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Plasma Biochemical Changes in *Clarias gariepinus* (Burchell, 1822) Fed Poultry Litter

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Abstract: *Clarias gariepinus* juveniles were fed for twelve weeks with poultry litter in other to assess its effect on biochemical parameters as bio-indicator of health status. A control experiment was set up with fish fed a normal 40% crude protein diet. Fish fed with poultry litter shows a significant increase ($p<0.05$) in the values of plasma electrolyte of sodium, chloride, phosphate: excretory products of urea and creatinine; globulin and albumin/globulin ratio compared with initial values and fish fed the control diet which is suggestible of abnormal physiological function of metabolism in fish fed with poultry litter when compared with fish fed control diet. While significantly lower ($p<0.05$) levels of potassium, bi-carbonate and triglycerides observed in fish fed poultry litter is an indication of lower immune level of fish compared with fish fed control diet. The present study shows that feeding fish with poultry litter reflect disturbance in metabolism activities, hence it should not be used as a complete feed for *C. gariepinus*.

Key words: Plasma biochemistry, poultry droppings, *Clarias gariepinus*

INTRODUCTION

The aim of this study is to investigate the effects of feeding poultry litter on plasma biochemical parameters of *Clarias gariepinus* juveniles.

Aquaculture is one of the fastest growing food production sectors in the world and provides significant supplement and substitute to wild fishes (Francis *et al*., 2001). The aquaculture sector is confronted with the problem of high cost and irregular supply of conventional fish feed ingredients. However, Omitoyin (1995) and Aderemi *et al*. (2004) observed that majority of feed ingredients required for the animal feeds can be met by using agro-industrial products, which are considered as wastes. The ingestion of a number of dietary components however has measurable effects on blood constituents of various animals (Church *et al*., 1984; Arowora *et al*., 2003). Blood contains a lot of metabolites and other constituents, which provide a valuable medium for clinical investigation and nutritional status of the individual (Heming and Paleczny, 1987; Arowora *et al*., 2003). Blood is also a good indicator to determine the health of an organism (Joshi *et al*., 2002a). Taiwo *et al*. (2003) reported negative impact on the growth of *C. gariepinus* broodstock fed grasscutter faeces.

Hilmy *et al*. (1987) observed an increase in protein content of serum and liver in fish following cadmium and zinc toxicity. Everall *et al*. (1991) reported similar change in adult captive Atlantic salmon.

In Nigeria many semi-intensive fish farmers particularly in the rural and peri-urban cities are faced with the problem of availability of cost effective fish feed (Omitoyin, 2005). In other to solve this problem, many of these fish farmers feed their fish directly with poultry litter in addition to other forms of supplementary feed. There is therefore the need to investigate the effect of this direct feeding of fish with poultry litter which is a major waste by product from the poultry industry in Nigeria.

MATERIALS AND METHODS

Experimental Fish and Management

This study was conducted between July and October 2005. One hundred twenty pieces of *Clarias gariepinus* juveniles of average length (11.0±1.5 cm) and weight (15.70±0.1) were purchased from a commercial fish farm in Mokola, Ibadan Nigeria. The fish were disinfected with 0.1% potassium permanganate as described by Joshi *et al*. (2002b) and were acclimatized for 14 days to laboratory condition in a glass aquaria size 7×0.5×0.45 m in the research laboratory of the Department of Wildlife and Fisheries Management, University of Ibadan, Nigeria. The fishes were fed with standard commercial cat fish diet (40% crude protein). After acclimatization, the fishes were divided into two treatments with three replicates in six 90×60×30 cm glass aquaria. Eighteen fishes were randomly distributed into each aquarium. The test fish were fed for 12 weeks with dried poultry litter collected from the battery cage system of the Teaching and Research farm of the University of Ibadan. The litter was sun-dried for two days before grinded and pelleted, while the control group were fed with 40% crude protein commercial catfish diet at 3% of their body weight.

Water quality parameters such as temperature, dissolved oxygen and pH of the experimental set up were monitored using standard methods (APHA, 1998; Boyd, 1979). While the proximate composition of poultry litter and control diets were carried out using the AOAC (1990).

Plasma Biochemical Evaluation

Blood samples of the *Clarias gariepinus* juveniles at the beginning of feeding trial and after twelve weeks of feeding with poultry litter and control diet were collected from un-anaesthetized fish by cardiac puncture with a 1.4×50 mm^2 non-heparinized injection needle as described by Morgan and Iwama (1997) and Abdelmeguid *et al*. (2002). Plasma sodium and potassium were analyzed in the blood samples by using flame emission photometry (Morgan and Iwama, 1997). Plasma total proteins were estimated through the biuret method (Reinholf, 1953). The plasma urea, triglycerides, creatinine, globulin and albumin/globulin ratio by the standard methods described by Coles (1986), while cholesterol was determined by the direct method described by Hrubec *et al*. (1996). Plasma chloride was determined by using mercuric nitrate method according to Schales and Schales (1941). Calcium, phosphate and bicarbonate by Toro and Ackmann (1975).

Water Quality Parameters

The following water quality parameters were determined: Dissolved oxygen, pH and temperature respectively using Lamottee freshwater aquaculture test kit model AQ-2/AQ-3 codes 3633-03/3634-03 (2003).

Statistical Analysis

Experimental design was one-way analysis of variance (Steel *et al*., 1997) and mean differences were carried out according to Duncan multiple (1957) range test.

RESULTS

There were no significant differences in water quality parameters measured during the experimental period as presented in Table 1.

