

Evaluation of Growth Performance and Survival Rate of African Catfish (*Clarias gariepinus*) Fed with Graded Levels of Egg Shell Substituted Ration

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Abstract

An eight (8) weeks study was carried out on Four hundred and five (405) African catfish (*Clarias gariepinus*) juveniles to examine the effect of graded levels of egg shell on their growth performance and survival rates. They were acclimatized for two (2) weeks after which they were weighed and allotted into five dietary treatments of three (3) replicates each and 27 fishes per replicate making a total number of eighty-one (81) fishes per treatment. The dietary treatments contained 0, 25, 50, 75 and 100(%) egg shell inclusion from treatment one to treatment five respectively. Parameter on daily feed intake, weekly weight gain and daily mortalities were recorded. The result of the experiment indicated that treatment four (4) with 75% inclusion of egg shell was the best in terms of weight gain and survival rates and was significantly different ($P < 0.05$) when compared with the other treatments. For Catfish farming to remain viable in the nearest future, lower feed cost and increased profit are required; it is therefore recommended that diets of African catfish (*Clarias gariepinus*) be supplemented with well processed egg shell at 75% level of inclusion to achieve this.

Keywords: African Catfish; Egg Shell; Performance; Performance; Survival Rate; Weight Gain

Introduction

African Catfish, *Clarias gariepinus* is undoubtedly ideal aquaculture specie in the world and is widely distributed [1]. It is hardy, adaptable with ability to withstand adverse environmental conditions [2]. It is mostly bred due to its wide range of distribution, tolerance to variable temperature, high feed conversion and accessory breathing organs which enable them to survive for sometimes out of water [3].

Fish needs feeds to grow, irrespective of the good health, quality or condition of their environment and if this is not adequately supplied, a malnourish condition may occur [4,5] stated that inability of aquatic animal to absorb inorganic elements from their external surrounding is one of the major problems among many factors in deciding the mineral requirements quantitatively. There is a general problem encountered in mineral nutrition research such as formulating minerals-free-diet and overcoming tissues stores of minerals. Feed management determines the viability of aquaculture as its accounts for at least 60 percent of the cost of fish production. Fish require a dietary source of calcium and phosphorus to meet their relatively high metabolic requirements.

According to [6] Calcium and Phosphorus make up 70% of the total mineral elements in the body and are essential for the formation of bone, energy transfer through adenosine triphosphate

(ATP) and an essential component of buffer systems in the blood [7]. Noted that Phosphorus is involved in the control of appetite, weight and feed efficiency while [8] asserted that inadequate supply of Phosphorus may lead to severe consequences in terms of reduced performance, excessive mortality, and reduction in carcass quality.

There are various sources of calcium and phosphorus among which are bone meal, egg shell, di-calcium phosphate (DCP) and oyster shell. These sources have different proportion of calcium and phosphorus; some are rich in calcium while others are rich in phosphorus.

Efficient utilization of by-products of poultry has direct impact on the economy and environmental pollution of the country by reducing the loss of potential revenues as well as the cost of disposal of these products [9]. Waste products from the poultry processing especially the egg producing industries could be efficiently utilized and converted into useful products of higher value [10]. Egg shell is one of such by-products from the egg producing industries which contains calcite, a crystalline form of calcium carbonate that serve as bone building materials [11]. It was reported that 94% of a dry shell is calcium carbonate with a typical mass of 5.5g while the remaining mass is composed largely of phosphorus and magnesium and some trace amount of sodium, potassium, zinc, manganese, iron and copper (Gary, et al. 2004). Based on the findings of [12]

egg shells are useful by-product that can be used as supplements to supply calcium to a reasonable level in the diet of African Catfish (*C. gariepinus*). It therefore becomes imperative to reduce the expenses on Catfish farming by employing the use of well processed egg shell as substitute for other expensive feed ingredients in their diets. The aim of the study is to determine the effect of graded level of egg shell on the growth performance, carcass characteristics and survival rate of African catfish juveniles.

