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Study of haematological parameters of Tilapia exposed to sponge plant (*Luffa cylindrica*) fruit extract

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ABSTRACT

The sub-lethal concentration of sponge plant (*Luffa cylindrica*) fruit extract (800mg/L, 1600mg/L, 3200mg/L, 6400mg/L, and 0.00 mg/L as a control) was treated to Tilapia Juveniles for eight weeks. Two fish were chosen randomly from each treatment group and sacrificed to take blood samples for haematological analysis. Tilapia those were given sub-lethal quantities of the fruit extract experienced a slight but significant decrease in their red blood cell count, hematocrit, mean corpuscular volume, platelet count, and packed cell volume. This happened after the fish were exposed to the fruit extract. Only the mean corpuscular volume showed a statistically significant drop from the levels of the control group. The findings of this study revealed that the fruit extract of *L. cylindrica* negatively impacted the haematological parameters of Tilapia.

Key Words - *Luffa cylindrica*, Haematological parameters, Tilapia

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INTRODUCTION

The destruction of the natural environment that occurs as a direct result of the introduction of any matter, energy, or substance in such numbers to render it hazardous to the health of humans and other species is called pollution. Organic pollutants are biodegradable pollutants, and inorganic pollutants, non-biodegradable pollutants, are the two primary categories of pollutants (Obano *et al.*, 2006). Fishermen frequently use pescicidal plants to kill fish (Audu, 2014). Fish that have been subjected to stress frequently display behaviours, especially respiratory impairment. This is because direct injury to the gill epithelia and subsequent mucus accumulation are both the results of stress (Inodi *et al.*, 2010). There is cause for concern that the presence of these plant poisons in large concentrations may have a deleterious effect on the organisms that live in the water. In many parts of the world, *L. cylindrica* was traditionally employed as a fish poison. Sponge gourd, often referred to as *Luffa cylindrica*, is a type of gourd that is a member of the Cucurbitaceae family and can be utilized as a vegetable sponge or bath sponge. One female flower develops into a large green cylindrical fruit called gourds, which have a spongy endocarp and about 30 flat and have been used medicinally and as piscicides (Sujatha *et al.*, 2013). *L. cylindrica* is a wild climbing plant that matures into its adult form in a year and is monoecious. According to the findings of the phytochemistry study, the fruit extract contains 11 significant constituents, the most abundant of which are alkaloids and saponins. These constituents include phenols, tannins, alkaloids, flavonoids, saponins, oxalates, cyanogenic glycosides, anthraquinonols, steroids, terpenoids,

and phytate. Some of the alkaloids that can be found in plants that are toxic to fish include nicotine, pyrethrum, ryania, rotenone, coumerin, resin, akuammine, tannins, saponins, and diosgenin (Obomanu, *et al.*, 2005). Nevertheless, these alkaloids are hazardous to fish and other aquatic species at large concentrations (Fafioye, 2005). When assessing fish health, histological metrics, proximate composition, and haematological indicators are all helpful biomarkers. The quantity of red blood cells is a rather stable indicator, and the fish's body employs several compensatory physiological mechanisms to maintain this number within a small range. In the clinical diagnosis of fish physiology, haematological variables have been increasingly used to identify the effects of environmental stressors and hazardous chemicals. This is because of the close link between the circulatory system and the external environment. After being subjected to various stressors, such as pollution, illnesses, metals, hypoxia, etc., several blood parameters are utilized to diagnose and characterize the overall health of fish species. According to the findings of the research, the values of haematological parameters will reflect any physiologic change that occurs when toxicants alter the quality of the water. The responses of an animal's blood cells can be utilized as effective indicators of changes in the animal's internal or exterior environment. It is possible for the haematological levels of fish exposed to chemical contaminants to either increase or decrease.

MATERIALS AND METHODS

The investigation was carried out in the Post Graduate Department of Zoology laboratory at B.N.M. University in Madhepura from July, 2019 to June, 2020. The *Luffa cylindrica* fruit was purchased from the local market. The fruits were then crushed and created to make a more consistent form. After collecting the pure extract of this aqueous solution into a bottle, covering it, and storing it in a refrigerator at a temperature of 40°C until it was time to administer it, it was done so to maintain its freshness until it could be used. After ensuring that the aqueous extract was thoroughly combined, the experimental tanks were left devoid of fish for a period of half an hour before any fish were introduced to acclimatized fish to their new environment. In the control condition, no extract was added.