Table 1: Water quality parameters of experimental set up

Parameters	Test fish	Control fish
Temperature	27.0±0.1	27.0±0.1
Dissolved oxygen	6.5±1.0	6.5±1.0
pH	7.0±1.1	7.0±1.1

Table 2: Plasma bio-chemical changes in *Clarias gariepinus* fed poultry litters

Parameters	Initial mean	Test mean	Control mean
Sodium (mmol L^{-1})	136.10±0.11a	141.60±0.33b	136.51±0.33a
Potassium (mmol L^{-1})	46.01±0.00b	43.30±0.01a	46.07±0.03b
Chloride (mmol L^{-1})	102.30±0.21a	106.70±0.01b	102.10±0.03a
Bicarbonate (mmol L^{-1})	23.12±0.04b	20.30±0.01a	24.09±0.01b
Calcium (mg dL^{-1})	9.22±0.01a	8.35±0.02a	8.80±0.03a
Phosphate (mg dL^{-1})	4.80±0.04a	5.29±0.01b	4.61±0.02a
Urea (mg dL^{-1})	27.12±0.05a	32.06±0.01b	28.30±0.01a
Creatinine (mg dL^{-1})	1.00±0.01a	1.48±0.02a	1.21±0. 01a
Total Protein (g dL^{-1})	6.72±0.02a	7.06±0.01a	6.83±0.01a
Albumin (g μL^{-1})	3.31±0.01a	3.01±0.04a	3.30±0.02a
Globulin (UI L^{-1})	3.91±0.04a	6.69±0.01b	4.05±0.02a
Albumin/globulin ratio (g dL^{-1})	0.81±0.08a	88.01±0.33b	0.92±0.33a
Alkaline phosphate (IU L^{-1})	233.14±0.28	200.06±0.33a	253.10±0.33c
Cholesterol (mg dL^{-1})	110.06±0.12a	110.10±3.33a	110.00±0.23a
Triglyceride (mg dL^{-1})	89.01±0.10b	72.03±0.5a	89.14±0.3b

Mean with the same superscripts along the horizontal row are not significantly different ($p>0.05$)

Table 3: Proximate analysis of experimental diets

Treatments	Crude protein	Fat	Crude fibre	Ash	Moisture
Control diet	39.3 ± 0.10^{b}	4.22 ± 0.11^{b}	5.88 ± 11^{a}	10.30 ± 0.12^{a}	9.96 ± 0.10^{a}
Poultry litter	17.4 ± 0.20^{a}	0.69 ± 0.15^{a}	35.88 ± 0.25^{b}	33.90 ± 0.23^{b}	9.45 ± 0.03^{a}

Means with the same alphabets along the vertical roll are not significantly different ($p>0.05$)

The values of sodium, chloride, phosphate, urea, globulin and albumin/globulin ration of fish fed poultry litter was significantly different ($p<0.05$) from the initial values and those fed the control diet (Table 2). However both the initial values of phosphorous and bicarbonate and that of fish fed control diet were significantly ($p<0.05$) better than fish fed poultry litter. Poultry litter has a significantly ($p<0.05$) lower nutritional value compared to the control diet (Table 3).

DISCUSSION

Water quality parameters of experimental set-up for both treatments were similar and within the optimum range recommended for culture of *C. gariepinus* (Viveen *et al*., 1985; Omitoyin *et al*., 2006).

The increase in the value of plasma electrolytes, renal excretory products of urea and creatinine observed in this study in the fish fed poultry litters compared to initial values and those fed the control diet are suggestive of abnormal physiological function of metabolism. However, the higher plasma electrolyte, total protein and albumin/globulin ratio, values of test fish is an indication of efficient immune responses and body physiological reaction to poultry litters. While reductions in serum albumin and increases in globulin levels i.e., alterations in albumin/globulin ratio may result from the poorer liver function as well as proteinuria due to kidney damage (Uyanik *et al*., 2001) characterized by degeneration in tubular epithelium as well as hyaline casts in the lumen. Since the albumin levels decreased, the increases in globulin levels may elevate the total protein as suggested by Uyanik *et al*. (2001). The increase in total protein and globulin levels as reported by Chapatwala *et al*. (1982a), Chapatwala *et al*. (1982b) and Uyanik *et al*. (2001) may depend on dehydration due to diminished feed and water intake. The lower level of bicarbonate, Calcium Globulin and Triglyceride indicated the deficiency of hepatic metabolites compound as well as abnormal physiological function of the metabolism and indicates the low immune level of fish fed with poultry litters compared with fish fed control diet which was similar to the observation of Tiwari and Singh (2005).

The results reported for serum proteins are in agreement with those obtained by Mckim *et al*. (1970) and Abdelmeguid *et al*. (2002). The increase in serum creatinine concentration in fish fed with poultry litters in comparison with those fed control diet and initial values might be induced by glomerular insufficiency, increased muscle tissue catabolism or impairment of carbohydrate metabolism

as reported by Murray *et al*. (1990) and Abdelmeguid *et al*. (2002) respectively. Proximate composition of the poultry litter fed to catfish also revealed that it was less than half of the optimum level of 40% C.P when compared with that of control diet as recommended by Faturoti *et al*. (1986a).

It is therefore evidence from this study that disturbance in blood serum as a result of feeding fish with poultry litters reflect disturbance in metabolism activities, hence poultry litters should not be used as a complete feed for *C. gariepinus*.

Further study should be carried out on partial utilization of poultry litters as feed component in the diet of *C. gariepinus* and other fish species in aquaculture production rather than as a complete feed.

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