Effects of Supplementing Fish Meal with Garden Snail (*Limicolaria* Spp.) In *Clarias gariepinus* Diets

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Abstact: Fingerling *C. gariepinus* of mean weight 3.0g were stocked 20 fish per trough in a mini flow-through system consisting of fifteen troughs and fed diets containing 0%, 25%, 50%, 75%, 100% of garden snails as replacement for fish meal for 42 days. Each treatment was replicated thrice. It was observed that garden snails were better utilized than fish meal as the fish fed 25% garden snail had a superior growth to the control. There was no significant difference (P.0>05) in the mean weight gain, food conversion ratio, specific growth rate, gross feed conversion efficiency and condition factor of fish fed the varying levels of garden snail. The fish fed 75% garden snail had a lower growth as a result of mortality. It is suggested that 25% garden snails can be efficiently utilized in *C. gariepinus* diets. This study also showed that the protein quality of garden snails compares well with that of fish meal. [Report and Opinion. 2010; 2(1):58-62]. (ISSN: 1553-9873).

Key word: effect; supplementing; fish meal; garden snail

(1) Introduction

The feeding cost of fish takes 60% or two third of the total operational cost in fish farming (Lovell 1981, NRC 1983, Niamat and Jafri 1984, Akiyama 1988). This has been a major factor affecting the development and expansion of Aquaculture enterprise in Africa. The success of fish farming depends invariably on provision of suitable and economical fish feed. A survey of fish farms in Nigeria in 1995 showed 86% of fish farms do not use standard supplementary feed due to high cost of production (Eyo 1995).

Fish meal which forms the major component of fish feed is scarce, highly competed for by other animals and is the source of the high costs in formulation. The quest to reduce the quantity of fish meal while maintaining the protein quality in fish feed has been the focus of fish nutritionists for several years. Several studies on replacing fish meal with plant protein (Lim and Dominy 1990, Shiau *et al* 1990) and other animal sources have also been attempted, mussels (Guerrero 1982), crabs and frogs (Smith *et al* 1988), lizard (Fagbenro 1993, Faleye 1992), periwinkle (Akegbejo 1999) and blended poultry meat meal (Sadiku and Jauncey 1995). *Limicolaria* sp. is a gastropod mollusc which is very common during the rainy season and can be reared in large quantity for the purpose of incorporating it in feed. Snail meal was found to be comparable to fish meal as supplemental protein source in poultry layer diets. Chick growth trial showed that weight gain was similar to fish meal. Odaibo (1997) reported that boiling snails for 10 to 15 minutes or drying improves performance. This study was conducted to investigate the level of utilization, growth and acceptability of garden snails in *C. gariepinus* diets.

(2.1) Diet preparation:

Garden snails were collected from vegetation around the experimental area. The shells were cracked and the soft parts removed. The viscera mass were cut off, leaving the foot and the mantle. They were washed with alum in several changes of clean water to remove slime. They were boiled for 15 minutes and oven dried at 110^0C for 8 hours. The snails were taken to the mill and ground into powder. Soya bean was prepared by toasting to remove the effect of trypsin inhibitor. The groundnut cake, yellow maize, fish meal and the toasted soya bean were ground separately.

Table 1: Percentage Composition of Ingredients in Experimental Diets (g/100g)

Ingredients	DI (0%)	DII (25%)	DIII (50%)	DIV (75%)	DV (100%)
Fishmeal	27.50	20.63	14.45	6.88	0.00
Snail meat meal	0.00	7.27	15.02	22.29	29.05
Yellow maize	19.10	18.70	18.13	17.43	17.55
Groundnut cake	23.20	23.20	23.20	23.20	23.20
Soyabean meal	23.20	23.20	23.20	23.20	23.20
Vitamin and Mineral premix	2.00	2.00	2.00	2.00	2.00
Palm oil	2.50	2.50	2.50	2.00	2.50
Common salt	0.50	0.50	0.50	2.50	0.50
Bone meal	1.00	1.00	1.00	0.50	1.00
Binder	1.00	1.00	1.00	1.00	1.00

Table 2: Proximate Composition of Dietary Ingredients (g/100g dry matter) fed to *C. gariepinus* for 42 days

Ingredients	%Crude protein	% Lipid	% Crude fibre	% Ash	%Dry matter
Fishmeal	71.33	7.97	1.08	20.22	90.22
Snail meal	66.76	7.85	4.10	6.84	91.0
Yellow maize	10.77	3.56	3.47	1.94	90.42
Soya bean meal	46.21	24.76	4.70	2.87	91.64
Groundnut cake	40.59	23.39	6.03	6.20	92.41

The calculated quantities were weighed out and mixed with the specific quantities of palm oil, salt, vitamin and mineral premix, bone meal and starch as a binder. Five different diets were formulated containing 0%, 25%, 50%, 75%, 100% garden snail respectively. All five diets were iso-nitrogenous containing 42.5% crude protein. Table 1 shows the percentage composition of the ingredients in the varying diets. In order to pellet the diets boiling water was added to the properly mixed ingredients. The pellets were sun-dried until the moisture content was very low.

