SUBSTITUTING FISH MEAL WITH GRASSHOPPER MEAL IN THE DIET OF *CLARIAS GARIEPINUS* FINGERLINGS.

By

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ABSTRACT.

The effect of inclusion of grasshopper meal on the growth, feed conversion ratio and survival of Clarias gariepinus fingerlings of mean weight, 9.71g was investigated. The results show that the best growth and food utilization indexes were recorded in the fingering fed with 10% grasshopper meal and 30% fish meal while the poorest growth and food utilization indexes were recorded with the diet containing 25% grasshopper meal and 15% fish meal. The best survival of 100% was observed in the diet containing 30% grasshopper meal and 10% fish meal while the worst survival of 73.3% was observed in the diet containing 25% grasshopper meal and 15% fish meal

INTRODUCTION

Catfish is very important in the sustainability of aquaculture industry in Nigeria. In spite of the breakthrough in the artificial propagation of the African catfish species (Madu *et al*, 1988 and Madu, 1990), demand for fingerlings in the expanding industry still outstrips the supply. The increasing human population and the desire to obtain a nutritionally balanced level of protein intake is the major cause of the high fish demand in Nigeria.

Fishmeal is used extensively as a source of protein in fish feed because of its unrivalled nutritive value. Compared with other commercially used protein sources, fishmeal has the highest biological value; higher in digestible energy; rich in available lysine and methionine, minerals, vitamins and perhaps, unidentified growth factors required by fish (Lovell, 1981; Eyo and Ngugu, 1989). Although fishmeal has been recognised as the best source of animal protein for most fish species, it is relatively expensive. As a result, numerous attempts have been made to replace fishmeal in fish feed with other less expensive feedstuffs (Jackson *et al*, 1982). Research on partial replacement of fishmeal with kidney bean and pigeon pea for *Clarias Gariepinus* has been carried out by Adeparusi (1994) and Adeparusi and Balogun (1998). Fagbenro (1999 a, b, c, d), used winged beans as a protein feedstuff in fish meal-free diets for *Clarias gariepinus*. Akegbejo-Samsons (1999), used periwinkle flesh to replace fish meal in the diet of *C. gariepinus*; Arowosoge (1987), used cotton seed meal while Fasakin and Balogun (1996) worked on groundnut cake.

In the last decade, much effort has been made in the use of soya bean meal as a good replacement for fishmeal in the diet of *C. gariepinus* (Balogun and Ologhobo, 1989; Sadiku and Jauncy, 1998 a, b; Fagbenro and Davies, 2002; Fagbenro and Davies, 2003; Eyo, 1990 and 1999; Davies *et al*, 1999). The search for less expensive feedstuffs to replace fish meal in the diet of *Clarias gariepinus* has stimulated this study which is aimed at substituting fish meal with grasshopper meal in the diet of *Clarias gariepinus* fingerlings.

MATERIALS AND METHODS

Clarias gariepinus fingerlings (mean weight, 9.71g) used for this study were obtained from the outdoor tanks of the National Institute for Freshwater Fisheries Research's Hatchery complex and acclimated in an open hatchery trough for three days. During acclimation, they were fed with commercial feed of 40% crude protein level at 5% of their body weight twice daily.

Twenty fingerlings of *C. gariepinus* were later randomly selected and distributed into each of the 18 experimental flow-through bowls of 25 litre capacity. A constant volume of 20 litres was maintained throughout the study. Each bowl was assigned to one of the experimental diets (Table 1) containing different levels of grasshopper meal and fishmeal in three replicates. Experimental diets were prepared according to methods described by Ufodike and Matty (1983).

At the onset of the feeding trials, the catfish fingerlings were weighed with Acculab electronic top-loading balance and fed twice daily (morning and evening) at 5% body weight with the daily ration divided into two. Sampling of the experimental fish, clearing of faecal matter and changing of water were done weekly in each plastic bowl. The mean weights of the fingerlings were obtained using the same balance mentioned above and mortality in each bowl was estimated at the end of the 8-week experimental period. The six experimental diets were analysed for crude protein, crude fibre, crude lipid, moisture content, total ash and carbohydrate (NFE) using standard methods described by AOAC (1990). The following water quality parameters were monitored weekly using standard methods described by APHA (1980): temperature, pH, total alkalinity and dissolved oxygen. Mean growth rates of the fingerlings and food utilization were obtained in the form of mean weight gain, mean relative growth, specific growth rate and food conversion ratio, all calculated with recommended formulae. The results obtained were subjected to statistical analysis using Duncan's Multiple Range Test at 95% confidence level.

