**Original Research Article**

# THE EFFECT OF BAY LEAF GARLIC DECOCTIONON ON LOW CHOLINESTERASE LEVELS DUE TO PESTICIDE EXPOSURE IN FARMERS IN PASURUAN

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**Abstract**

**Background:** Pesticides are chemicals used by farmers to control and kill pests and diseases. Pesticides can poison humans, although their main use is to control and kill agricultural pests. Pesticide poisoning is still a problem that often occurs in society.

**Objectives:** The aim of this study was to determine the effectiveness of garlic and bay leaf decoction in increasing cholinesterase levels of farmers exposed to pesticides in Pasuruan Raya.

**Methods:** The design of this study was a pre-experimental, one-group pretest-posttest with a population of rice processing farmers in Pasuruan Raya. The sample size used was 20 farmers taken by purposive sampling. The independent variable was the administration of a decoction of garlic and bay leaf for fifteen days, the dependent variable was the level of cholinesterase in the blood. Data were analyzed using paired sample t test.

**Conclusion:** The use of garlic and bay leaf decoction in this study is a complementary therapy given to farmers as a regulator of reducing cholinesterase levels which is an indicator of the accumulation of pesticides in the body. It is expected to be an effective and efficient solution. it is hoped that farmers will be able to independently maintain their health through smart techniques in utilizing local wisdom resources by cultivating materials, managing, preparing and processing natural materials into medicines that can be done independently, not only able to improve health status but also provide opportunities for development into business ventures creative economy that can increase income and economic welfare.

**Keywords:** *Farmers, Pesticides, Garlic, Bay leaves*

## INTRODUCTION

Greater Pasuruan is a fertile area which is divided into the City and Pasuruan Regencies with an agricultural land area of 60,401 hectares covering rice fields, plantations, fisheries, 15% of the population earn a living as farmers (BPS Kabupaten Pasuruan 2022). Geographically, it has great potential for the benefits of agriculture, plantations, fisheries, animal husbandry and

agro-industry. This opportunity gives great hope for improving the economic status and welfare of the community by optimizing production results. In managing rice fields and plantations, farmers regularly use pesticides to control plant-damaging pests which are generally made from organophosphates, the high schedule and duration of spraying pests, and personal hygiene after spraying which are still often neglected so that they are very at risk of exposure to toxic substances.

The results of Jumaida's research (2013) found a decrease in cholinesterase enzyme levels in rice farmers more than vegetable farmers in Pasuruan district. Especially with the farmers' knowledge that is still low and the adherence to using self-protection equipment (PPE) that is less consistent. According to WHO, an estimated 18.2 per mil of farmers experience pesticide poisoning and 168,000 people die each year due to this poisoning (Kassebaum et al. 2016). Garlic and bay leaves are widely grown by farmers as agricultural commodities, these ingredients have also long been consumed as spices for cooking, some active substances flavonoids, tannins, estragole, these compounds have activities as anti-oxidants, anti-inflammatory and antimicrobial, However, it has not been widely used appropriately by farmers as a prevention and treatment of poisoning due to pesticide exposure (Harismah 2017).

Farmers should receive special attention, especially related to their health, which of course has an impact on their quality of life and productivity. In general, the purpose of this study was to test the effectiveness of herbal complementary therapy of garlic and bay leaf decoction on Cholinesterase (CHE) levels as an indicator of exposure to organophosphate pesticides experienced by farmers and to examine the physiological response to clinical complaints felt by farmers. Blood cholinesterase activity is the amount of active cholinesterase enzyme in blood plasma and red blood cells which play a role in maintaining the balance of the nervous system. Blood cholinesterase activity can be used as an indicator of organophosphate pesticide poisoning (Keman Soedjajadi 2020).

**Objective(s):** The aim of this study was to determine the effectiveness of garlic and bay leaf decoction in increasing cholinesterase levels of farmers exposed to pesticides in Pasuruan Raya.

## METHODS
### Study Design
The design used in this study was a pre-experimental design with a one group pretest-posttest work approach. The group of respondents, totaling 20 people, was first examined for the first stage of Cholinesterase levels and anamnesa of various physical complaints experienced in the last one week then given an intervention in the form of drinking garlic and bay leaf decoction then carried out a second stage of examination of Cholinesterase levels, Hb levels and anamnesis of various complaints physical experience of the respondent.

