

Histidine: an amino-acid in the Carcass quality and mineral profile of African Catfish *Clarias gariepinus* (Burchell 1822)

ABSTRACT

150 fingerlings of African catfish (*Clarias gariepinus*) with initial mean weight of ± 5.1 g was stocked in a glass aquaria and were fed to satiation for 156 days. Histidine was used as a supplement to determine the mineral and carcass quality of African Catfish (*Clarias gariepinus*) fingerlings at varying inclusion levels (0, 0.2%, 0.4%, 0.6% and 0.8%) representing D1 – D5 in a formulated diet of 40% crude protein.

The carcass proximate and mineral composition were significantly improved by histidine supplementation but, exhibited no definite pattern of inclination while, moisture decreased significantly with increased histidine level up to diet D5. The calcium composition were significant different ($P < 0.05$) with values ranging between 41.0 and 87.6 mg/gDM.

Keywords: African Catfish, Histidine, mineral composition, Carcass quality.

INTRODUCTION

Aquaculture continues to increase, with a gradual movement from traditional, low cost semi-intensive systems to a more costly and high yielding intensive systems where, processed feed is a major cost aspect. Sequel to this, production from capture fisheries increased from an average of 86.9 million tonnes live weight between 1985 and 1995 to 96.4m tonnes in 2018, aquaculture production increased from 14.9m tonnes to 81.1m tonnes. Of that, 54.3m tonnes was finfish, with another 32.2m tonnes comprising aquatic algae (UNFAO, 2020).

In Nigeria, fish are a cheap source of animal protein, representing about 50% of the total protein intake (Ayinla, 2007). The input needed to increase growth in the aquaculture sector is feeding which represents about 60% - 70% of the total cost of fish production (Nwana 2002).

Emerging evidence from studies with both aquatic and terrestrial animals shows that many Essential amino acids regulate key metabolic pathways that are crucial to the maintenance, growth, reproduction and immune responses. In reality, the role of diets supplemented with histidine in the nutrition, growth, minerals and carcass quality of *Clarias gariepinus* is much more complex and is closely interlinked to the dynamics in the pond system.

The target of feed production is to mix proteins of assorted qualities to obtain the needed Essential Amino Acid (EAA) pattern of the fish. Since protein must be supplied to the fish with sufficient amount of essential amino acids, the lower the protein content in the diet, the higher must be the concentration of these amino acids in the protein (Palavesan and Immanuel 2008). Histidine has long been identified as one of the essential amino acids ranking among methionine, lysine, threonine, valine, leucine, tryptophan, etc. while lipids has been established as esters of fatty acids and glycerol and are principal forms of energy storage, (Gupa and Gupta, 2006).

2.0 MATERIALS AND METHODS

2.1 Experimental Fish Collection

The fish used in this experiment was purchased from YMR farms Housing Estate, Oba-Ile, Akure, Ondo State. Feed ingredients such as include Fish meal, Soyabean, Groundnut Cake, Yellow maize, Vitamin premix, Vegetable oil and starch were obtained at Garl feed mill, Akure.

2.2 Experimental Diets

Five diets was prepared by adding (0, 0.2, 0.4, 0.6 and 0.8%) of dietary histidine supplementation in diets formulated to containing 40% crude protein. The diets are tagged as D1-D5. The numerous ingredients were powdered using hammer mill; weighed, mixed to homogeneity and pelleted using a pelleting machine with a 2mm die holes. 300ml of warm water at 70°C was added to the premixed ingredients and mixed until a dough-like paste was formed. The dough was passed through Hobart pelleting machine (Model A200T). The moist pellets were sun dried to a constant moisture level (< 10%) for 5days, packed in air-tight containers and prior to use and stored in a cool dry place.

2.3 Feeding trials

The experiment which was conducted at the Federal polytechnic Ile-Oluji (FEDPOLEL) Teaching and Research farm. Five dietary treatments (D1-D5) were replicated thrice. A dissolved oxygen level at 7.5-8.35 was maintained throughout the experimental period while the pH ranged between 6.5 and 8.5. The fish was cultured in 15 glass aquaria altogether filled with 5litres of fresh water and cultured for a period of 56 days.

The experimental fish (*Clarias gariepinus*) was acclimatized for 7days. 150 fingerlings with initial mean weight of $\pm 5.1g$ was randomly allotted at the rate of 10 fingerlings per glass tank into five dietary groups tagged as D1 – D5 with each group in triplicate. Fish was fed *ad-libitum* i.e. to apparent satiation twice daily between 7 am – 8 am and 4 pm – 5 pm for 56 days.

