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# Aspartate Transaminase (AST) Activity In Selected Tissues and Organs of *Clarias gariepinus* Exposed to Different Levels of Paraquat.

Chimela Wala [1] Abdulraheem Bawa-Allah[1*] Hadiza Muhammad[1] and Nwibari Mesua [2]

1. Department of Biological Sciences, Faculty of Science, Nigeria Police Academy Wudil, Kano Nigeria
2. Hydrobiology and Fisheries Unit, Department of Animal & Environmental Biology Faculty of Biological Sciences, College of Natural and Applied Sciences University of Port- Harcourt.

* E-mail of the corresponding author: bblola7@yahoo.ca

**Abstract**

Analyzing the activities of aspatate transaminase in tissues can help detect tissue damage caused by toxicants such as paraquat. The activities of aspatate transaminase (AST) in some tissues and organs of *Clarias gariepinus* exposed to various levels of paraquat (2, 4, 6 and 8ppm) were studied for a period of thirty (30) days. The tissues and organs investigated include blood plasma, kidney, liver, gills and muscle. The results showed changes in AST activity in the treatment group as compared to the control group; however the increase was not concentration dependent. AST activity was highest in the liver (445.00±0.00IU/L SD) and lowest in the gill (65.00±27.39 IU/L SD) in the control group. There was no significant change in AST activity in the liver across the treatment range. AST activity however declined in the muscle with the lowest at 6ppm of paraquat. There was a significant increase in AST activity in the gills at 4ppm of paraquat, this later declined to almost control levels at higher concentrations. In the kidneys AST activity also significantly peaked at 4ppm of paraquat. This declined slightly and was maintained at higher treatment concentrations. AST activity peaked in the plasma at 4ppm of paraquat as well. This dropped slightly and picked up at 8ppm. Analyzing the activities of AST in tissues can help detect tissue damage cause by toxicants such as paraquat. It can consequently be inferred that AST activity can be used as a reliable biomarker for diseased condition in the plasma, gills and kidney but not the liver or muscle of *Clarias gariepinus*.

**Keywords:** Enzymes, Herbicides, Toxicant

## 1. Introduction

Aquatic ecosystems suffer much as a result of pollutants that enter the aquatic environment. Agricultural practices include the use of herbicides and pesticides that end up in the aquatic environment and contribute immensely to the pollution of water bodies which is detrimental to the aquatic ecosystem. Paraquat is one of the herbicides widely used in the control of weeds and it finds its way into the aquatic environment rendering it polluted. Fish is one of the aquatic biota that is adversely affected by this situation in both captured and cultured fisheries. Several tissues and organs of the fish suffer as a result of aquatic pollution. Their enzymes, physiological functions and ability to resist diseases are also affected. Several fishes like *Clarias gariepinus* (African Catfish) occupy vital positions in the fish industry of the Niger Delta region of Nigeria in particular as well as the world over (Horsefall and Spiff 2001). Enzymes play vital roles in the existence and functioning of various organs and tissues of fishes. Aspatate transaminase, (AST) is one enzyme that is of vital importance to fishes. This enzyme is widely distributed in many tissues and organs being abundant in the liver, myocardium, skeletal system, muscles, kidneys and erythrocytes. AST catalyses the transfer of a-amino group of aspartic acid to α-ketoglutarate which eventually results in the formation of oxaboacetic acid and glutamic acid respectively. Analyzing the activities of AST in tissues can help detect tissue damage cause by toxicants

## 2. Materials and Methods

A hundred fishes weighing between 270 and 300g were aquarium bred for 3 months. It was ensured that the water in the aquaria containing fishes of different groups was pure and pollutant free. The water was kept at room temperature at all time with a pH of 7.0 Five groups of fishes (20 in each group) were studied in the experiment. The first group was the control group placed in an aquarium containing no paraquat. The second to fifth groups of fishes were placed in aquaria containing 2ppm, 4ppm, 6ppm and 8ppm of paraquat respectively. The fishes were fed with 30% of crude protein at 1% body weight. After thirty (30) days, 0.5g of each of the organs (Kidneys, livers, gills and muscles) was macerated and analyzed for aspartate transaminase (AST) using the Reitman-Frankel (1957) method.

The results obtained were analyzed using one-way analysis of variance (ANOVA) to test if exposure to paraquat produced any significant differences in enzymes activities in various organs tissues at different concentration levels of paraquat. Where differences were found, Duncan's multiple range test (DMRT) was used to compare or separate differences between means.

