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Hematology and growth performance of African Catfish *Clarias gariepinus* (Burchell 1822) juveniles exposed to poultry processing effluent

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Abstract

Fish are abundant in most bodies of water. They can be found in nearly all aquatic environment. However, it is an important resource for humans worldwide, especially as food. Therefore, the Impacts of processed poultry effluents on African catfish *Clarias gariepinus* growth performance and hematology was carried out for12 weeks in the laboratory. Two hundred and forty juveniles of African catfish (*C. gariepinus*) between 10.43-10.58g were acclimated in a plastic tank of $1m^3$ and fed with fish meal of 0.9 - 1.5mm coppens fed at 5% body weight. Twenty *C. gariepinus* juveniles were introduced to different concentrations distilled and treated water in triplicates. Two concentrations of the effluent (50% and 100%) with pond water as control. T1 =100% water (control), T2 =50% effluent and T3 =100% effluent were in triplicates. Sixty juveniles of fish were introduced into all treatment and fed with commercially prepared feed. Fish length and weight were measured weekly and used as growth indices. Blood samples were collected from the fish species for heamatological analyses, while the rearing water physico-chemical parameters such as pH, Tempt, CO_2, DO, BOD, COD, Na, K, TP, Mn, Zn, Fe, Cu, and Pb were monitored. There were variations in weekly growth measurement of the fish length and weight in the concentrations, the feed conversion ratio for T1 (1.18±0.62) was better when compared with T2 (1.52±0.80) and T3 (1.54±0.32). However, there was no significance difference ($P>0.05$) among the three groups. The white blood cell count (WBC) of the fish in T2 (8.72±1.05) and T3 (8.88±1.70) were higher than the control T1 (4.54±2.65). The exposure of juvenile fish to different concentration of poultry effluents has shown adverse effects on the growth performance and heamatological indices. Farmers were advised to take caution/careful with type of waste water their fishes were exposed to.

Keywords: African catfish, Poultry, Effluents, Growth performance, Hematology.

1.0 Introduction

Environmental pollution such as processed poultry wastewater has become one of the most important problems in the world (Dutta and Dalal, 2008). These effluents enter water bodies as a consequence leaching from the soil or drains discharged directly into aquatic ecosystems which fish will be exposed to. Several studies indicate that after exposure to pollutants, fish may exhibit an increase or decrease in the level of serum protein, serum enzyme, cortisol, glucose, cholesterol and ions after exposed to varying pollutants. The effects vary depending on the level of pollution, type of pollution, species of fish, water quality and length of exposure to pollutants. The continual use and indiscriminate disposal of pollutant and processed poultry wastewater has prompted concerns on the safety and living of the aquatic biota (Huang *et. al.,* 2008).

2.0 Materials and Methods

The research work was carried out at the Veterinary Microbiology and Hematology Laboratory, University of Ibadan, Nigeria and Federal College of Animal Health and Production Technology, Ibadan, Oyo State, Nigeria.

Processed poultry wastewater was collected with 50 liter keg from Green Pasture Poultry slaughtered house and cold room at Oluyole Estate, Ibadan, Oyo state, Nigeria. The effluents were brought into the laboratory at every 3 days interval to prepare and change the concentrations throughout the duration of the experiment (12 weeks). The water used as control and wastewater physico-chemical characteristics and heavy metals were determined following standard recommended Association of Analytical Chemistry (AOAC, 2005) procedure using Atomic Absorption Spectrophotometer (Perkin Elmer 306 Model). Water pH and Temp were measured with multiprobe YSI model 65 while dissolved oxygen was measured with multiprobe YSI model 55 and other parameters also measured using classical spectrophotometric methods (Egemen and Sunlu, 1996; Wetzel and Likens, 2000).

Two hundred and forty (240) juveniles of *C. gariepinus* were obtained from Otis farm, Podo, Ibadan, Nigeria. The fish were acclimated for 14 days at the laboratory, after which the juvenile were randomly distributed (20 each) into triplicate concentrations (T1, T2 and T3) and monitored every 24hrs. T1 = distilled water (control), T2 = 50% Processed Poultry Effluents + 50% distilled water and T3 = 100% Processed Poultry Effluent.

The culturing water was 25 litres and the fish were fed with commercially prepared feed (Coppens Meal) at 5% body weight. Weekly measurement of fish weight was done using a top loading weighing scale (PN1200) model to the nearest of 0.1g, while the fish length was measured using standard measuring board in centimeters for growth performance. Behavioral changes in all the fish were observed and documented.

Blood samples were taken from the fish at the end of the experiment by inserting the needle into the musculature perpendicular to the ventral surface of the fish until the spine is reached or blood enters the syringe (Osuigwe *et al*., 2005). The blood plasma or serum was obtained by centrifuging 5ml of the whole blood for 3minutes and the plasma were collected and stored in plastic tube at -20^{0}C for analysis. Hemoglobin (HB) was determined by Dacie and Lewis (2001). The pack cell volume (PCV) was determined according to the procedure described by Siwicki and Anderson (2000). The red and white blood cell counts were determined using Neubauer Chamber.

2.1 Statistical Analysis

A two-way Analysis of variance (ANOVA) was employed to determine whether there were significant differences in the variables measured among the experimental groups using

SPSS (version 20.0). Difference in mean were separated using Duncan Multiple Range Test (DMRT) when (P<0.05) accepted to be significantly different.

3.0 Result and Discussion

The physico-chemical parameters and heavy metals of the water and effluents were presented in Table 1. The control water pH was average of 6.50 and 6.35 in effluent was within the normal standard acceptable range. The results obtained are similar to the results obtained by Adewumi and Olaleye (2011) in water sample collected from Ureje, Egbe and Ero dams and sewage effluents discharged from industries in Ekiti State, Nigeria.