### Setting
This research was conducted in May and June 2023 in the Greater Pasuruan area which includes Pasuruan regency and city, Rejoso sub-district and Mojoparon sub-district represent the regency area while Purworejo sub-district represents the city area. The consideration for choosing this area was because the paddy fields were still wide, and for generations the residents cultivated their own rice fields, sprayed organophosphate pesticides that did not consistently use safety standards.

### Research Subject
The sample size taken was 20 farmers. Sampling was carried out using purposive sampling (Nursalam 2020). The inclusion criteria are as follows 1). age 35-55 years, 2). Normal Hb and BMI levels, 3). Not in a state

of serious illness or smoking during treatment, 4). Male gender, 5). Working as a farmer for more than 5 years, while the exclusion criteria are farmers who do not routinely spray pesticides on their fields themselves

## Instruments

For checking Cholinesterase enzyme levels are carried out at a government laboratory that has been calibrated. Examination of serum Cholinesterase levels using the ELISA Kit method, venous blood sampling using a syringe instrument, and an interview guide to find out clinical complaints. Normal Cholinesterase enzyme values are 4,260 - 11,250 U/L for ages less than 40 years and 5,320 - 12,920 U/L for ages over 40 years (Titaley 2021).

## Intervention

Respondents who have met the inclusion and exclusion criteria were first given an explanation regarding the characteristics of garlic and bay leaves as intervention ingredients, the researchers had provided a package containing one single clove of garlic and seven pieces of dried bay leaves, then explained how to prepare the ingredients for the decoction, namely prepare 750 cc of water, add 7 bay leaves and a single garlic clove, then boil until 1 cup (250 ml) remains, let it cool then filter and drink morning and evening for fifteen days this process carried out independently by the respondent assisted by his family, while venous blood sampling and interviews were carried out by the researcher.

## Data Analysis

To find out the effect of garlic and bay leaf on cholinesterase enzyme levels and clinical complaints of farmers, the data was tested through SPSS version 16. The data is first tested for normality, if the data is not normally distributed then a nonparametric test is performed, if the data is normally distributed then a test is performed. parametric

paired sample t test. Conclusions are drawn based on the probability value <0.05, then H0 is rejected.

## Ethical Consideration

This research has been submitted to the University Ethics committee with number: 212/UN25.1.14/KEPK/2023 and declared ethically feasible according to 7 (seven) WHO Standards 2011, namely 1) Social Value, 2) Scientific Value, 3) Burden Equalization and Benefits, 4) Risk, 5) Persuasion/Exploitation, 6) Confidentiality and Privacy, and 7) Consent After Explanation, which refers to the 2016 CIOMS Guidelines. This is shown by the fulfillment of indicators for each standard. Prior to conducting the research, they first received a recommendation from the University's LP2M with number: 4459/UN25.3.1/LT/2023 and permission from KESBANGPOL with Number: 000.9.2/462/423.206/IPEL/2023.

## RESULTS

**Table 1.** Characteristics of Respondents based on CHE levels according to the age of Farmers in the Pasuruan Region

| Age group (Years) | f | % | CHE | | | |
|---|---|---|---|---|---|---|
| | | | <Normal | | Normal | |
| 35- 40 | 4 | 20% | 1 | 5% | 3 | 15 % |
| 41-55 | 16 | 80% | 9 | 45% | 7 | 35% |
| Total | 20 | 100% | 10 | 50% | 10 | 50% |

The table above shows that most of the respondents 80% are aged over 40 years as many as 45% of them have Cholinsterase enzyme levels below normal values and 35% are normal while respondents who are under 40 years are 20%, as many as 5% of them have Cholinsterase enzyme levels below normal values and 15% normal.

