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BIOCHEMICAL CHANGES IN THE BLOOD OF CLARIAS GARIEPINUS JUVENILES FED WITH POULTRY WASTE

James Abayomi Oso [(a)1] *Dolapo Funmi Odeyemi* [(b)]

[(a)] *Professor, Department of Zoology and Environmental Biology, Faculty of Science, Ekiti State University, Ado Ekiti, Nigeria; Email: james.oso@eksu.edu.ng*

[(b)] *Lecturer II, Department of Science Laboratory Technology, Biotechnology option, Faculty of Science, Ekiti State University, Ado Ekiti, Nigeria; Email: dolapo.odeyemi@eksu.edu.ng*

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ABSTRACT

Artificial Nutrition is one of the most important means of boosting production in fish farming and maximizing the cost of feeding, effectively increasing profitability in fish production. This study evaluates the effect of poultry waste meal on the serum, kidney and liver of Clarias gariepinus. After acclimatization, the fish samples were qrouped into qroups 1, G1, fed with poultry waste and qroup 2, G2, with Coppens feed. The result showed a significantly higher difference (P > 0.05) in the mean serum composition for Fish fed with poultry waste for Aspartate Amino Transferase, A.S.T. (69.50±1.05), Alanine Amino Transferase, A.L.T. (69.95±1.07), Alkaline Phosphate, A.L.P. (69.10±1.31) compared to that of those fed with Coppens feed A.S.T. (54.87±1.47); A.L.T. (59.67±1.53); A.L.P. (56.47±0.50) respectively. High-density lipoprotein, HDL was significantly (P > 0.05) higher in C. gariepinus juveniles fed with poultry Coppens (71.07±1.17) than those provided with poultry waste (63.13±0.93). Alternately, Low-density lipoprotein, LDL, was significantly higher (P > 0.05) in Fish fed with poultry waste (81.33±0.93) than those provided with Coppens (74.17±1.08). Triqlyceride was considerably higher in C. gariepinus juveniles fed with poultry waste (81.33±0.93) than in C. gariepinus juveniles fed with Coppens (74.17±1.08). The composition of Total Cholesterol in both experimental Fish is 86.6±0.60 for C. gariepinus juveniles fed with Coppens and 94.27±1.62 for C. gariepinus juveniles fed with poultry waste. The mean biochemical composition of the liver of C. gariepinus juvenile fed poultry waste showed a higher significant difference (P > 0.05) for A.S.T. (75.77±0.72), A.L.T. (60.17±0.12), A.L.P. (61.40±1.48), LDL (77.03±1.21), Triglyceride (77.03±0.93) and Total Cholesterol (68.87±0.46) than those fed with Coppens feed although HDL (78.00±1.14) was significantly higher in those provided with Coppens than those fed with poultry waste (59.73 ±1.07) while for the kidney A.S.T. (51.27±1.08), A.L.T. (47.77±0.87), A.L.P. (69.10±1.31), LDL (81.33±0.93) and Triglyceride (70.30±1.25) had a significantly higher difference (P > 0.05) than that C. gariepinus fed poultry waste A.S.T. (46.20±0.35), A.L.T. (39.33±1.15), A.L.P. (43.03±11.58), LDL (74.17±1.08) and Triglyceride (67.83±1.19) except HDL (71.07±1.17) which was significantly higher in Coppens fed Fish than those provided with poultry waste (63..13±0.93). An increase in biochemical composition observed in this study suggests a disruption in the metabolism of the fish juveniles fed with poultry waste. Therefore, poultry waste should not be depended on solely as fish feed for Clarias gariepinus.