Table1: Gross Composition of Experimental Diets (40% CP)

Ingredients	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Fishmeal	30.8	30.8	30.8	30.8	30.8
Soya bean meal	10.3	10.3	10.3	10.3	10.3
Groundnut cake	23.6	23.6	23.6	23.6	23.6
Cotton seed Meal	9.89	9.89	9.89	9.89	9.89
Yellow maize	14.9	14.9	14.9	14.9	14.9
Vitamin Premix	2.50	2.50	2.50	2.50	2.50
Vegetable oil	6.00	6.00	6.00	6.00	6.00
Methionine	0.40	0.40	0.40	0.40	0.40
Lysine	0.20	0.20	0.20	0.20	0.20
Starch	1.41	1.41	1.41	1.41	1.41
Histidine	0.0	0.2	0.4	0.6	0.8

3.0 RESULTS

Table 2: Proximate Composition of Experimental Diets

Parameters	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Moisture	5.67	3.38	3.00	2.67	2.68
Lipid	22.0	22.0	20.0	19.0	20.0
Crude Protein	41.8	41.2	41.2	41.0	41.6
Ash	10.0	9.0	10.0	9.00	9.00
Crude Fibre	4.84	6.64	6.11	5.43	5.99
NFE	15.7	17.8	19.7	22.9	20.8

NFE- Nitrogen Free Extracts

Table 3: proximate composition of *Clarias gariepinus* Fed with Experimental Diets.

Parameters	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Moisture	2.32±0.34 ^b	4.43±1.91 ^{ab}	8.09±2.54 ^{ab}	5.66±4.09 ^{ab}	10.8±5.33 ^a
Ash	12.0±2.00 ^{ab}	12.0±2.00 ^{ab}	11.3±1.15 ^b	16.7±4.16 ^a	12.0±2.00 ^a
Lipid	26.0±1.73 ^a	27.3±1.16 ^a	25.0±6.25 ^a	27.3±3.22 ^a	25.7±1.53 ^a
Crude protein	53.2±1.04 ^a	53.9±3.54 ^a	52.8±4.53 ^a	49.4±2.56 ^a	52.1±6.00 ^a

Means in the same column with different superscripts are significantly different. (P<0.05).

Table 4: Mineral composition of *Clarias gariepinus* fed with Experimental Diets (mg/gDM)

Parameters	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Ca	87.6±0.49 ^a	41.0±1.01 ^e	70.3±0.30 ^c	79.4±0.28 ^b	67.2±0.16 ^d
Phosphorus	76.6±0.73 ^a	51.5±1.60 ^b	43.7±0.29 ^c	72.9±6.21 ^a	55.4±0.59 ^b
Magnesium	5.09±0.52 ^a	4.12±0.21 ^b	2.62±0.45 ^c	5.08±0.16 ^a	4.02±0.54 ^b
Manganese	0.81±0.03 ^a	0.59±0.10 ^c	0.51±0.02 ^c	0.74±0.04 ^{ab}	0.71±0.02 ^b
Zinc	1.35±0.38 ^a	0.98±0.45 ^a	0.94±0.04 ^a	1.00±0.31 ^a	1.11±0.16 ^a

Means in the same column with different superscripts are significantly different. (P<0.05).

4.0 DISCUSSION & CONCLUSION

The results of the carcass analysis of the recents study shows that there were no significant differences (P> 0.05) in the lipid and protein composition. The highest lipid was in fish fed Diet 2 (27.33%). The highest moisture contents were recorded in fish fed Diet5 (10.76) while the least

value was in fish fed diet1. Fish fed diet 2 had the highest protein content with the least in fish fed diet4. There are no significant different ($P>0.05$) in the ash content of the fish fed in all the treatments and values.

Nwanna *et al.*, (2016) indicated that calcium and phosphorus contents of the fish made up about 80-90% of the total minerals making them the most dominant inorganic component in the fish, this was found to be true in the recent experiment as calcium and phosphorus constituted a high proportion in the fish carcass. Other minerals such as zinc and manganese were also presents but in minute's quantity.

Different fish species exhibits wide variations in histidine requirements, (Zehra and Khan, 2014) reports 1.91-2.06% in *Catla catla*. In *Heteropneustes fossilis*, (Khan and Abidi, 2014) reports 3.51 – 3.63g 100g⁻¹ dietary protein which was found to be higher than *Labeo rohita* 2.25g 100g⁻¹ dietary protein (Murthy and Varghese, 1995).

Conclusively, carcass proximate composition and minerals were significantly improved by histidine supplementation. However, the reports of optimum histidine requirements of *Clarias gariepinus* from the present study was found to be about 0.83% of the dietary protein and 0.33g100g⁻¹ protein.