Materials and Methods

Experimental Site

The experiment was carried out at the fishery unit of the teaching and research farm of Federal College of Agriculture, Moor plantation, Ibadan.

Experimental Design

Four hundred and five (405) African Catfish juveniles of weight ranging from 72 - 76g were purchased from Aquatech Nigeria limited, Ibadan. They were acclimatized for two (2) weeks after which they were weighed and allotted into five dietary treatments of three (3) replicates each and 27 fishes per replicate.

Experimental diets comprise 0, 25, 50, 75 and 100(%) graded levels of egg shell mixed with compounded feed from treatment 1(T1) to treatment 5 (T5) respectively.

T1 = compounded feed + 0% inclusion of egg shell (control)

T2 = compounded feed + 25% inclusion of egg shell

T3 = compounded feed + 50% inclusion of egg shell

T4 = compounded feed + 75% inclusion of egg shell

T5 = compounded feed + 100% inclusion of egg shell

Egg shell used obtained from God's will hatchery, Oluyole, Ibadan was air dried for a week and grounded to powder afterwards.

Ingredients (%)	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)
Maize	10.00	10.00	10.00	10.00	10.00
Soya bean meal	45.24	45.24	45.24	45.24	45.24
Fish meal	27.78	27.78	27.78	27.78	27.78
Bone meal	2.50	1.88	1.25	0.63	0.00
Egg shell	0.00	0.63	1.25	1.88	2.50
Starch	11.98	11.98	11.98	11.98	11.98
Vitamin pre-mix	2.50	2.50	2.50	2.50	2.50
Total	100.00	100.00	100.00	100.00	100.00

Table I: Gross Composition of the Experimental Diets.

Experimental diets were given twice daily (in the morning and evening) using 4% of their body weight. Water replacement was done weekly to improve its quality and reduce pollution. Weight measurement per replicate were carried out on weekly basis and early in the morning to reduce stress, record on daily feed intake, weekly body weight gain and mortalities were also taken.

Experimental diets	Crude Protein (%)	Crude fat (%)	Crude Fibre (%)	Ash (%)	Moisture (%)	Dry matter (%)
Treatment 1	41.86	3.18	2.67	9.76	8.65	33.88
Treatment 2	42.45	3.25	2.49	10.86	8.54	32.41
Treatment 3	41.97	3.29	2.53	10.69	8.74	32.78
Treatment 4	45.59	3.15	2.74	9.97	8.48	33.07
Treatment 5	42.78	3.31	2.44	10.95	8.26	32.26
Test ingredient	0.14	0.08	0.13	11.28	6.11	82.26

Table 2: Proximate Composition of the Experimental Diets.

%Ca	%P	%Na	%k	%Mg	Fe (mg/kg)	Mn (mg/kg)	Cu (mg/kg)
29.38	0.07	0.17	0.49	0.24	22618.00	118.00	1.20

Table 3: Mineral Composition of the Test Ingredient.

Statistical Analysis

Data collected was subjected to analysis of variance (ANOVA) using SAS statistical package (SAS, 1999). Means were separated using Duncan multiple range test.

Results

Table 2 showed the effect of egg shell inclusion on the growth performance and survival rates of catfish (*Clarias gariepinus*). Significant differences ($p < 0.05$) across the different dietary treatments was recorded on final weight and total weight gain while the other parameters were not significantly different ($p > 0.05$).

Fishes in treatment 4 had the highest value of final weight (11.67g) while treatment 2 recorded the lowest (7.00g). The total weight gain across the dietary treatment follows the same trend as the final weight.

Parameters	T1	T2	T3	T4	T5
Initial weight(g)	2.67	2.67	2.67	2.67	2.67
Final weight (g)	7.00 ^c	8.33 ^b	9.67 ^{ab}	11.67 ^a	8.00 ^c
Total weight gain(g)	4.33 ^c	5.66 ^b	7.00 ^{ab}	9.00 ^a	5.33 ^c
Average weight gain (g)	0.54	0.71	0.89	1.13	0.67
Survival rate (%)	52.00	55.00	68.00	74.00	50.00

Table 4: Effect of Graded Levels of Egg Shell on the growth Performance of African Catfish (*Clarias Gariepinus*).