INTRODUCTION

Fish is an essential protein dietary source for the human populace in developing nations. According to Omojowo and Omojasola (2013), over a billion people depend on Fish as an essential animal protein source worldwide. In Nigeria, the contribution of fish farming to the national economy through providing animal protein and job opportunities must be considered. The need for fish protein has been emphasized to meet the protein demand for the world population, which is growing alarmingly (The World Fish Center, 2017). This, therefore, calls for an increase in the consumption of meals high in Nutrition, particularly protein, of which Fish presents an excellent option due to its balanced composition of amino acids, vitamins and minerals necessary for healthy growth. In addition, Fish is also soft and easily digestible when compared to beef and chicken. Artificial Nutrition in fish farming is one of the effective means to boost profitability by enhancing faster growth, improving stocking density, reducing the period of cultivation and so on. The alarming cost of fish farming can be

[1]*Corresponding author: ORCID ID: 0000-0001-9661-213X*

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attributed to the expensive cost of fish feed because feed accounts for a minimum of 60% of the total cost of production in the fish farming business, which is one of the problems hindering aquacultural development in Nigeria. This results in low-income rates for fish farmers and reduced fish stock availability for the consuming human population. Prepared Fish feed may be complete (composed of all essential ingredients such as protein, carbohydrates, fats, vitamins and minerals) or supplemental. However, a complete diet is necessary for the ideal growth and health of the Fish (Craig & Helfrich, 2009). Protein, believed to be the most expensive and essential component in the fish diet, is mainly traditionally supplied by fishmeal and, lately, soybean meal (Ajani et al., 2016). This is because of its excellent amino acid profile and high digestibility. Fish meal is a high-quality protein source, and it is considered irreplaceable in fish feed because of its superior profile of indispensable amino acids and its value as an attractant. However, its increasing cost and scarcity due to its importance in human Nutrition has resulted in the shortfall in world fishmeal production, hence the need for an alternative protein source in fish diets.

LITERATURE REVIEW

Clarias gariepinus is a *Clarias* and family Claridae species commonly known as catfish. It has an elongated, scaleless body with a flat, bony head and a broad mouth comprising four pairs of barbels. It is an omnivorous fish with a wide range of diet. The Fish is generally considered one of the most important tropical catfish species for aquaculture in West Africa (Solomon & Taruwa, 2011). Due to the high cost of purchasing fish feed, most fish farmers need help to afford the purchase of all ning, and the gap between fish production and consumption demand over the years. Livestock litter has been used as fish feed for years in countries such as Nigeria. The report suggests that animal wastes are composed of varying quantities of essential nutrients, which also include undigested feeds, products of excretory metabolism and residues from microbial synthesis, all of which can be used up by Fish (Fashakin *et al.* (2000). These materials can form a considerable part of the conventional fish diet thereby reducing the cost of fish feed production as well offer solution to the careless dumping of organic waste in the environment.

Among the organic wastes used, chicken wastes are mostly considered because they are readily soluble and have high phosphorus concentrations. The chicken's gut is relatively short, so some of the feed consumed is not digested, leaving substantive nutrients for Fish feeding on the organic waste (Adewumi *et al*., 2011).

As living organisms, the food we eat affects our biological system. One such effect in Fish, among others, is the variation in the organism's haematological characteristics responsible for immunosuppression. Blood is a fluid connective tissue that carries nutrients to every body part. According to Mohammed and Sambo (2010), blood is a fluid connective tissue circulating in the body. It serves as a link between different cells and structures of the body transporting nutrients and metabolic wastes. Studying blood components and their functions is essential for understanding normal and pathological conditions. The report has shown that blood parameter evaluation is essential in determining the Fish's physiological state. Therefore, any observable abnormality in the blood parameters can have a detrimental effect on the whole body. Physiological anomalies also disrupt the typical blood composition; blood is an essential diagnostic indicator (Barbieri *et al*., 2016).

Haematology is a branch of medicine that studies blood and its pathology, which entails the examination of blood cells and other constituents of the blood. Mohammed and Sambo (2010) state that factors such as food, microorganisms, age, weight and water quality can influence the blood parameters of Fish. The understanding of blood features is an essential diagnostic tool that can used to assess physiological and pathological alterations in fish samples. Reports on the physiology and pathology of Fish have established normal ranges for fish blood parameters (Zhou *et al*., 2009). Reliable information on metabolic deficiencies and disorders and chronic stress can be derived from the analysis of blood indices (Pereira *et al*., 2016).

