The workings of this group are selective, not persistent in soil, and can kill insects that interfere. It works as a contact poison, stomach poison, and also respiratory poison. With a low dose it has a satisfying effect, in addition to working quickly and easily decomposes. Organophosphate group works by inhibiting the level of the enzyme *cholinesterase*, so that *Acetylcholine* is not hydrolysed. Therefore, organophosphate pesticide poisoning is caused by excessive *Acetylcholine*, resulting in the continuous stimulation of muscarinic and nicotinic nerves. Poisoning can occur through the mouth, inhalation, and skin.

The clinical symptoms of organophosphate pesticide poisoning are in:

1. Eyes; pupils shrink and blurred vision.
2. Fluid removal; increased perspiration, *lakrimasi*, *salvias*, and *sekresi, bronchial.*
3. Digestive tract; nausea, vomiting, diarrhea, and abdominal pain.
4. Airway; coughing, sneezing, and choking.
5. Cardiovascular; bradycardia and hypotension.
6. Central nervous system; headache, confused.
7. Weak muscles, *fasciculation*, and cramps.

8. Complications that can occur include pulmonary oedema, breathing stops *atrioventricular blockade*, and *convulsions*.

Carbamate Group

Carbamate group pesticide is a contact poison, stomach poison, and respiratory poison. Works like the organophosphate group, which inhibits *cholinesterase* enzyme levels. If poisoning is caused by carbamate pesticides, the symptoms are the same as organophosphate pesticides, but it is more sudden and not longer. Although the symptoms of poisoning quickly disappear, because of the sudden appearance and quick intensification it can be fatal if help is not immediately sought, caused by respiratory depression. Poisoning in humans can occur through the mouth, inhalation, and skin. The clinical symptoms are sweating, dizziness, the body feels weak, chest tightness, stomach cramps, vomiting, and other symptoms such as in organophosphate poisoning (Sartono, 2002).

Methods

Study Design and Data Collection

This study uses a descriptive qualitative design, a type of observational analytic study used because observation or data collection is done at the same time to find out the percentages (Budiarto, 2004). This study aims to determine sex, age, and *cholinesterase* enzyme levels (Low and Normal).

The Sampling Techniques

The method used in sampling is probability sampling (M Sopiyudin Dahlan, 2014); it means giving equal opportunity to all members of the population to be selected as samples. The sampling technique of this study used simple random sampling, which is the technique of taking members randomly from the population without regard to strata in the population (Sastroasmoro, 2011).

a. Criteria for Inclusion
   Workers on PT. Great Giant Pineapple
b. Exclusion Criteria
   Did not take part in a health check during the study.

Collection Techniques

Primary Data: This data was taken when conducting research in the field. Retrieval of data is done after the ethical requirements of writing have been met by gaining permission from the PT Great Giant Pineapple.

Secondary Data: Secondary data obtained from theories, journals, previous studies and profiles of PT Great Giant Pineapple and the results of Laboratory Examinations.

Data

The analysis was Univariate carried out to see the frequency distribution of dependent and independent variables (Riyanto, 2011) to obtain the percentage of sex, age, and *cholinesterase* enzyme levels (low, normal).

Results

Overview of Research Locations

Standing History

PT Great Giant Pineapple is a sister company of PT Sewu Segar Nusantara that produces quality fruits with the labels Sunpride and Sunfresh. Established since 1992 with its address on the Taman Nasional, Rajabasa Lama 1, Kecamatan Labuhan Ratu, Kabupaten East Lampung.

Its boundaries are as follows:
1. North borders: National Way Kambas Park and Rantau Jaya – Sukadana
2. South is bordered by Rajabasa Lama
   – Labuhan Ratu and (Way Mati, Jatipuro) Sukadana
3. East borders: Way Kambas with Cavendish Banana Plantation
4. West borders: Surabaya Udik – Sukadana

Univariate

The analysis used in this study is a univariate analysis performed on each variable. This data uses categorical data so that the data presentation uses only frequency distributions with a measure of the number and percentage or proportion which have been calculated previously. The results of each of these variables are displayed in tabular form *cholinesterase* enzyme activity, occupation, age and sex of plantation workers at PT. Great Giant Pineapple. The results of the study conducted on 599 respondents obtained the following results:

Based on table 3.1 the frequency distribution of *Cholinesterase* Enzyme Activity obtained results of 4 Workers (0.66%) for the low *cholinesterase* enzyme activity category, with 595 Workers (99.4%) for the normal *cholinesterase* enzyme activity category.