Means on the same row with different superscripts are significantly different (P < 0.05).

Table 3 showed the effect of egg shell inclusion on the carcass analysis of catfish (*Clarias gariepinus*). The fishes in treatment yielded the best live weight (12.67g) and were significantly different (P < 0.05) from fishes in the other treatments. Egg shell inclusion did not have any significant effect (P > 0.05) on the live weight of T1, T2 and T5 but had significant effect on T3 and T4. The whole body with or without intestine and bone revealed significant differences among T1, T4 and T5. However, the intestine, head with gill and muscle weight were not significantly different with graded level of egg shell in their diet. The mid rib of fishes in T4 had the highest value (5.17g) followed by T3 and T5 (4.00g) and finally T1 and T2. The length of tail fin and head fin revealed similar pattern among the dietary treatments with T4 having the best value of 0.97 and 0.48 for tail and head fin respectively. Weight of head without gill was highest and significantly different in treatment 4 when compared with other treatments.

Parameters	T1	T2	T3	T4	T5
Live weight (g)	8.33 ^b	8.33 ^b	9.67 ^{ab}	12.67 ^a	8.00 ^b
Whole body with intestine and bone (g)	7.43 ^b	8.00 ^{ab}	9.33 ^{ab}	11.33 ^a	7.33 ^b
Whole body without intestine and bone (g)	5.33 ^b	5.33 ^b	6.00 ^{ab}	9.10 ^a	5.27 ^b
Intestine (g)	0.23	0.47	0.48	0.83	0.23
Head with gill (g)	3.33	3.00	3.33	4.00	3.33
Head without gill (g)	2.67 ^b	2.53 ^b	3.00 ^{ab}	3.67 ^a	2.67 ^b
Tail fin(cm)	0.63 ^b	0.67 ^b	0.73 ^{ab}	0.97 ^a	0.83 ^{ab}
Head fin (cm)	0.31 ^b	0.33 ^b	0.37 ^{ab}	0.48 ^a	0.42 ^{ab}
Muscle (g)	3.33 ^a	2.87 ^a	3.67 ^a	4.67 ^a	3.67 ^a
Mid rib (g)	3.67 ^{ab}	3.33 ^b	4.00 ^{ab}	5.17 ^a	4.00 ^{ab}
Eye (cm)	0.16 ^b	0.17 ^b	0.19 ^{ab}	0.24 ^{ab}	0.26 ^a

Table 5: Effect of Graded Levels of Egg Shell on the Carcass Characteristics of African Catfish (*Clarias Gariepinus*).

Means on the same row with different superscripts are significantly different (P < 0.05).

Discussion

The effect of 0% level of inclusion of egg shell in treatment 1 gave the least weight gain (4.33g). This could be as a result of deficiency of mineral caused by dietary imbalance of calcium and phosphorus as stated by Nakamura (1982). It was observed from the study that treatment four (4) with 75% egg shell inclusion had the best final weight of 11.67g. This supported the findings of [13] who reported that fish with adequate supplement apart from the main feed gain body weight faster. The result is also in line with the findings of [14] who observed better growth rate after supplementing their diet with 75% of egg shell.

Conclusion

The aim of any aquaculture business is to reduce income spent on feed, increase capital income of the owner and improve the nutritional yield of its consumer. It can be concluded from the study that egg shell at the rate of 75% should be used as supplement to replace bone meal in the diet of African Catfish (*Clarias gariepinus*) as it has been discovered to yield preferably weight gain and high survival rate.

Hence, there is a need to boost the production of this highly demanded cultured fish with low-cost balanced diet feed for aquaculture sustainability and food security in Nigeria.

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