However there were variations between the two water samples, both pH and temperature had minor fluctuations which is insignificant ($p>0.05$), the pH level decreased from 6.50 to 6.35mg/l in the effluent, while temperature had a significant increase from 28^0C to 35^0C which could be as a result of time and place of collection. Carbon-dioxide significantly increased from 3.70 to 39.60mg/l in the effluent, while dissolved oxygen (DO) value drastically reduced from 7.30 to 2.70mg/l, far below the level recorded for ordinary water. Both biological oxygen demand (BOD) and chemical oxygen demand (COD) optimally increased from 1.10 to 624.50mg/l, and 3.20 to 1756.80mg/l respectively.

Results obtained showed increased values ranges from 7.47 to 112.05mg/l sodium level, 4.10 to 102.50mg/l potassium, 0.65 to 121.52mg/l Total phosphorus in the water and effluent. However, the metals Zn, Fe and Mn increased in value from 0.11 to 0.73mg/l, 0.50 to 4.05mg/l and 0.21 to 0.25mg/l respectively, while Cu and Pb were not detected in both the effluent and the control water used for the experiment respectively. The physico-chemical parameters observed in the two water samples signify fluctuations in the levels recommended by WHO standard of a quality water for drinking and culturing of aquatic animals (Mihayo and Mkoma, 2012). Some physico-chemical parameters such as temperature and oxygen (1-6mg/l) and shallow water need higher level (4-15mg/l) are significant parameters that restrict survival, growth and distribution of fish (Akbulut, 2016).

The growth performance of *C. gariepinus* juveniles exposed to the effluent at different concentration is represented in Table 2. The average initial body weight of the fish in different groups was 10.55±0.23, 10.58±0.44 and 10.43±0.13g for T_1 , T_2 and T_3 respectively. However, the results showed no significant difference ($p>0.05$) in the three groups. The weekly weight gain for T_1 = 10.12±0.92 g, T_2 = 9.21±0.13 g and T_3 = 9.60±0.10g has T_1 with the highest value when compared. Fish exposed to different types of minerals in the water, depends on the availability of mineralizing agent such as CO_2 concentration (Birke, 2010). The average final length of the *C. gariepinus* showed significant difference ($p>0.05$) among the groups, with T_1 (21.83±0.27cm) having the highest value of average final length, followed by T_2 (20.15±0.52cm) and T_3 (18.23±0.11cm) systematically. The average weekly feed intake of the fish species for the three groups showed significant difference ($p>0.05$) level among the three groups.

However, T3 (18.30 ± 0.23 g) has the highest feed intake > T2 (13.99 ± 0.20 g) > T1 (11.94 ± 0.12g) as the least. The food conversion ratio among the groups was high in T1 (1.18±0.62) followed by T2 (1.52 ± 0.80), and T3 (1.54 ± 0.32) as least. Fish exposed to different level of concentrations revealed a different growth pattern throughout the study period. This study was in line with the findings of Idodo-Umeh (2008), Uban and Cook (2011) in their studies of growth performance of *C. gariepinus*. of parasitofauna of five freshwater fishes in Nigeria freshwater ecosystem.

Heamatological indices of *C. gariepinus* juveniles exposed to processed poultry effluent at different concentrations is represented in Table 3. Heamatological alterations are usually the first detectable and quantifiable response to environmental change (Wendeler, 2010). The packed cell volume (PVC) levels in T1 (29.50±0.04), T2 (26.66±0.30), and T3 (21.33±0.06)showed significant difference ($p<0.05$) among the three groups. Hemoglobin of the three groups T1 (9.53±0.80), T2 (8.39±0.80) and T3 (7.08±0.30) showed level of significant ($p<0.05$) among the three groups of fish exposed to processed poultry effluents.

Meanwhile, red blood cell (RBC) showed no level of significant ($p>0.05$) between T1 (2.14±0.82) and T2 (2.32±0.50) but showed a significant difference ($p<0.05$) among the three groups (Tab 3). The white blood cell (WBC) showed no level of significant difference ($p>0.05$) between T2 (8.72±1.05) and T3 (8.88±1.70) groups, but showed a significant difference ($p<0.05$) when compared with T1 (4.54±2.65). This was in agreement with the report that increase in stressed animals is a protective response to stress (Akinrotimi *et al*., 2012).

The lymphocyte value of T3 (56.71±1.61) was higher than T2 (37.66±0.90) and T1 (28.17±0.41), showing a significant difference ($p<0.05$) among the groups. More so, the monocyte of the fish species showed significant difference ($p<0.05$) among the groups T1 (2.17±0.02), T2 (3.17±0.10) and T3 (4.70±0.14). Anti-bodies are small molecules that find and bind to foreign materials so that monocyte can find them (Gafaar, 2010).

The eosinophil of T1 (3.34±0.10) and T3 (3.83±0.12) groups, showed no significant difference ($p>0.05$), while significant difference ($p<0.05$) among the three groups was observed when compared with T2 (5.2±0.20). Similarly, the basophil values for the three groups exposed to different level of effluent showed no significant difference ($p>0.05$) among the three groups viz T1 (0.33±0.02), T 2 (0.17±0.04) and T 3 (0.33±0.03) respectively.

4.0 Conclusion

Results of growth and heamatological studies of *C. gariepinus* juvenile showed that exposure of the fish to processed poultry effluent could be toxic at various degrees of concentration. Subsequently, more attention should be given to source of water coming into our fish farm and ascertain if the water was treated before discharging directly into ponds, streams, rivers, lakes and even the ocean for better yield of our aquatic organisms. Hence, further studies are required to evaluate the potential environmental and health risk of the fishes cultured/reared in such wastewater/effluents if consumed.

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