The state of health of a fish can also be determined using blood biochemistry parameters. External factors such as fish handling, diseases and stress can induce alteration in blood composition. For instance, a considerable fluctuation was observed in the concentration of cortisol, glucose, cholesterol and hypoxic stress. Cortisol and glucose levels are specific pointers of sympathetic activation in stress conditions. Also, factors such as diet plans and stocking densities can alter specific biochemistry parameters (Pereira *et al*., 2016).

As earlier established haem, haematological parameters play a significant role in the assessment of the healthy state of the Fish (Pradhan *et al*., 2012). Studies on haematological indices have reported a correlation between the physiology and evolution in organisms; hence, the physiology of Fish is essential in diagnosing fish health and its economic significance (Pradhan *et al*., 2012). Several studies have reported qualitative and quantitative alterations in blood parameters such as White Blood Cell (WBC) count, Red Blood Cell (R.B.C.s) count, Haematocrit and Haemoglobin (Hb) in Fish as a tool in assessing the wellbeing of Fish (Pradhan *et al*., 2012).

Haematological parameters have been reported to significantly improve antibody levels, lysozymes, and cytokine activities through monospecies or multispecies in fish culturing (Dawood *et al*., 2017). Studies have also suggested that the use of probiotics enhances the blood parameters of Fish (Da Paixão *et al*., 2017).

Haematological parameters are considered important pointers to the Fish's state of health. Blood profile gives essential information on fish nutrition, physiology and wellbeing. Hence, the haematological status reflects animal physiological processes. The environmental conditions of Fish, particularly water quality and food components, can affect the packed cell volume (PCV), red blood cell count (R.B.C.), erythrocyte count, white blood cell count (WBC) and haemoglobin (Hb). Also, serum biochemical condition provides information on the state of internal organs, electrolytes, proteins, and nutritional and metabolic parameters. Many studies have been conducted on the physiology and life activities of *Clarias* species from different water bodies. However, more information is needed on the effects of poultry waste on the blood parameters of *Clarias gariepinus* juveniles in Ekiti State, Nigeria, hence the need for this study.

MATERIALS AND METHODS

Experimental Site

The study was conducted at the Animal house of the Department of Zoology and Environmental Biology, Ekiti State University (EKSU), Ekiti State, Nigeria.

Source of Experimental Fish

Sixty *juveniles of C. gariepinu*s were purchased from a commercial fish vendor in Ado Ekiti. They were acclimatized for one week, the first phase, and fed with 1mm size commercial feed.

Experimental Design

The Fish were divided into two groups: a control group fed with coppens and a treatment group fed with poultry waste. The Two bowls were arranged and filled with water. The Fish stocking densities of each bowl were 30 juveniles per bowl after acclimatization.

Feeding and Monitoring

The juveniles were fed with the experimental diets in duplicate bowls at the rate of 5% of their body weight. The Fish were fed twice daily between 9:00 and 10:00 am and 5:00 and 6:00 pm.

Determination of Biochemical Composition

In the laboratory, the serum was separated from the cell components of the blood via centrifugation for 5 min at 14,000 rev/min. Blood alanine aminotransferase (A.L.T.), aspartate aminotransferase (A.S.T.) and alkaline phosphatase (A.P.) were determined using a portable automated chemical analyzer following the procedures and using the reagents recommended and as described by the manufacturer (RANDOX et al., U.K.; AST/ALT (Cat. No. Sc 2643) and A.L.P. multi-sera level 2 (Cat. No. 1530) and level 3 (Cat. No.1532)), assay kits. The blood analyses were done within 48 hours of sample collection.

Statistical Analysis

Haematological parameters and biochemical indices were analyzed using one-way analysis of variance (ANOVA) at a 5% level of significance, while a post-hoc comparison of the significance of variance result obtained from ANOVA was done using the Duncan Multiple Range Test (DMRT).

