

## The Effect of Cypermethrin on *Jambal Roti* to AST and ALT levels the Wistar Rat (*Rattus norvegicus*)

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**Abstract:** Cypermethrin are used to control pests, diseases and weeds on agricultural activities. Yet, producer of *Jambal Roti* used it to prevent decomposition, thus lengthen the product shelf life and reduced the loss. This study aimed to determine the effect of cypermethrin to AST (Aspartate Aminotransferase) and ALT (Alanine Aminotransferase) levels of Wistar Rats (*Rattus norvegicus*). Wistar Rat treated of cypermethrin exposure with doses 0.00 mg/kg (K-), 0.05 mg/kg, 0.60 mg/kg, 1.10 mg/kg, 1.60 mg/kg, 2.15 mg/kg and fish meat containing cypermethrin 1.73 mg/kg (positive control: K+). AST and ALT level on blood of rats determined by Enzymatic photometric method. The results showed that cypermethrin increase the level of AST and ALT of Wistar Rats. The highest levels of AST and ALT is  $117 \pm 0.58$  IU/L and  $25 \pm 0.58$  IU/L, which obtained at doses of 2.15 mg/kg cypermethrin.

**keywords :** cypermethrin, *jambal roti*, AST, ALT, wistar rat.

### Introduction

Cypermethrin is a synthetic pyrethroid insecticide<sup>[1,2,3,4,5,6]</sup> that have the toxic effect and dangerous to humans<sup>[7,8]</sup>. Commonly used to control pests on cotton and vegetables<sup>[6,9,10]</sup>, rice and mango<sup>[11]</sup>, and pests on any other agricultural activities<sup>[3,12,13,14,15]</sup>. Cypermethrin also used to control insects or household pests<sup>[16,17]</sup>, industry<sup>[14,18]</sup>, food storage<sup>[19]</sup>, animal husbandry<sup>[20]</sup>, ectoparasites controlling on cattle, sheep, poultry, and fish<sup>[21]</sup>; ectoparasites that risk to animal and human health<sup>[22,23]</sup>; and prevent damage on *Jambal Roti* products<sup>[24]</sup>.

*Jambal roti* (salted dry fish) is preserved products by salting, fermenting and drying. These products are mostly found in Indonesia, especially in Java island and has high economic value. Generally made from *Giant Catfish* (*Arius thalassinus* Ruppell)<sup>[25,26]</sup>. Has a specific criteria, thus these fish are expensive and preferred by consumers. Among others, fragrant flavor that caused the degradation of proteins and fats which produces methyl ketone compounds, butyl aldehyde, amino acids, and other compounds. Besides that, high content of amino acids affect the taste of *Jambal Roti*. Soft texture resembles bread (*roti*) as a result of proteolytic enzymes was produced by microorganisms<sup>[27]</sup>.

Cypermethrin use in fishery products was to prevent damage due to fly. *Jambal Roti* of Giant Catfish (*Arius thalassinus* Ruppell) from producer in Lamongan District, East Java contains 0.027 – 2.124 mg/kg cypermethrin. The existence of cypermethrin in *Jambal Roti* can cause health problems in humans<sup>[24]</sup>. Chemical compounds which are consumed including cypermethrin contained in *Jambal Roti*, will experience various processes in the body including metabolism in the liver. Liver cells which was exposed to cypermethrin can be damaged. The liver is an organ that is often damaged due to the toxicant<sup>[28]</sup>.

Liver damage can be detected through biochemistry examination of the liver. One of the liver biochemical examination that used is group tests of transaminase enzyme, i.e. aspartat aminotransferase enzyme (AST) or often called *serum of glutamic-oxaloacetic transaminase* (SGOT) and alanin aminotransferase (ALT) or called *serum of glutamic-pyruvic transaminase* (SGPT) <sup>[29,30,31]</sup>. Both of these enzymes will come out of the cell when the liver cell damaged thus would cause self-increase levels in blood serum <sup>[32]</sup>. Increase in SGOT and SGPT indicate damage to the liver cells <sup>[33,34,35,36]</sup>.