**Table 2.** Characteristics of Respondents based on Length of time being a Farmer in the Pasuruan Region

| Length of Working | f | % |
|---|---|---|
| 5-10 year | 2 | 10 |
| 11-15 year | 4 | 20 |
| 16-20 year | 5 | 25 |
| 21-25 year | 8 | 40 |
| 26-30 year | 1 | 5 |
| Total | 20 | 100 |

The table above shows that the length of time worked as a farmer is mostly in the range of 21-25 years.

**Tabel 3**. Characteristics of Respondents based on Clinical Complaints Experienced by Farmers in the Pasuruan Region.

| Clinical Complaints | Frequency | |
|---|---|---|
| | Pre | Post |
| Dizzy | 14 (70%) | 13 (65%) |
| Muscle pain | 9 (45%) | 9 (45%0 |
| Mild diarrhea | 5 (25%) | 0 (0%) |
| Skin itching | 12 (60%) | 5 (25%) |
| Watery eyes | 6 (30%) | 5 (25%) |
| Nousea, anorexia | 2 (10%) | 0 (0%) |
| Total | 20 (100%) | 20 (100%) |

The results of interviews with all respondents in the week before the intervention and clinical complaints after the intervention related to the body condition felt after the pesticide spraying, obtained data from respondents who complained of dizziness from 14 people (70%) to 13 people (65%), muscle pain 9 people (45%) still 9 people but it has subsided, mild diarrhea 5 people (25%) to 0%, mild itching of the skin 12 people (60%) decreased to 5 people, sore watery eyes 6 people (30%) ) to 5 people, stomach nausea, appetite decreased from 2 people (10%) to 0.

**Tabel 4**. Characteristics of Respondents based on Cholinesterase Enzyme Levels of Farmers in the Pasuruan Region

| Pretest | | Posttest | | Mean Difference |
|---|---|---|---|---|
| Mean | Sd | Mean | Sd | |
| 5.301,25 | 1.677 | 5.700,0 | 1.502 | 399,35 |

The average CHE before administration of garlic and bay leaf decoction was 5,301.25 U/L, while after the intervention the average CHE value was 5,700.0 where there was an average difference of 399.35 where the CHE value after the intervention was higher.

**Tabel 5.** Parametric Test Paired sample t test using SPSS

| | Mean | SD | T | Df | Sig. (2-Tailed) |
|---|---|---|---|---|---|
| Pair 1 CHE *Pretest-* CHE *Posttest* | -399.35 | 419.907 | -4.253 | 19 | .000 |

The results of the Paired Sample t Test obtained a mean value of -399.35 and a standard deviation of 419,907 while the significance value for the two areas obtained a p value = 0.000 with an alpha of 0.005.

**DISCUSSION**

There are characteristics of respondents aged less than 40 years, 5% of whom have CHE levels below normal, and 80% of respondents in the age group over 40 years have below normal CHE levels. The older a person is, the decreased ability of various bodily functions as a result of degenerative processes, the theory of aging (Irianti, Pramono, and Sugiyanto 2022), however, not all farmers who are elderly experience more severe pesticide poisoning than those who are younger, are more influenced by pesticides. duration and frequency as well as the use of PPE when

spraying pesticides. In accordance with research results from which stated that there was no relationship between age and cholinesterase enzyme activity p=0.440; OR=0.455 (Tutu, Manapiring, and Umboh 2020).

The working period of respondents in this study had an average of 18.5 years and most (40%) were in the range of 21-25 years. This length of work allows farmers to be exposed to pesticides for longer and the residue of pesticides in the body also increases. Pesticides can enter the body through the skin, mucosa, respiratory tract and digestive tract. According to Halisa, Ningrum, and Moelyaningrum (2022) one of the factors that can affect the decrease in CHE levels is the length of time farmers work to cultivate rice fields, this can be interpreted that the longer the farmer's working period, the lower the CHE level in his blood as a result of exposure to pesticide poisons. The link between the farmer's working period and the incident was also strengthened by the results of Tutu, Manapiring, and Umboh (2020) that there is a relationship between working time and cholinesterase enzyme activity (p = 0.032; OR = 7.500) and also research by Hardi, Ikhtiar, and Baharuddin (2023) there is a strong relationship between CHE levels and length of work with p=0.009.

