WATER QUALITY PARAMETERS, CARCASS AND MINERAL COMPOSITION OF *CLARIAS GARIEPINUS* REARED IN PLASTIC TANKS FED FISH FEED DIET SUPPLEMENTED WITH MICROBIAL PHYTASE

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Abstract

Evaluation of water quality parameters, carcass and mineral composition of Clarias gariepinus fed with fish feed diet supplemented with microbial phytase (Aspergillus niger) was carried out. 240 Clarias gariepinus fingerlings (Mean initial body weight 4.67±0.12) were divided into four treatment groups with each of 3 replicates and feed were given to the experimental fish 3 times daily at the rate of 3% body weight throughout the experimental period. The result showed that there was no significant difference at p< 0.05 in the water quality parameters between treatments. Highest crude protein value of 62.78% was recorded in fish fed with 40ml phytase (PTA) and the least value of 44.56% was recorded in the control experiment (TD). PTA has the highest concentration of ammonia 4.5mg/l, while 30ml phytase (PTB) has the lowest value of 0.4mg/l. Treatment with 40ml phytase has the highest potassium concentration of 1.5mg/l while PTB has the lowest value of 0.7mg/l. Addition of phytase to fish feed increased the concentration in the bone and the whole body.

Key words: *Aspergillus niger, Clarias gariepinus*, Dissolved oxygen

Introduction

There is great reliance on fishmeal by aquaculture feed industry because of its balanced amino acid profile, high palatability and absence of anti-nutritional factors (Baruah *et al.*, 2007). He reported a large increase over the past decades on the proportion of global fishmeal that is being utilized for the production of fish feed. For any aquaculture venture to be viable and profitable, it must have a regular and adequate supply of balanced artificial diets for the cultured fishes. Due to the decreasing fishmeal production, the use of plant- based feed in aquaculture is inevitable in the near future. Research in fish nutrition in recent years has its focus on the replacement of animal protein sources by plant based protein with the aim of reducing the cost of supplemented feeds (De Silva, 2001). Phytase is an enzyme which is microbial in nature and cannot be produced by fish unless supplied by inclusion in formulated diet of plant origin. Phytase addition increases the concentration of minerals like magnesium, phosphorus, calcium, manganese and Zinc in plasma, bone and the whole body (Yan and Reigh, 2002).

Materials and methods

Experimental diet and fish collection

The fungus phytase ('Natuphos') obtained from *Aspergillus niger* was purchased from Soleace and Moxie investment Limited at Oko - Oba Agege- Lagos. Also the experimental and commercially available 'Coppens' were purchased from the same source. Fish were fed with 2mm size of the experimental feed before the commencement of the feeding trial. 0.1g of microbial phytase 500FTU/kg of the commercial diet was dissolved in 100ml Phosphate Buffer Solution (PBS) (Doekes *et al.*, 2012). The prepared phytase at different levels of inclusion was sprayed on 1kg of the diet, dried at room temperature and kept in the refrigerator at 4°C until used.

Experimental design and Laboratory procedure

Water quality and mineral contents maintenance

The physic-chemical parameters such as dissolved oxygen level, temperature, and the pH level in the tanks were measured during the experiment using fresh water aquaculture test kit Model AQ-2 (code 3633-03 La Motte) and suitable conditions were maintained by cleaning the tanks and constant changing of water every 2days.

Results and Discussion

Carcass composition of the fish before and after feeding experiment is represented in Table 1. Highest crude protein value of 62.78% was recorded in fish fed with 40ml phytase and the least value of 44.56% was recorded in the control experiment. The summary of the water quality parameter and mineral contents of the water during the experiment is presented in Table 1

Table 1: Mean and standard deviation for water quality parameters of *Clarias gariepinus* reared in plastic tank fed with experimental feed incorporated with microbial phytase.

Parameter	PTA			PTB			PTC			TD		
	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
Nitrate (mg/l)	0.6±0.3	0.2	1.0	0.5±0.3	0.2	1.0	0.6±0.3	0.2	1.0	0.6±0.2	0.2	1.0
Phosphate (mg/l)	1.0±0.3	0.1	1.0	0.5±0.3	0.1	1.0	0.4±0.2	0.1	1.0	0.5±0.3	0.2	1.0
Potassium (mg/l)	1.2±0.2	0.8	1.5	1.1±0.2	0.7	1.3	1.1±0.4	1.0	1.4	1.1±0.1	0.9	1.4
Ph	6.7±0.2	6.0	6.9	6.6±0.2	6.0	6.9	6.6±0.2	6.0	6.9	6.5±0.2	6.1	6.9
Temperature (°C)	27.4±0.5	26.8	29.3	27.1±0.2	26.7	28.0	27.1±0.4	26.5	28.0	27.4±0.3	26.5	29.3
Dissolved oxygen(mg/l)	3.4±1.1	2.0	8.0	3.1±0.8	1.0	4.5	3.1±0.7	2.0	4.5	3.2±0.7	2.0	4.5
Ammonia (mg/l)	2.4±1.0	0.3	4.5	2.0±1.0	0.4	3.5	2.1±0.8	0.5	3.0	1.9±0.2	0.5	3.0