Based on table 4.2 it is known that workers aged > 40 years are 253 (42.3%), while workers of< 40 years of age are 346 (57.7%). Workers of male sex were 388 (64.8%) and women were 211 (35.2%).

Discussion

Cholesterase Enzyme Activity

Based on the results of this study it was found that workers with the result of a low *cholinesterase* enzyme examination were 4 workers from 599 workers. This is in line with, at the time of the pre-survey study at PT. Great Giant Pineapple, that the company had followed the SOP in the use of pesticides and carried out integrated supervision in terms of controlling the use of pesticides. Meanwhile, if there are still some violations that are detected and detected poisoning or the results of a periodic examination of the low *cholinesterase* enzyme, then it is followed up by giving periodic treatment and migrating temporarily to parts that are not in direct contact with pesticides.

This is in line with the journal (Adriyani, 2006), about efforts to control environmental pollution. The company uses back to nature farming system, which is the best system for preventing pesticide pollution, and using pesticides is the last choice as a way to control pests. Agriculture with this system is one of the solutions to reduce the use of pesticides in agriculture; ways to prevent and reduce pest attacks include regulating plant types and planting times, choosing varieties that are resistant to pests, utilising natural predators, using insect hormones, sterilisation.

Based on the Republic of Indonesia's Ministry of Agriculture Regulation on pesticides is the process of maintaining pesticides from starting pesticide registration permits with companies, including pesticide storage containers given dangerous labels, symptoms of poisoning, first aid in accidents (P3K), storage, instructions for use, pictograms, production numbers, months and production years (batch numbers), as well as months and years of expiration, are listed in the standard operating procedures manual of the company.

In the use of PPE (Personal Protective Equipment), workers must use personal protective equipment such as rubber gloves, aprons, work clothes (overalls), long-sleeved shirts and trousers, rubber boots, dust glasses, face shields, headgear, dust masks, and respirators.

The company uses natural predators, also known as biological control, by raising owls as rat and other insect pest predators (Koeswahyono, 2008). That is the form of the company in the planning for the use of pesticides. The company controls integrated pests by using the smallest amount of pesticides as needed. The most effective integrated pest control is achieved by seeing agriculture as a system with the main objective being to avoid developing resistance to insecticides and to minimise ecological disturbances of predators and parasites that prey on insect pests in agriculture (Alhifni & Ahwarumi, 2018). *Cholinesterase* enzyme examination is carried out from the company in accordance with the risk of worker exposure. The above is a form of pesticide control for workers.

The Ministry of Health of the Republic of Indonesia has regulations regarding the use of protective clothing for pesticide management, namely (Surat Keputusan Menteri Kesehatan, 2001). Concerning the management of pesticides in these regulations, among others, it is stated to protect the surface of the skin by using: shoes, long sleeves, long pants, hats, gloves on hands, face shields, and masks. Article 5 paragraphs (1) and (3) state that staff, technicians or operators must meet health requirements and in carrying out their duties must use safe protective equipment. But in practice, there is a lack of monitoring of the use of safe protective clothing for pesticide management in workers.

PT. Great Giant Pineapple has provided a Personal Protection Tool (PPE) in accordance with the (Surat Keputusan Menteri Kesehatan, 2001) and Agriculture Minister Regulation of the Republic of Indonesia (Permentan) no 39/Permentan/SR.330/7/2015 concerning pesticides. Workers who do not obey the regulations that have been set by the company regarding the use of PPE and do not take part in routine health checks in the handling of pesticides will be given a sanction or punishment from management in the form of a warning to stop. Workers who are detected with poisoning will be transferred to a place that is not in direct contact with pesticides and treatment is given by the integrated clinic of the company to overcome poisoning to workers.