The results of the examination of the hemoglobin level and Body Mass Index (BMI) of the respondents before the intervention was carried out, as a whole, showed that they were still within the normal range. According to Baeda (2022) BMI is a measure that is commonly used to determine nutritional status categories through a comparison between height and weight so that it can be identified in the normal, under or excess category. Hemoglobin is a type of protein in the blood that functions to bind and distribute hemoglobin for the needs of body cells. The results of Nurillah's research 2020) stated that there was no significant relationship between hemoglobin levels and levels of the

cholinesterase enzyme in farmers exposed to pesticides in the Jember region. However, in this study, BMI and Hb levels as indicators of nutritional status were used as a condition for inclusion of respondents to receive intervention in an effort to narrow the confounding variables, this is also related to the explanation of Lee et al. (2017) which states that exposure to pesticides that enter the body results in changes in various important body components. Hemoglobin is one of the important components that will be directly disturbed, the impact of pesticides is an imbalance between free radicals and antioxidants which ends in oxidative stress so that the levels and role of hemoglobin will be disrupted.

Respondents felt subjective clinical complaints after receiving the intervention, there was a decrease in the number and level of complaints. in the last three months the most complaints submitted were dizziness, itching on the skin. Complaints of dizziness and muscle aches felt by farmers appear and come and go in a relatively long time, while complaints of sore, watery eyes, itching of the skin and mild nausea and diarrhea are felt shortly after spraying pesticides, which usually lasts one to three days. This is possible because some farmers in spraying pesticides without wearing goggles, the spraying position does not pay attention to the wind direction, there is contact with the skin of the drug because farmers do not wear safe clothes that prevent drug contact with the skin.

The main thing that farmers pay less attention to is the completeness of the use of PPE. This is in accordance with the research of Fajriani, dkk (2019)Sujarwadi, dkk ( 2021) he results showed that 83.7% of farmers did not wear complete PPE and 16.3% wore complete PPE when spraying pesticides. Based on measurements of cholinesterase levels, 14% of farmers experienced mild poisoning and 86% were normal. The results of the chi-square analysis showed a value of 0.017 ($<\alpha=0.05$). So it can be concluded that there is a

significant relationship between the use of complete PPE and CHE levels. Also strengthened by the research of Halisa, dkk (2022) that there is a relationship between the level of knowledge, humidity, temperature and wind direction with a decrease in cholinesterase levels so that farmers need to use PPE and comply with the instructions for using pesticides in packaging including paying attention to the time, frequency and duration of spraying.

The longer farmers are sprayers, the higher the contact with pesticides and the higher the risk of pesticide poisoning. Pesticides that enter the body can accumulate in the body's tissues (bio-accumulation). The longer working period of farmers carrying out spraying activities will cause poisoning due to longer exposure to pesticides, so that the amount of pesticide poisons that enter the body will accumulate and will affect the health of farmers, with the impact of poisoning that will slowly be felt by farmers (Osang 2016), Also presented by Lee et al. (2017) that pesticides that enter the body will bind to the enzyme cholinesterase and form phosphorylated cholinesterase so that the function of the enzyme becomes disrupted, causing impaired muscle function and various body tissues. Studies on the prevalence of pesticide poisoning in farmers show that there is a strong relationship between low Cholinesterase levels and the frequency, use of PPE and the duration of spraying pesticides (Halisa, Ningrum, and Moelyaningrum 2022).

Pesticides are used continuously in large doses and are carried out without heeding safety rules. Pesticides accumulate in various agricultural products, poisoning farmers which results in death, by blocking the work of the cholinesterase enzyme in the blood (Berniyanti 2020). The use of pesticides will have a negative impact on human health in the form of poisoning, indicators of pesticide poisoning in the body can be seen from decreased levels of cholinesterase in the blood (setiati 2014).

Pesticides contaminating the body can enter the mouth through the digestive system, through the skin, through breathing and through the eyes. To determine body poisoning due to exposure to pesticides, it is necessary to look at the levels of the farmer's cholinesterase enzyme through blood tests. The kinetic of cholinesterase in the blood is the amount of cholinesterase enzyme which plays an active role in maintaining the balance of the nervous system, plasma and blood erythrocytes. This blood cholinesterase level is an indicator of poisoning by organophosphate pesticides (Berniyanti 2020).