## 3. Results

The results showed changes in AST activity in the treatment group as compared to the control group. AST activity was highest in the liver (445.00±0.00IU/L SD) and lowest in the gill (65.00±27.39 IU/L SD) in the control group. There was no significant change in AST activity in the liver across the treatment range. AST activity however declined in the muscle with the lowest at 6ppm of paraquat. There was a significant increase in AST activity in the gills at 4ppm of paraquat, this later declined to almost control levels at higher concentrations. In the kidneys AST activity also significantly peaked at 4ppm of paraquat. This declined slightly and was maintained at higher treatment concentrations. AST activity peaked in the plasma at 4ppm of paraquat as well. This dropped slightly and picked up at 8ppm. All these are illustrated in the figure below.

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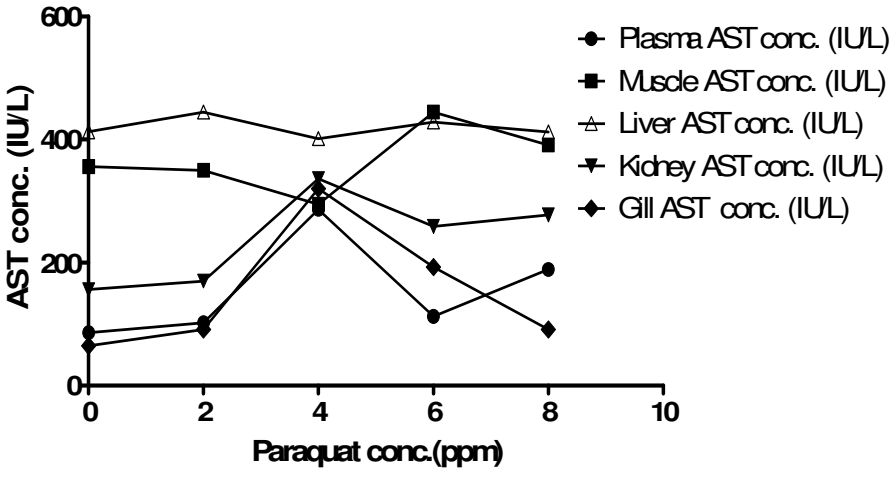


Fig1. Relative Aspartate Transaminase (AST) activity in organs of *Clarias gariepinus* exposed to various levels of paraquat for 30 days.

## 4. Discussion

The exposure of *Clarias gariepinus* to paraquat lead to changes in the activity of AST in the organs investigated except the liver. Where changes were found, it could suggest that there is an inactive or ineffective transamination and oxidative deamination processes in these organs. This finding can also indicate a breakdown

of the promotion of gluconeogenesis from amino acids as well as disruption in aminotransferase activities in the organs all of which could be as a result of tissue damage. Similar results have been reported by Gill et al (1991) in the liver, gill and kidney of *Barbus Conchonius* exposed to 12.6mg/l of cadmium chloride for 48hours with the gills mostly affected by cadmium poisoning. *Cyprinus carpio* exposed to 32.5mg/l of diazinon for 90hours produced depressed activities in AST in the liver and muscle. Grass carp exposed to 2.0mg/l of diquat experienced significant difference in levels of the enzyme activity. The increase in the activity may be due to disturbance in the Kreb's cycle. Decreased activity in Kreb's cycle causes a decrease in Kreb's cycle intermediates (Chetty et al, 1980; Prasidap et al 1984) which could cause cell death and subsequently tissue damage.

The increase in enzyme activity in the study indicates that there might be tissue damage, because fish enzymes (AST inclusive) are the most sensitive biomarkers employed in the diagnosis of hepatic damage since they are cytoplasmic in nature and are released into circulation (blood) after cellular damage (Mayne, 2002; Leelavinothan et al 2005). Enzyme activity in the gills, plasma and kidneys peaked at 4ppm of paraquat and later declined slightly. This decline could have been as a result of enzyme saturation or enzyme inhibition.

## 5. Conclusion

Organ damage caused by paraquat exposure resulted in increased enzyme activities in the plasma gills and kidney but no change and a reduced activity in the liver and muscle respectively. It can consequently be inferred that AST activity can be used as a reliable biomarker for diseased condition in the plasma, gills and kidney but not the liver or muscle of *Clarias gariepinus*.

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