(2.2) Calculation of Growth Parameters

The growth parameters were calculated as follows:

$$SGR = \frac{\ln \text{final weight} - \ln \text{of Initial weight}}{\text{Time (days)}}$$

SGR= Specific Growth Rate

FCR = Feed consumed (g)/weight gain (g)

FCR= Food Conversion Ratio

PER=live weight gain (g)/protein consumed

PER= Protein Efficiency Ratio

$$GEFC = \frac{1 \times 100}{FCR}$$ Sveier, et al 2000

GEFC= Gross Efficiency Food Conversion

PI = Total Food Intake x crude protein of feed (%)

PI= Protein Intake

$$PS = \frac{\text{Total number of fish harvested} \times 100}{\text{Total number of fish stocked}}$$

PS= Percentage Survival

$$\text{Condition Factor (CF)} = \frac{100 \times \text{WEIGHT}}{L^3}$$

(2.3) Proximate Analysis and Statistical Analysis
The proximate composition of the varying ingredients (Table 2) were carried out according to AOAC (2000). The statistical analysis was done using computer package SPSS version 10, T- test for one sample was applied.

(2.4) Fish Stocking and Feeding
Fingerling *Clarias gariepinus* were obtained from the Genetic Improvement Laboratory of National Institute for Freshwater Fisheries Research New Bussa, Niger State Nigeria. They were acclimatized for one week and stocked 20 fingerlings per trough while ensuring that the variation in weight is minimized. Fifteen plastic troughs were stocked replicating the five treatments thrice. Feeding was carried out *ad- libitum* using 42.5% crude protein feed twice daily (8am and 6pm) for 42 days.

(2.5) Experimental design, Aeration and Water Exchange
Aeration and renewal of water was carried out by sprinkling from a 2mm hose which receives biologically filtered water from overhead tanks. The flow through system consists of an outlet pipe situated at the centre of the trough. It was perforated and covered with a sleeve which controls the level water at any point in time.

(3) Result Analysis

(3.1) Survival and Effect of Garden Snail on Fish
Survival was high in all fish fed the varying levels of snail meal (Table 3). There was no significant difference ($P>0.05$) in the survival rates of each treatments. Fish fed 25% garden snail inclusion had the highest mean weight gain while the lowest was with fish fed 75% garden snail meal (Table 3). There was no significant difference in the SGR of fish in all diets. The SGR, GFCE, PER were highest with fish fed diet containing 25% garden snail. The FCR was lowest with this feed also. Table 4 shows the nutrient utilization of *C. gariepinus* during the rearing period. It was observed that the fish fed 25% and 50% garden snails had the best condition factor while all others fell below.

Table 3: Growth Performance and Survival of *C. gariepinus* Fingerlings Fed Varying Levels of Garden Snail For 42 days

Growth Parameters	**DI 0%**	**DII 25%**	**DIII 50%**	**DIV 75%**	**DV 100%**
Mean Initial Weight	2.77	3.47	3.07	2.94	2.95
Mean Final Weight	4.55	5.96	5.01	4.50	4.88
Mean Initial Length	8.00	8.60	7.80	8.60	8.20
Mean Final Length	8.50	8.90	9.10	9.10	8.30
Mean Weight Gain	1.78	2.49	1.94	1.56	1.93
Specific Growth Rate	0.51	0.56	0.51	0.44	0.52
Condition Factor	0.34	0.40	0.40	0.25	0.35
Percentage Survival	97.50	100	100	92.50	97.5

Table 4: Nutrient Utilization of *C. gariepinus* Fed Varying Levels of Garden Snail in Diets

Nutrient utilization parameters	**DI 0%**	**DII 25%**	**DIII 50%**	**DIV 75%**	**DV 100%**
Mean Weight Gain	1.78	2.49	1.94	1.56	1.93
Mean Feed Intake	2.10	2.73	2.25	2.01	22.25
Total Feed Intake	12.61	16.38	13.52	12.05	13.49
Feed Conversion Ratio	1.18	1.10	1.16	1.229	1.16
Gross Feed Conversion Ratio	84.75	90.91	86.21	77.52	86.21
Protein Intake	5.36	6.96	5.75	5.12	5.73
Daily Protein Gain	4.54	6.35	4.96	3.97	4.92
Protein Efficiency Ratio	0.85	0.91	0.86	0.77	0.82

(4) Conclusion

The positive growth recorded in this study shows *C. gariepinus* acceptance and utilization of garden snails in the diets. There was no significant variation (P>0.05) for FCR, GFCE, PER and SGR in all the levels of garden snails presented compared to the diet without garden snail. This indicates that the protein quality in the garden snails compares well with that of fishmeal. The superior growth of fish fed diet containing 25%, 50%, and 100% garden snails over the control shows higher level of utilization of these diets. The growth of the fish also shows there is no growth suppressive component in garden snail meal. Growth depression has been observed with other snails such as golden snail in poultry feed (Serre, 1998). With this level of acceptance and utilization the use of garden snails in the diet of *C. gariepinus* will go a long way in reducing the high cost of rearing fish and improve production through aquaculture. Since garden snails can be produced at little or no cost on farm using decaying wastes from farm and households this non- conventional resource should be explored. The lower growth recorded with fish fed diet containing 75% garden snails was as a result of mortality. The water quality parameters were at conducive levels and there was high acceptability of feed and so the immediate cause of the mortalities could not be ascertained. It may be due to stress as it occurred during the second week after stocking. The acceptance of garden snail by *C. gariepinus* corroborates its acceptance by ducks and Tilapia although the levels of acceptance in the latter were high 50% and 75% respectively (Keraten, 1998; Serra, 1998)

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