RESULTS

The result of the effects of poultry waste feed on the serum of *C. gariepinus* juveniles is presented in Table 1. The result indicated a significant difference ($P > 0.05$) in the mean serum composition of both Fish fed the experimental diets. The result showed that comparatively, Aspartate Amino Transferase was significantly ($P > 0.05$) higher (69.50±1.05) in *C. gariepinus juveniles* fed with poultry waste than in *C. gariepinus* juveniles fed with Coppens (54.87±1.47). *C. gariepinus* juveniles fed with poultry waste (69.95±1.07) significantly ($P > 0.05$) had more Alanine Amino Transferase than *C. gariepinus* juveniles fed with Coppens (59.67±1.53). Alkaline Phosphate was significantly ($P > 0.05$) higher in *C. gariepinus* juveniles fed with poultry waste (69.10±1.31) than in *C. gariepinus* juveniles fed with Coppens (56.47±0.50). The result showed that High-density lipoprotein was significantly ($P > 0.05$) higher in *C. gariepinus* juveniles fed with poultry Coppens (71.07±1.17) than in *C. gariepinus* juveniles fed with poultry waste (63.13±0.93). Results for Low-density lipoprotein showed that *C. gariepinus* juveniles fed with poultry waste (81.33±0.93) had a significant ($P > 0.05$) higher composition than *C. gariepinus* juveniles fed with Coppens (74.17±1.08). Triglyceride was significantly higher in *C. gariepinus* juveniles fed with poultry waste (81.33±0.93) than in *C. gariepinus* juveniles fed with Coppens (74.17±1.08). The composition of Total Cholesterol in both experimental Fish is 86.6±0.60 for *C. gariepinus* juveniles fed with Coppens and 94.27±1.62 for *C. gariepinus* juveniles fed with poultry waste, which showed that *C. gariepinus* juveniles fed with poultry waste had a significant ($P > 0.05$) higher composition than *C. gariepinus juveniles* fed with Coppens.

Table 1. Serum Composition of *C. gariepinus* Juveniles fed Poultry waste

Biochemical Parameters	G_1	G_2
AST U/I	$54.87±1.47^a$	$69.50±1.05^b$
ALT U/I	$59.67±1.53^a$	$69.95±1.07^b$
ALP U/I	$56.47±0.50^a$	$69.10±1.31^b$
HDL mg/dl	$71.07±1.17^b$	$63.13±0.93^a$
LDL mg/dl	$74.17±1.08^a$	$81.33±0.93^b$
TG mg/dl	$67.83±1.19^a$	$70.30±1.25^b$
TC mg/dl	$86.6±0.60^a$	$94.27±1.62^b$

This means that the same alphabet across the rows is not significantly different at $P \leq 0.05$.

G_1 (Control): *C. gariepinus* juveniles fed with Coppens

G_2: *C. gariepinus* juveniles fed with Poultry waste.

ALP= Alkaline Phosphate, TG= Triglyceride, AST= Aspartate Amino Transferase, ALT= Alanine Amino Transferase, HDL= High-density lipoprotein, LDL= Low-density lipoprotein, TC= Total Cholesterol.

Effects of poultry waste feed on the Liver of *Clarias gariepinus* juvenile

The result of the effects of poultry waste feed on the biochemical composition of the liver of *Clarias gariepinus* juvenile is presented in Table 2. The result indicated a significant difference (P > 0.05) in the mean biochemical composition of the livers of both Fish fed the two experimental diets. The result showed that the liver of *Clarias gariepinus* juvenile fed poultry waste had a significantly (P > 0.05) higher Aspartate Amino Transferase (75.77±0.72), Alanine Amino Transferase (60.17±0.12), Alkaline Phosphate (61.40±1.48), Low-density lipoprotein (77.03±1.21), Triglyceride (77.03±0.93) and Total Cholesterol (68.87±0.46). In contrast, the liver of *Clarias gariepinus* juvenile-fed Coppens had a significant (P > 0.05) higher High-density lipoprotein (78.00±1.14).