## Materials and Methods

The materials used in the study include cypermethrin (SIGMA), male Wistar Rats (*Rattus norvegicus*) who has received a license from the Department of Animal Husbandry and Animal Health Malang No. 524.5 / 2071 / 421,118 / 2014, aquabidest, feed, reagents of AST and ALT. This research was conducted at the Laboratory of Physiology Sciences Faculty of Medicine, University of Brawijaya. We use 45 male Wistar Rats (*R. norvegicus*) weighed 165-200 g and age of 7-8 weeks. Treatment was orally given for 14 days using the sonde gavage; syringe with a blunted-tip needle.

The research method used is the experimental method. We followed the pattern of a completely randomized design with seven treatment exposure of cypermethrin, i.e. 0.00 mg/kg (K-), 0.05 mg/kg, 0.60 mg/kg, 1.10 mg/kg, 1.60 mg/kg, 2.15 mg/kg and fish meat containing cypermethrin 1.73 mg/kg (positive control: K+).

Each treatment consisted of six Wistar Rats. Before treatment, Wistar Rats adapted for seven days. During adaptation, Wistar Rats were given the standard feed and distilled water drink. We made observations on the behavior and health conditions. Weighing is done at the beginning and at the end of the adaptation period <sup>[37]</sup>. Wistar Rats kept in an insulated enclosure. Three Wistar Rats were placed in each bulkhead. After adaptation, three Wistar Rats were randomly selected for analysis as initial data. On the 7<sup>th</sup> day and 14<sup>th</sup> giving treatment, each of three rats will be killed randomly for analysis. Blood was drawn from the rats that had been killed and dissected, used a syringe injection direct from rats heart. The blood is then inserted into the tube. Blood in eppendorf tube centrifuged at 3000 rpm for 10 minutes to take the serum. The whole action is given to Wistar Rats starting from before, during and after the treatment, has approved ethics committee health research Faculty of Medicine, University of Brawijaya and has received the Certificate of *Ethical Clearance* Number. 175/EC/KEPK/03/2014.

AST and ALT levels were analyzed using *Photometric Enzymatic Method* <sup>[35]</sup>. A total of 0.1 mL sample of serum was added into 1 mL mixture four parts of reagent 1, namely TRIS pH 7.5, L-Aspartate (AST/GOT), L-Alanine (ALT/GPT), Malate dehydrogenase (MDH), and Lactate Dehydrogenase (LDH), and 1 part of reagent 2 (monoreagen) is 2-Oxoglutarate and NADH. Then shaken and incubated in a *Waterbath* at 37 °C for 1 min. The concentration of the sample is read using a photometer wavelength of 340 nm, a factor 1745, the program K 20. For ALT/GPT, reagent 1 is not using MDH.

Normality test of data used analysis of variance with completely randomized design to determine the effect of treatment cypermethrin exposure on AST and ALT levels of Wistar Rats. The analysis continued to Duncan test, performed using *SPSS for windows versi 20*.

## Results and Discussion

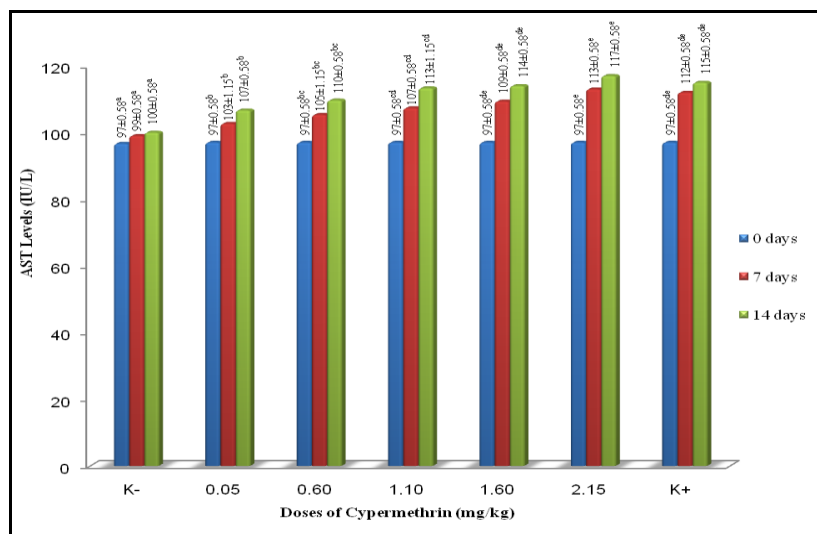
### AST (Aspartate Aminotransferase)