Explanation of *Cholinesterase* Enzyme Levels Based on Gender

It is found that the number of male workers is 388, and women are 211 workers. The sexes of men and women have different normal rates of *cholinesterase* activity. Free *cholinesterase* levels in normal adult male plasma averaged around 4.4 µg / ml. Women on average have a higher blood cholesterol activity compared to men. However, it is not recommended that women come into direct contact with pesticides, because during pregnancy the average level of *cholinesterase* tends to fall (Afriyanto, 2008). Based on research (Wulandari & Santoso, 2020; zuraida, 2011) which states that there is no meaningful relationship between sex and pesticide poisoning levels, in this study four men were found to have low *cholinesterase* enzyme activity.

Explanation of *Cholinesterase* Enzyme Levels Based on Workers' Age

In this study, the number of workers aged > 40 years was 253, and <40 years were 346. In this study, there were 2 people aged > 40 years and 2 people < 40 years of low *cholinesterase* enzyme activity. There is no relationship between age and *cholinesterase* enzyme levels. This is because in the field of farmer activities both age categories > 40 or < 40 are not much different depending on the discipline of workers in following the SOP (Surat Keputusan Menteri Kesehatan, 2001).

Conclusion

Based on the results and discussion of research on the Overview of Cholesterase Enzyme Levels in PT. Great Giant Pineapple East Lampung Regency, it can be concluded that the explanation of the Frequency Distribution of *cholinesterase* enzyme activity is 4 Workers (0.7%) for the low *cholinesterase* enzyme activity category, while 68 Workers (99.3%) for the normal *cholinesterase* enzyme activity category. Explanation on the Frequency Distribution of workers based on male gender as many as 388 (64.8%), and female gender as many as 211 (35.2%). Explanation Frequency Distribution of workers by age is the worker's age > 40 years as many as 253 (42.3%) and < 40 years as many as 346 (57.7%). It is expected that Management at PT. Great Giant Pineapple, East Lampung Regency can maintain and improve the supervision of workers' discipline in controlling pests and the use of pesticides by workers so that there are no more low levels of the enzyme *cholinesterase* in workers, and maintain transfer (mutation) and treatment of workers who have low *cholinesterase* enzyme activity so that there is no increase in poisoning. Also conduct regular counselling about pesticides and briefings every morning before work to increase the knowledge of each worker about the limits of pesticides including the dangers of pesticides, how pesticides enter into the body and how to prevent pesticide poisoning.

Ethical Approval

This study was conducted after obtaining approval from the Health Research Ethics Committee of the Poltekkes Kemenkes Tanjung Karang. The aim is to ensure that the proposed research is ethically acceptable and that the welfare and rights of research participants are protected.

Figure 2.1. The mechanism of action of the enzyme *Acetylcholinesterase*
Source: (Mycek Mary J, Richard A, 2001)

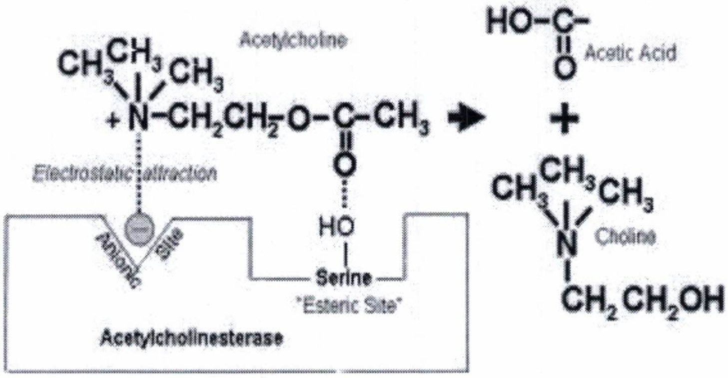

Figure 2.2 The release process of *neurotransmitters*
Source: (Mycek Mary J, Richard A, 2001)