Fingerlings of the species *Oreochromis mossambicus* (Peters, 1852) were obtained from the fish market. These fingerlings had an average length of 100.38 cm and weighed 230.07 g on average. During the experiment, the fish were provided with pellet feeds, and the water quality was kept at the optimum. The water in the fish tanks, which had dimensions of 60 x 30 x 30 cm, was replaced with fresh water when needed.

Experiments were carried out in glass aquariums of 15 litres capacity. This was done to determine the median lethal concentration value, also referred to as the LC_{50} value, over the course of 96 hours.

The fish did not get any food at any point throughout the experiment. At intervals that had been established, the number of deaths that occurred in each tank was counted and recorded. The dead fish were gathered together and stored away so that a more in-depth examination of them later could be conducted.

The levels of dissolved oxygen (D.O.), free carbon dioxide (CO_2), total alkalinity, and ammonia content in the water were some of the significant physicochemical parameters as per APHA (2012). Blood was drawn from two fish that were slaughtered once every two weeks (14 days) using an insulin syringe and needle that had been washed with EDTA. This was done so that the various haematological parameters could be calculated. The packed cell volume (PCV), mean corpuscular volume (MCV), Red Blood cell count (RBC), White Blood corpuscular (WBC), mean corpuscular volume (MCV), haemoglobin, and platelet count were determined from the blood sample that was transferred into a 5 ml heparinized (EDTA bottle) tube and kept on ice until analysis.

RESULTS

The red blood cell (RBC) counts of young Tilapia that was subjected to a sublethal dosage of fruit extract of *Luffa cylindrica* are displayed in Figure 1. With increasing concentrations of the extract, there was a substantial drop in the fish's mean red blood cell counts. However, there was no significant difference between the two highest concentrations and the control group. For example, white blood cell counts were found to be higher in fish that were exposed to higher concentrations of the extract. Juvenile organisms that were subjected to sublethal concentrations of *L. cylindrica* fruit extract had mean PCV values that decreased with increasing concentrations of the extract. This phenomenon is referred to as the "density of cell packing" (PCV). The haemoglobin values of the test organisms exposed to the fruit extract of *L. cylindrica* declined with increasing concentration compared to control.

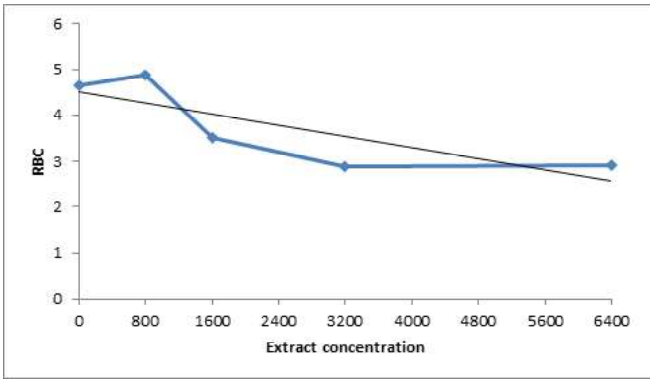

Fig. 1- RBC level in Tilapia exposed to concentration of *L.cylindrica* fruit extract for 60 days

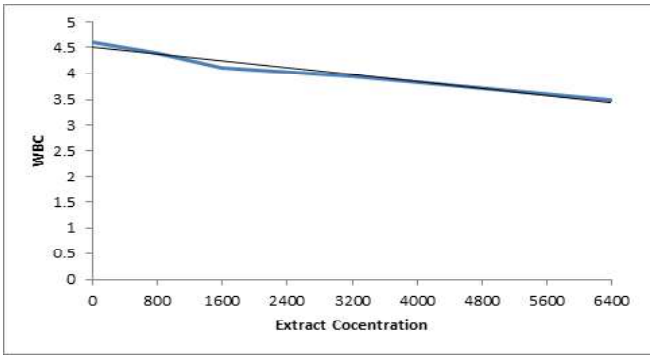

Fig. 2- WBC level in Tilapia exposed to concentration *L.cylindrica* fruit extract for 60 days

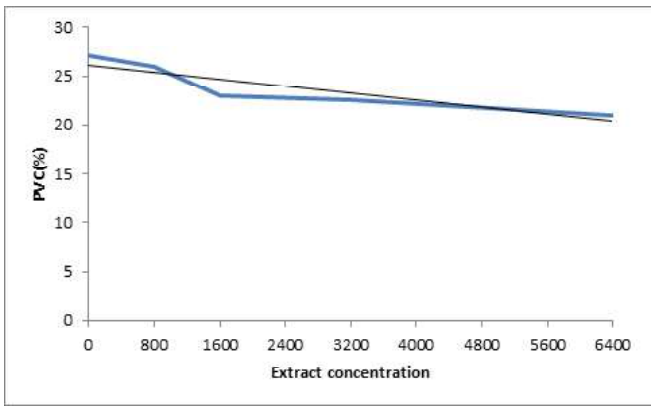

Fig. 3- PVC(%) level in Tilapia exposed to concentration *L.cylindrica* fruit extract for 60 days