Table 2: Mean proximate fish carcass composition before and after feeding trail

Sample	%CP	% Ash	% EE	%CF	%DM	%MC
PTA	61.28	12.00	8.75	1.50	22.62	77.72
PTB	59.67	12.50	9.05	1.00	22.13	77.88
PTC	62.78	12.00	9.00	2.00	22.31	77.69
TD	44.56	13.50	8.75	1.65	20.41	79.60
Initial value	57.72	7.44	8.00	1.99	26.23	73.77

Keys:
Tank PTA: 20ml of phytase solution with experiment al feed
Tank PTB: 30m1 of phytase solution with experimental feed
Tank PTC: 40m1 of phytase solution with experimental feed
Tank TD: Experimental feed (control). Where: DM = Dry matter, CP = Crude protein, CF = crude Fibre, EE = Ether extract and MC = Moisture content value obtained for treatment PTA, PTB, PTC and TD was 2.4, 2.0, 2.1 and 1.9mg/l respectively. PTA has the highest concentration of ammonia 4.5mg/l, while PTB has the lowest value of 0.4mg/l (Table 5).

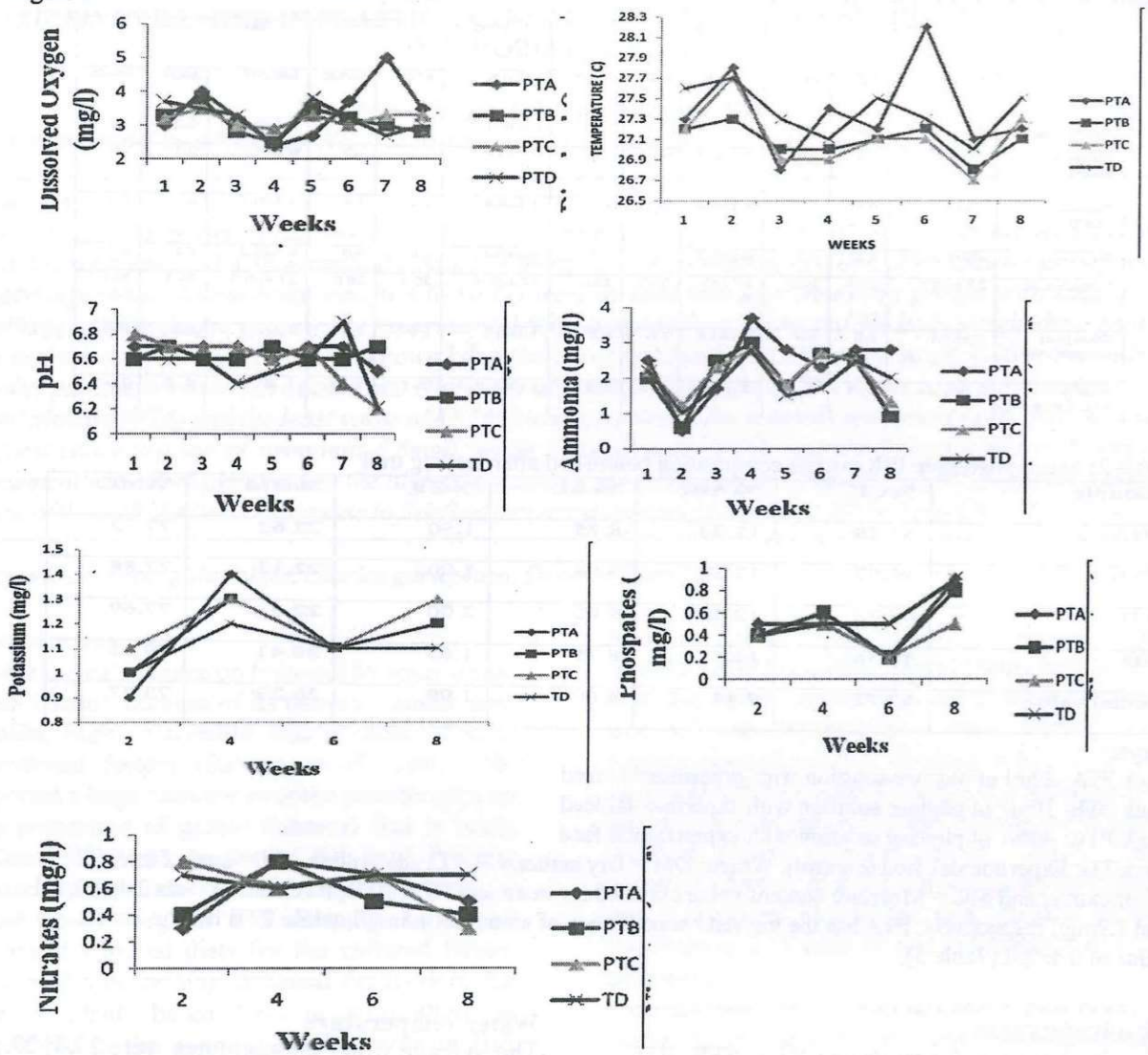
Dissolved oxygen

Dissolved oxygen for treatment PTA, PTB, PTC and TD were 3.4, 3.1, 3.1 and 3.2mg/l respectively. PTA had the highest dissolved oxygen of 8.0mg/l, while PTB had the lowest of 1.0mg/l respectively (Table 1 and Fig.1). Prolonged exposure to low, nonlethal levels of DO constitutes a chronic stress and will cause fish to stop feeding, reduce their ability to convert ingested food into fish flesh, and make them more susceptible to disease.

Water temperature

The average water temperatures were 27.4, 27.1, 27.1 and 27.4°C for treatment PTA, PTB, PTC and TD respectively (Table 1 and Fig. 1). Treatment PTA and TD has the highest water temperature of 29.3°C while PTC and TD has the lowest of 26.5°C respectively (table 5). The optimum temperature range for 'cold water' and 'warm water' fishes are 14-18°C and 24-30°C respectively (Boyd, 1978). All treatment was within the tolerance range. But PTA with highest temperature has the highest survival rate. It has the better FCR than other treatment

Figure 1



Hydrogen ion concentration (pH)

The mean pH recorded for this study was 6.7, 6.6, 6.6, and 6.5 respectively (Table 1 and Fig. 1). All treatments have the highest mean value of pH of 6.9 while PTA, PTB, and PTC have the lowest value of 6.0. The quantity of hydrogen ions (H+) in water will determine if it is acidic or basic. The acceptable range for fish culture is normally between pH 6.5-9.0 (Boyd, 1979). pH obtained for the treatments were within the tolerance range.