The effect of giving garlic and bay leaf decoction on changes in cholinesterase enzyme levels can be seen in the average cholinesterase enzyme levels of farmers before the intervention and after the intervention, the mean pretest was 5,301.25 U/L and the mean posttest was 5,700 U/L where there was an increase in the mean enzyme levels. cholinesterase after administration of garlic and bay leaf decoction. The results of the paired sample t test showed that p value = 0.000 was lower than alpha 0.05, thus H0 was rejected and Ha was accepted, which means that there was an effect of giving garlic and bay leaf decoction to increasing levels of farmer's cholinesterase enzyme.

Garlic (Allium sativum Linn.) has a number of properties that are very beneficial for the body. In one garlic, it usually consists of 8 to 10 cloves. Each clove weighs about 6 to 8 grams depending on the size. The ingredients contained in garlic are antioxidants, such as: amino acids, flavonoids, allicin, allin, antihemolytic factor, allitiamin, selenium, germanium and oligosaccharides 4.5 grams of protein, 0.2 grams of fat, 100 mg of fiber, 23.1 grams of carbohydrates, 4 calories, 0.9 mg vitamin C, 42 mg calcium, 0.1 mg manganese, 0.4 gram selenium, 134 mg phosphorus (Kemenkes 2017). Allicin is the main anti-oxidant in garlic bulbs. This compound is able to suppress the production of nitric oxide (NO). NO accumulation will

induce the formation of a strong oxidizing agent, peroxynitrite. NO can be produced from the amino acid arginine with the help of the enzyme nitric oxide synthase (Borek 2001).

The research results of Brajawikalpa and Kautama (2016) concluded that a dose of garlic extract 3.6 mg/200 g times BW can reduce LDL levels, increase HDL and total cholesterol, and the greater the dose of garlic extract given the greater the decrease in LDL levels. total cholesterol, and increased HDL levels Bay leaf (syzygiumpolyanthum) is an easy plant to find. The chemicals contained in the stems, bark and bay leaves are essential oils, tannins, saponins and flavanoids, besides that the leaves also contain alkaloids and polyphenols. Bay leaves also contain the active substances ß-sitosterol and niacin. The benefits of bay leaves apart from being a cooking spice are also empirically used by the community as a medicine to treat high cholesterol, diabetes, hypertension, gastritis and diarrhea. As a traditional medicinal ingredient, Syzygium polyanthum is used as a medicine for diabetes mellitus, gastric disorders, treating haemorrhoids, skin diseases such as scabies, tonic, hypertension and cholesterol. It has been scientifically proven that Syzygium polyanthum has bioactivity as an antimicrobial, antioxidant, antidiabetic and anti-cholesterol agent (Harismah 2017).

**CONCLUSION**

Farmers in the Pasuruan Raya area in the process of spraying pesticides still pay little attention to the use of PPE which can make CHE enzyme levels below normal levels. Complementary herbal therapy of decoction of garlic and bay leaves in overcoming toxic residues of pesticide exposure in farmers has been shown effective to increase CHE levels, although it still needs to be tested in more depth, garlic and bay leaves can be an option for intervention considering the low cost, no side effects. a dangerous side when compared to chemical-based drugs, herbal medicinal raw materials

are widely available from plantation products and what is no less important is that they are easy to implement independently.

**SUGGESTIONS**

Research related to the utilization of agricultural products, especially garlic (Allium sativum Linn.) and bay leaves (syzygiumpolyanthum) is not widely available, as well as a combination of other herbal ingredients as an effort to overcome pesticide exposure experienced by farmers so that more in-depth research is needed with a more robust design. . The use of garlic and bay leaves is actually used every day as a seasoning for food preparations, and this cooking technique can be applied specifically to farmers.

**DECLARATION OF CONFLICTING INTEREST**

There is no conflict of interest with certain parties.

**AUTHOR CONTRIBUTION**
**Mukhammad Toha:** Conduct research the research leader and compile manuscripts.

**Ida Zuhroidah:** Conduct research and compile manuscripts.

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