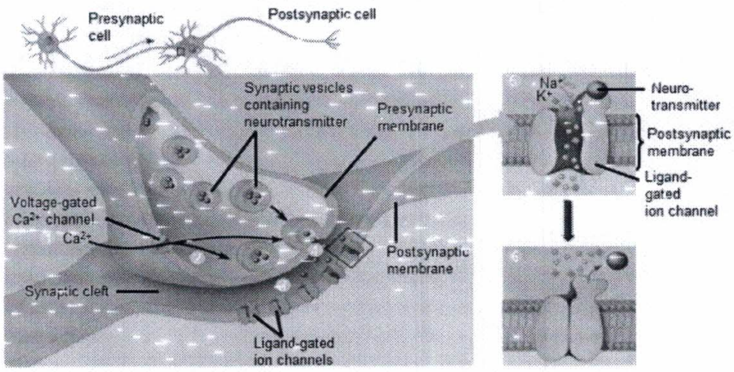

Table 2.1 Classification Levels Toxicity levels of *cholinesterase*

Blood % activity of AChE blood	Interpretation of
75% - 100% of the normal	No poisoning
50% - 75% of normal	Mild poisoning
25% - 50% of normal	Medium poisoning
0% - 25% of normal	heavy poisoning

Source: (Ikhsan, 2009)

Table 3.1. Frequency distribution of *Cholinesterase* Enzyme Activity in PT. Great Giant Pineapple East Lampung workers in 2019

Variable	Amount (n = 599)	Percentage (%)
Cholinesterase Enzyme Activity		
- Low	4	5.6%
- Normal	595	94.4%
Total	599	100%

Table 4.2. Frequency distribution of Age, Gender, workers PT. Great Giant Pineapple East Life in 2019

Variable	Amount (n = 599)	Percentage (%)
Age		
- > 40 years	253	42.3
- < 40 years	346	57.7
Gender		
- Male	388	64.8
- Female	211	35.2
Total	599	100.0

REFERENCES

Abdilah. (2013). Pemeriksaan kadar pestisida dalam darah petani. *IAIN Batu Sangkar*.

Adriyani, R. (2006). Usaha pengendalian pencemaran lingkungan akibat penggunaan pestisida pertanian. *Jurnal Kesehatan Lingkungan*, *3*(1).

Afriyanto. (2008). *Kajian Keracunan Pestisida Pada Petani Penyemprot Cabe Di Desa Candi Kecamatan Bandungan Kabupaten Semarang*.

Alhifni, A., & Ahwarumi, B. (2018). AGRICULTURE AND PLANTATION MANAGEMENT TO SUPPORT THE EMPOWERMENT OF RURAL ISLAMIC BOARDING SCHOOL (CASE STUDY IN ISLAMIC BOARDING SCHOOL ABDUSSALAM). *JURNAL SYARIKAH : JURNAL EKONOMI ISLAM*, Vol. 4. https://doi.org/10.30997/jsei.v4i1.1220

Budiarto, E. (2004). *Metodelogi Penelitian Kedokteran*. Jakrta: EGC.

Budiawan, A. R. (2013). Faktor risiko Cholinesterase rendah pada petani bawang merah. *KEMAS: Jurnal Kesehatan Masyarakat*, *8*(2).

Entianopa, E., & Santoso, E. (2016). Faktor Yang Berhubungan Dengan Paparan Pestisida Pada Pekerja Chemis (Penyemprotan). *Jurnal Endurance*, *1*(2), 88–93. https://doi.org/10.22216/jen.v1i2.985

Gandasoebrata, R. (2001). *Penuntun Laboratorium Klinik edisi ke-13, Jakarta: Dian Rakyat Harikushartono, Hidayah N, Darmowandowo W, Soegijanto S, Demam Berdarah Dengue: Ilmu Penyakit Anak, Diagnosa dan Penatalaksanaan*. Jakarta: Penerbit Salemba Medika.

Ikhsan, M. (2009). Pemeriksaan Glukosa Darah Enzimatik. *Teknoogi Laboratorium*.