REFERENCE

1. Association of official analytical chemists international aoac,(2006). Official method of analysis, 15th edition. AOAC, inc., arlington, virginia.
2. Ayinla O. A., (2007). Analysis of feed and fertilizers for sustainable aquaculture and development in nigeria: study and analysis of feeds and fertilizers. fao fisheries technical paper no, 497. fao, rome, 453-470pp.
3. Gupta, S.K. and Gupta, P.C. (2006). General and applied ichthyology (fish and fisheries).
4. Chand and Company PVT.LTD, New Delhi, Pp. 954.
5. Halver, J. E. 2002. The vitamins. in: fish nutrition. j. e. halver and r. w. hardy (eds.), 3rd edition. london: academics press. pp. 61-141.
6. Khan, M. A., Abidi, S. F., (2014). Dietary histidine requirements of singhi, *h. fossilis* fry (bloch). aquaculture res, 45, 1341-1354.
7. Khan, M. A., Abidi, S. F., (2009). Optimum histidine requirements of fry african catfish, *c. gariepinus* (burchell). aquac. res. 40, 1000-1010
8. Liang, J. J., Liu, Y. J., Tian, L. X., Yang, H. J., Liang, G. Y., (2012). Dietary available phosphorus requirements of juvenile grass carp (*ctenopharyngodon idella*) aquaculture, nutr, 18, 181-188
9. Murthy, H. S., Varghese, T. J., (1995). arginine and histidine requirements of the indian major carp, *labeo rohita* (hamilton). aquac. nutr. 1, 235-239.
10. M. Y. Diyaware, B. M. Modu And U. P. Yakubu Effects of dietary protein level on growth performancw and feed utilization of hybrid catfish (*heterobranchus bidorsalis x clarias anguillaris*) fry in north-east nigeria. african journal of biotechnology vol. 8(16), pp. 3954-3957.
11. NRC, (National Research Council), (2011). Nutrients requirements of fish. national academy press, washington, d.c., usa.
12. Nwanna L. C. (2002). Performance of hybrid clariid catfish fingerling (*male heterobranchus bidorsalis x female clarias gariepinus*) fed poultry layer waste diets in glass tanks. journal of applied aquaculture, 12(3): 99-106.
13. Nwanna L. C., Omojola I., Abiodun F., (2016). Effects of protein deficiency diets on growth and carcass, protein ash ratio of *clarias gariepinus* (burchell 1822). journal of applied sci. environment managements. volume 18(3) 537-541.

14. Ozorio, R. O. A., Booms, Huisman, E. A., Verreth, J. A. J., (2002). Changes in amino acid composition in the tissues of african catfish (*clarias gariepinus*) as a consequence of dietary l-cartinine supplements. j. appl. ichthyol. 18, 140-147.
15. Palavesan A., And Immanuel G., (2008). Isolation and characterization of lipase-producing bacillus strains from oil mill waste. african journal of biotechnology, 7(15); 2728-2735.
16. Stale J. H., Barbara G. H., (2011). Dietary threonine requirements of atlantic salmon smolts (*salmon salar*). aquaculture 321, 230-236.
17. Tacon Metian,2013 A. G. J. Tacon, M. Metian fish matters: Importance of aquatic foods in human nutrition and global food supply. rev. fish.sci., 21(1)(2013), pp. 22-38
18. Tacon, A.G.J., Cowey C. B., (1985). protein and aminoacidrequirementsin:tytler,p.,calow,p.(eds), fish energetics; new perspectives. croom helm,london.pp. 155-183.
19. United Nations Food and Agriculture Organization (FAO) report, *The State of World Fisheries and Aquaculture,2020*
20. Yu-Jie Gao, Yong-Jian Liu,Xian-Quan Chen,Hui-Jun Yang, Xue-Fei Li, Li-Xian Tian. Effects of graded levels of histidine on growth performance, digested enzymes activities,erythrocyte osmotic fragility and hypoxia-tolerance of juvenile grass carp. aquaculture vol 452, pages 388-394.
21. Zehra, S., Khan, M. A., (2014). Dietary histidine requirements of fingerlings *catla catla* (hamilton) based on growth, protein gain, histidine gain, rna/dna ratio, haematological indices and carcass composition. aquac. res. <http://dx.doi.org/10.1111/are.12558>.
22. Zhao, B., Feng, L., Liu, Y., Kuang, S. Y., Tang, L., Jiang, J., Hu, K., Jiang, W. D., Li, S. H.Zhou, X. Q., (2012). Effects of dietary histidine levels on growth performance, body composition and intestinal enzymes activities of juvenile carp (*cyprinus carpio var. jian*) aquac. nutr. 18, 220-232.