AST (*Aspartate Aminotransferase*) is an enzyme that is normally located in the liver and other organs. AST released into the blood when the liver is damaged. AST levels of blood then linked to damage of liver cell. AST measurement results of Wistar Rats during the study can be seen in Figure 1.

In Figure 1, it is seen that AST levels of Wistar Rats in all treatment increased during the study. Despite the increase, the average value of AST still within the normal range of AST levels for Wistar Rats. Mitruka <sup>[38]</sup> suggests that normal levels of AST in rats was  $141 \pm 67.4$  IU/L.

Results from analysis of variance showed that treatment of cypermethrin exposure with different doses affect the increased AST levels of Wistar Rats ( $p < 0.01$ ). Duncan test results indicated that cypermethrin at doses 2.15 mg/kg is the most influential in increasing AST levels of Wistar Rats ( $p = 0.05$ ). Increased AST levels indicate the presence of liver cell damage due the toxic effects of cypermethrin. Wibowo *et al.* <sup>[30]</sup> suggested that increased AST occur if there is enzymes release in intracellular into the blood caused necrosis of

liver cells, or the presence of acute liver damage. If there is severe damage to the liver, the increase in AST levels will be more prominent.

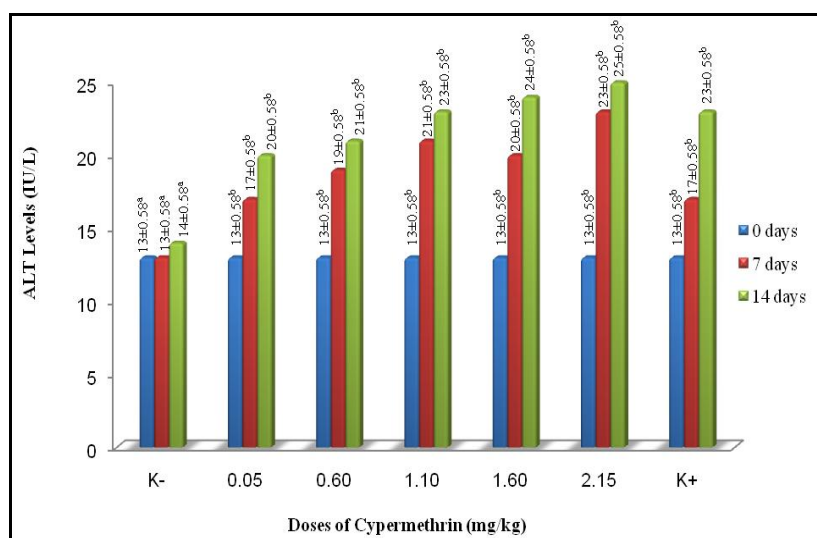


**Description:** The same superscript letters showed no significant difference between treatments ( $p=0.05$ )  
**Figure 1. Histogram AST Levels of Wistar Rats**