Kesumaningtyas, C., Soebagyo, B., & Harsono, G. (2020). Faktor Risiko Peningkatan Kadar Enzim Alanine Aminotransferase dan Aspartate Aminotransferase pada Human Immunodeficiency Virus Anak dalam Terapi Kombinasi Antiretroviral Lini Pertama. *Sari Pediatri*, Vol. 21, p. 236. https://doi.org/10.14238/sp21.4.2019.236-40

Koeswahyono, I. (2008). PENYELESAIAN PERSOALAN TANAH PERKEBUNAN DALAM PERSPEKTIF SOCIO LEGAL (STUDI PADA BEBERAPA PERKEBUNAN DI JAWA TIMUR). *Jurnal Hukum & Pembangunan*, Vol. 38, p. 525. https://doi.org/10.21143/jhp.vol38.no4.181

M Sopiyudin Dahlan. (2014). *Statistik Kedokteran*. Jakarta: Salemba Medica.

Mariana Raini. (2004). Pengaruh Istirahat terhadap Aktivitas Kolinesterase Petani. *Litbang.Depkes*, *32*.

Marselina. (2011). Lama pajanan organofosfat terhadap penurunan aktivitas enzim kolinesterase. *Universitas Indonesia*.

MB Colovic. (2013). Acetylcholinesterase Inhibitors : Pharmachology and Toxicology. *NCBI.*

Mycek Mary J, Richard A, H. (2001). *FARMAKOLOGI ULASAN BERGAMBAR EDISI 2.* Jakarta: Widya Medika.

Pawitra, A. S. (2012). PEMAKAIAN PESTISIDA KIMIA TERHADAP KADAR ENZIM CHOLINESTERASE DAN RESIDU PESTISIDA DALAM TANAH. *Jurnal Ilmiah Kesehatan Media Husada*, Vol. 1, pp. 19–30. https://doi.org/10.33475/jikmh.v1i1.59

Prasetya. (2010). Hubungan Antara Masa Kerja dan Arah Angin Terhadap Keracunan. *Universitas Samratulangi.*

Raini. (2007). Faktor yang berhubungan dengan paparan pestisida. *Kopertis.*

Raini, M. (2012). Toksikologi Pestisida Dan Penanganan Akibat Keracunan Pestisida. *Media of Health Research and Development*, *17*(3 Sept), 10–18. https://doi.org/10.22435/mpk.v17i3Sept.815.

Riyanto, A. (2011). *Metode Penelitian Keperawatan dan Tehnik Analisa Data.* Jakarta: Salemba Medica.

Rustia, H. (2009). *UNIVERSITAS INDONESIA PENGARUH PAJANAN PESTISIDA GOLONGAN SKRIPSI Diajukan sebagai salah satu syarat memperoleh gelar sarjana HANA NIKA RUSTIA PROGRAM SARJANA KESEHATAN MASYARAKAT UNIVERSITAS INDONESIA DEPOK.*

Sacher,R.A, M. (2004). *Tinjauan Klinis Hasil Pemeriksaan Laboratorium*. Jakarta: EGC.

Sartono. (2002). Pemeriksaan Kadar Pestisida dalam darah petani. *Unnes*, *8*.

Sastroasmoro. (2011). *Dasar Dasar Metodelogi*. Jakarta: Salemba Medica.

Soemirat, J. (2003). Penyemprotan Terhadap Kadar Kolinesterase. *Universitas Airlangga.*

Supriatna,Ade, I. S. (2002). Keracunan Pestisida Pada Petani Penyemprot Cabe. *Universitas Muhammadiyah Semarang.*

Tawakkalni, I., . W., & Haidah, N. (2019). FAKTOR YANG MEMPENGARUHI KADAR KOLINESTERASE DALAM DARAH PADA BURUH TANI. *GEMA LINGKUNGAN KESEHATAN*, Vol. 17. https://doi.org/10.36568/kesling.v17i2.1066