Table 2. Biochemical Composition of the Liver of *Clarias gariepinus* Juvenile fed poultry waste and Coppens

Biochemical Parameter	G_1	G_2
AST U/I	66.00 ± 0.30^a	75.77 ± 0.72^b
ALT U/I	51.33 ± 1.53^a	60.17 ± 0.12^b
ALP U/I	49.70 ± 1.57^a	61.40 ± 1.48^b
HDL mg/dl	78.00 ± 1.14^b	59.73 ± 1.07^a
LDL mg/dl	69.67 ± 0.64^a	77.03 ± 1.21^b
TG mg/dl	72.40 ± 1.91^a	77.03 ± 0.93^b
TC mg/dl	60.27 ± 0.31^a	68.87 ± 0.46^b

Means with the same alphabet across the rows are not significantly different at P≤0.05 using ANOVA
G_1 (Control): *Clarias gariepinus* juvenile fed with Coppens
G_2: *Clarias. gariepinus* juvenile fed with poultry waste.
ALP= Alkaline Phosphate, TG= Triglyceride, AST= Aspartate Amino Transferase, ALT= Alanine Amino Transferase, HDL= High-density lipoprotein, LDL= Low-density lipoprotein, TC= Total Cholesterol.

Effects of poultry waste feed on the Kidney of *Clarias gariepinus* juvenile

The result for the effects of poultry waste feed on the serum of *Clarias gariepinus* juvenile is presented in Table 3. The result indicated a significant difference (P > 0.05) in the mean serum composition of both Fish fed the experimental diets.

Table 3. Biochemical Composition of the Kidney of *Clarias gariepinus* Juvenile fed poultry waste and Coppens

Biochemical Parameter	G_1	G_2
AST U/I	46.20 ± 0.35^a	51.27 ± 1.08^b
ALT U/I	39.33 ± 1.15^a	47.77 ± 0.87^b
ALP U/I	43.03 ± 11.58^a	69.10 ± 1.31^b
HDL mg/dl	71.07 ± 1.17^b	63.13 ± 0.93^a
LDL mg/dl	74.17 ± 1.08^a	81.33 ± 1.62^b
TG mg/dl	67.83 ± 1.19^a	70.30 ± 1.25^b
TC mg/dl	59.03 ± 0.93^a	66.00 ± 1.06^b

Means with the same alphabet across the rows are not significantly different at P≤0.05 using ANOVA
G_1 (Control): *Clarias gariepinus* juvenile fed with Coppens
G_2: *Clarias gariepinus* juvenile fed with poultry waste.
ALP= Alkaline Phosphate, TG= Triglyceride, AST= Aspartate Amino Transferase, ALT= Alanine Amino Transferase, HDL= High-density lipoprotein, LDL= Low-density lipoprotein, TC= Total Cholesterol.

DISCUSSIONS

Blood analysis is a proven tool for assessing an individual's health status, including farm animals, as it provides reliable information on any deficiency or disorder in the body's metabolic activities (Pereira *et al*., 2016). Blood biochemistry parameters can also be used to detect the health of Fish. Exogenous factors, such as management, diseases and stress, always induce major changes in blood composition. For example, significant fluctuations were detected in the concentrations of cortisol, glucose, cholesterol and other essential components in response to handling and hypoxic stress. The cortisol and glucose levels are considered to be specific pointers of sympathetic activation during stress conditions. Primary ecological factors, such as dietary plan and stocking density, directly influence specific biochemistry parameters (Pereira *et al*., 2016). This study showed that juveniles fed with Coppens feed had better serum profiles than juveniles fed with poultry waste. This could be attributed to the composition differences between the two experimental diets. This observation agrees with reported similar findings. They further opined that commercial Fish feeds, such as Coppens, Multifeed, Aller Aqua and Euro, emit more pungent fishy odours because *C. gariepinus* uses the olfactory senses during feeding. The results obtained for biochemical composition showed that *Clarias gariepinus* juveniles fed with poultry waste had higher biochemical composition than *Clarias gariepinus* juveniles fed with Coppens, which correlates with the report. The increase in biochemical composition in Fish fed with poultry waste compared to those fed with Coppens might result from glomerular insufficiency, increased muscle tissue catabolism or disruption of carbohydrate metabolism.

CONCLUSIONS

The study, therefore, concludes that Coppens feed is a better diet than poultry waste diet for *C. gariepinus* juveniles*;* also, an increase in biochemical composition sequential to the use of poultry waste as fish diet reflects disruption in metabolic activities of the fish samples hence poultry litters should not be used as a complete feed for *Clarias gariepinus*.

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