Ammonia

The total ammonia concentrations for the maximum value obtained for this study was 4.5mg/l while the calculated toxic ammonia (NH_3) for this study was 0.01mg/l. Boyd, (1998) recorded toxic and non-toxic of < 0.1 mg/l and 0.2 – 2 mg/l respectively. The highest values obtained for PTA could be due to high Protein efficiency ratio.

Potassium

Mean value for potassium of treatment PTA, PTB, PTC and TD were 1.2, 1.1, 1.1 and 1.1mg/l respectively. Treatment1 has the highest potassium concentration 0f 1.5mg/l while PTB has the lowest value of 0.7mg/l. Alabama revealed that potassium concentrations were seldom above 5 mg/l. Kom *et al.*, (2004), suggested that freshwater pond fish grow quite well at sodium and potassium concentrations of 1 or 2 mg/L in waters where TDS concentrations are high enough to allow satisfactory osmoregulation.

Phosphate

Phosphorous is a limiting nutrient needed for the growth of all plants- aquatic plants and algae alike. Phosphate mean concentrations for treatment PTA, PTB, PTC and TD were 1.0, 0.5, 0.6 and 0.6mg/l respectively. All the treatments have the highest phosphate concentrations of 1.0mg/l and 1, 2 and 3 have the lowest values 0.1mg/l respectively.

However, excess concentrations especially in rivers and lakes can result to algal blooms.

Nitrate

Nitrates are the last step in the nitrifying cycle. Nitrates are nontoxic to fish. High nitrate levels contribute to algae bloom. Acceptable ranges for fish culture in ponds is between 0.2 and 10mg/l (Boyd, 1998). The mean concentrations of nitrate were 0.6, 0.5, 0.6, and 0.6mg/l respectively. All the treatments have the highest and lowest nitrate concentrations of 1.0mg/l and 0.2mg/l respectively. It indicates that the values were within the acceptable range.

Highest protein value recorded in PTC (40ml phytase inclusion) could be as a result of higher inclusion of phytase in the feed. Reddy *et al.*, 1982 revealed that higher inclusion of phytase breaks down the undigestible phytic acid (phytate) part found in grains and oil seeds.

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