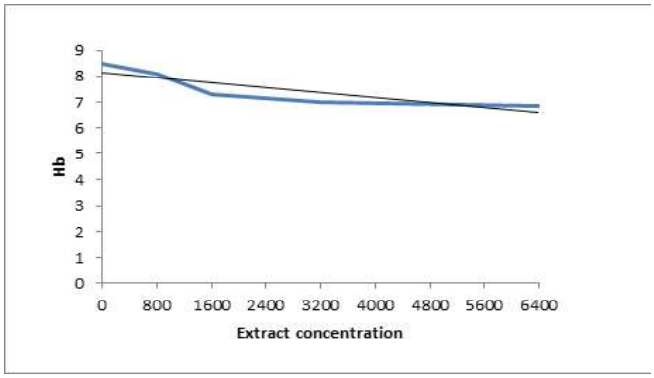

Fig. 4- Hb(g/dl) level in Tilapia exposed to concentration *L.cylindrica* fruit extract for 60 days

DISCUSSION

According to the findings of this research project, the toxicity of the *L. cylindrica* fruit extract was not significantly altered by any of the physicochemical characteristics that were investigated. Tilapia were subjected to a sub-lethal toxicity test, and it was discovered that an extract from the fruit of *L. cylindrica* caused considerable changes in the haematological indices of the fish. Ayotunde *et al.* (2011) and Audu *et al.* (2014) reported variations in the values of the haematological index that were comparable to one another. Through the use of packed cell volume, haemoglobin, and erythrocyte counts, it is possible to establish a correlation between fish health and the amount of oxygen in their surrounding environment. WBC are responsible for providing immunity to diseases caused by bacteria and chemicals.

A significantly decreased level of dissolved oxygen may indicate severe anaemia caused by the destruction of erythrocytes or haemo-dilution, both caused by impaired osmoregulation across the gill epithelium. Both of these conditions are caused by impaired osmoregulation across the gill epithelium. With the use of packed cell volume, one is able to determine not only the ratio of plasma to corpuscles but also the oxygen-carrying capacity of the blood (PCV). Larson *et al.* (1985), and Adamu and Audu (2008) found a significant fall in PCV. They attributed it to injury to the gills and reduced osmoregulation, which in turn caused anaemia and haemodilution. A reliable predictor of anaemia is the concentration of haemoglobin, the component in fish blood responsible for carrying oxygen. The interference of the extract with the pathway leading to the synthesis of haemoglobin in treated Tilapia may be because of drop in Hb concentration.

The decrease in red blood cell count was probably caused by the plant extract, which either sped up the rate at which RBCs were being broken down or sped up the rate at which RBCs were being created. For example, a freshwater fish called *Clarias gariepinus* had a considerable drop in the amount of haemoglobin and the number of erythrocytes in its blood after being subjected to aqueous extracts of the leaves of *Lepidagathis alopecuroides*. The direct connection between the haemoglobin concentration, packed cell volume values, and erythrocytes count may be explained by the symbiotic interaction between blood cells. There is a possibility that the fish's immune system was strengthened as a result of the stress response, which increased the number of white blood cells to protect the fish from infection and improve the fish's overall health. The exposure to toxicants may result in the degeneration of the erythrocytes and a sustained decline in the haemoglobin content of the fish.

CONCLUSION

The haematological parameters of Tilapia were shown to have deteriorated after they were exposed to the fruit extract of *L. cylindrica*. As a defense response, the white blood cell count increased while the platelet count, red blood cell count, and packed cell volume, MCV, all dropped. The fruit extract generated changes in the physicochemical characteristics of the water, which in turn caused stress factors, which in turn appeared in the test fish as indicators of distress, including agitation, fast breathing, gasping for air, and an inability to maintain their balance. Because *L. cylindrica* fruit extract can contaminate the aquatic system, it is a significant possibility that fish and other creatures that are not the intended target of the treatment could be injured by its continued usage. Consequently, keeping a watch on the haematological changes in Tilapia can be an effective method for determining the level of pollution in aquatic environments, the state of fish health, and the overall quality of fish in rivers and other bodies of water.

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