Several studies have shown different levels of AST based on the given exposure. AST levels affected by acetaminophen is 152-1098 IU/L<sup>[39]</sup>, 58.74-74.01 IU/L because cypermethrin doses 14.5 mg/kg<sup>[40]</sup>, 119-139 IU/L for tofu containing formalin<sup>[41]</sup>, 101.66-140.33 IU/L because induced paracetamol<sup>[42]</sup>, 130.6-203.8 IU/L because *Black Seed Nigella sativa* oil<sup>[43]</sup>, 26.95-46.16 IU/L because *Lindane* pesticide<sup>[44]</sup>, 204.66 IU/L because the synthetic estrogen (*Diethylstilbestrol*)<sup>[31]</sup>, 64.14-92.19 U/mL because cypermethrin doses 25 mg/kg<sup>[45]</sup>, 15.22-24.66 because vegetable oil<sup>[46]</sup>, 89-159.2 IU/L because Plumbum exposure<sup>[32]</sup>, 294.46-298.42 IU/L for cypermethrin doses 2.98-5.96 mg/kg<sup>[47]</sup>, 106.7-311.5 IU/L granting of cypermethrin doses 10 mg/kg<sup>[48]</sup>.

### ALT (Alanine Aminotransferase)

ALT (*Alanine Aminotransferase*) is an enzyme that widely available in the liver. Liver considered to be broken if the amount of enzyme greater than normal rate. ALT is more accurate for liver function test because ALT formed in the liver. ALT measurement results of Wistar Rats during the study can be seen in Figure 2.



**Description:** The same superscript letters showed no significant difference between treatments ( $p=0.05$ )  
**Figure 2. Histogram ALT Levels of Wistar Rats**

In Figure 2, it is seen that the ALT levels of Wistar Rats which were given cypermethrin exposure at different doses, increased during the study. The average value of ALT levels above the upper limit of normal range ALT levels for wistar rats. Mitruka<sup>[38]</sup> suggests that ALT normal levels of Rats were  $12.6 \pm 4.40$  IU/L.

Average levels of ALT on Wistar Rats which were given Cypermethrin exposure of different doses, was already above the normal limit of ALT levels since the 7th day, except for treatment doses at 0.05 mg/kg and K+. Results of analysis of variance, showed that cypermethrin exposure treatment with different doses was affect the increase in ALT levels of White Rats ( $p < 0.05$ ). Based on the results of Duncan tests, no significant difference in the increase value of ALT, but cypermethrin at doses 2.15 mg/kg showed the highest ALT value in wistar rats during the study. Increased ALT levels indicate the presence of liver cell damage due the toxic effects of cypermethrin. According to Amiruddin<sup>[49]</sup>, increase ALT levels due to damage to the liver cells by viruses, drugs, or toxins. The increase in ALT levels also suggests the development of abnormalities and liver necrosis.

Several studies have shown different levels of ALT based on exposure to a given. AST levels because acetaminophen is to 48-318 IU/L<sup>[39]</sup>, 12.65-29.31 IU/L because cypermethrin doses 14.5 mg/kg<sup>[40]</sup>, 63-86 IU/L because granting tofu containing formalin<sup>[41]</sup>, 125-203 IU/L because induced paracetamol<sup>[42]</sup>, 42.4-56,2 IU/L because *Black Seed Nigella sativa* oil<sup>[43]</sup>, 37.36-52.08 IU/L because *Lindane* pesticide<sup>[44]</sup>, 76.33 IU/L because synthetic estrogen (*Diethylstilbestrol*)<sup>[31]</sup>, 32.28-73.19 U/mL because cypermethrin doses 25 mg/kg<sup>[45]</sup>, 15.00-29.17 IU/L because vegetable oil<sup>[46]</sup>, 53.2-135 IU/L because Plumbum exposure<sup>[32]</sup>, 344.78-346.24 IU/L because granting of cypermethrin doses 2.98-5.96 mg/kg<sup>[47]</sup>, 21.3-47.8 IU/L because cypermethrin exposure doses 10 mg/kg<sup>[49]</sup>.

## Conclusion

Cypermethrin affect the increase in AST and ALT levels. AST levels are still within the limits of the range AST normal levels, but ALT levels are above the limit of the range of normal ALT levels. The highest levels of AST and ALT i.e.  $117 \pm 0.58$  IU/L and  $25 \pm 0.58$  IU/L obtained in treatment of cypermethrin dose of 2.15 mg/kg.

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