Wulandari, D. D., & Santoso, A. P. R. (2020). Pengaruh Lama Paparan Pestisida Terhadap Aktivitas Kolinesterase, Serum Glutamic Oxaloacetic Transaminase (SGOT) dan Serum Glutamic Pyruvic Transaminase (SGPT) pada Pekerja yang Terpapar Pestisida Golongan Organofosfat. *Jurnal Sains Dan Terapan Kimia*, Vol. 14, p. 9. https://doi.org/10.20527/jstk.v14i1.6516

Zuraida. (2011). Faktor yang Berhubungan Dengan Pestisida Pada Petani di Desa Srimahi Bekasi. *Universitas Sumatra Utara.*

IJICC_INTERNASIONAL

ORIGINALITY REPORT

22%	21%	7%	7%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	ww.ijicc.net Internet Source	6%
2	Submitted to Universiti Malaysia Sabah Student Paper	3%
3	conferences.unusa.ac.id Internet Source	1%
4	icomltp.poltekkesdepkes-sby.ac.id Internet Source	1%
5	repository.ubaya.ac.id Internet Source	1%
6	ojs.unida.ac.id Internet Source	1%
7	ijsrp.org Internet Source	1%
8	Hikmah Safitri, Sumengen Sutomo, M.Kamali Zaman. Muhamadiah Muhamadiah. "ANALISIS RESIDU PESTISIDA (DIMETHOAT) PADA TANAMAN CABAI MERAH BESAR (Capsicum annum L.) KELOMPOK TANI	1%

LESTARI JAYA KABUPATEN KAMPAR", Photon: Jurnal Sain dan Kesehatan, 2019
Publication

9	ojs.uho.ac.id Internet Source	1 %
10	talenta.usu.ac.id Internet Source	1 %
11	Submitted to Universitas Jember Student Paper	1 %
12	www.e-journal.unair.ac.id Internet Source	<1 %
13	core.ac.uk Internet Source	<1 %
14	saripediatri.org Internet Source	<1 %
15	adoc.tips Internet Source	<1 %
16	journal.poltekkesdepkes-sby.ac.id Internet Source	<1 %
17	es.scribd.com Internet Source	<1 %
18	www.journal.stikeskendal.ac.id Internet Source	<1 %
19	epdf.tips Internet Source	<1 %

20	ejournal2.undip.ac.id Internet Source	<1 %
21	digilib.unila.ac.id Internet Source	<1 %
22	ji.unbari.ac.id Internet Source	<1 %
23	basic.ub.ac.id Internet Source	<1 %
24	doaj.org Internet Source	<1 %
25	febrianfn.wordpress.com Internet Source	<1 %
26	rentalhikari.wordpress.com Internet Source	<1 %
27	www.researchgate.net Internet Source	<1 %
28	Nining Wahyuni, Andika Aliviameita. "Comparison of Erythrocyte Index Values of Venous and Capillary Blood", Medicra (Journal of Medical Laboratory Science/Technology), 2021 Publication	<1 %
29	jurnal.unej.ac.id Internet Source	<1 %

30 lib.unnes.ac.id
Internet Source
<1 %

31 Agus Wibowo, Sri Umi Mintarti Widjaja, Sugeng Hadi Utomo, Djoko Dwi Kusumojanto et al. "Does Islamic values matter for Indonesian students' entrepreneurial intentionfi The mediating role of entrepreneurial inspiration and attitude", Journal of Islamic Accounting and Business Research, 2021
Publication
<1 %

32 docplayer.info
Internet Source
<1 %

33 docplayer.net
Internet Source
<1 %

34 pdfs.semanticscholar.org
Internet Source
<1 %

35 Renny Indrawati, Elok Zubaidah, Aji Sutrisno, Leenawaty Limantara, Tatas Hardo Panintingjati Brotosudarmo. "Remnant photosynthetic pigments in tea dregs: identification, composition, and potential use as antibacterial photosensitizer", Potravinarstvo Slovak Journal of Food Sciences, 2021
Publication
<1 %

36	digilib.unisayogya.ac.id Internet Source	<1 %
37	ejournal.lldikti10.id Internet Source	<1 %

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		