Table 1. Composition of the experimental diets fed to *C. gariepinus* fingerlings for 8 weeks.

Ingredients	D1	D2	D3	D4	D5	D6
Grasshopper meal	10	15	20	25	30	-
Fish meal	30	25	20	15	10	40
Ground nut cake	20	20	20	20	20	20
Yellow maize	23	23	23	23	23	23
Soya bean meal	7	7	7	7	7	7
Vegetable oil	5	5	5	5	5	5
Vitamin\ mineral premix	5	5	5	5	5	5

RESULTS AND DISCUSSION

The water quality parameters monitored throughout the experiment were within tolerable range for cultured warm water fish (Table 2) as recommended by Boyd and Lichtkoppler (1979). The proximate composition of the experimental diets did not show much variation in the nutrients of the various diets except diet D6 which had no grasshopper meal (Table 3). Diet D5 had a

higher level of crude fibre than the other diets ($P < 0.05$) possibly due to the higher level of grasshopper meal since grasshopper has exoskeleton made of chitin.

Table 2. Mean water quality parameters measured during the experimental period

Parameters	Range	Mean
Temperature (°C)	27.0 – 29.5	28.50
pH	6.9 – 7.1	7.05
Dissolved Oxygen (mg/l)	6.95 – 7.45	7.20
Alkalinity (mg/l)	20.25 – 25.63	22.95

Table 3. Proximate composition of experimental diets fed to *C. gariepinus* fingerlings for 8 weeks.

Composition	D1	D2	D3	D4	D5	D6
Crude protein	31.06	32.37	33.04	30.87	29.24	48.55
Crude fibre	14.36	14.66	16.83	16.74	18.96	4.32
Crude lipid	13.25	15.75	18.47	17.58	15.85	10.81
Moisture	5.41	4.52	5.03	5.04	5.48	9.53
Ash	4.62	6.15	4.47	4.01	5.67	6.56
NFE (carbohydrate)	31.35	26.15	21.71	25.75	24.80	20.23

With a range of 9.3 – 10.1g and a mean weight of 9.71g, there were no significant differences among the initial weight of the fingerlings ($P > 0.05$) at stocking. However the final weights for most of the treatments showed significant difference ($P < 0.05$, Table 4). The various

diets have been shown to produce different effects on the growth of *C. gariepinus* fingerlings. From the mean cumulative weight increases (Fig 1), it was observed that diet D1 had the highest weight gain and together with diet D6 were significantly higher than the results obtained in other diets ($P < 0.05$). Other growth and food utilisation parameters like specific growth rate (SGR) and food conversion ratio (FCR) followed the same growth pattern as the cumulative weight increases (Table 4). This indicates that 10% grasshopper meal/30% fishmeal led to the greatest increases and best food utilisation by the fingerlings of *C. gariepinus*.

Many researchers who have worked on various substitutes of fishmeal for *C. gariepinus* feed obtained various results. Faturoti and Oyelese (1989), found yellow maize and sweet potato as good energy source in the diet of *C. gariepinus* while Eyo and Ngugu (1989), Eyo (1999), obtained poor growth rate while feeding *C .anguillaris* with soyabean diet. In this study, an attempt has been made to incorporate grasshopper meal into the diet of *C. gariepinus*. All the diets showed good performance (Table 4) but diet D1 had higher performance than other diets closely followed by diet D6 which had no grasshopper meal but high fish meal (40%) and high level of protein (48.5%). This confirms earlier findings by Ufodike and Ekokotu (1986) that excess levels of dietary protein might retard fish growth due to energy expenditure in deamination and excretion of excess protein. Fingerlings fed diets D4 and D5 had poor growth performance possibly because of low protein value and high level of crude fibre in them.

The survival rate in the treatments ranged from 73 33% in treatment D4 with the least growth performance to 100% in treatment D5. Generally, the survival rate was good in most of the treatments.

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Table 4. Growth and food utilisation of *C. gariepinus* fingerlings fed experimental diets for 8 weeks.

Parameter	D1	D2	D3	D4	D5	D6
Initial weight (g)	10.1	10.1	9.3	9.6	9.3	9.9
Final weight (g)	45.0	34.2	32.4	16.2	18.7	42.9
Weight gain	34.9	24.1	23.1	6.6	9.4	33.0

n (g)						
Weight gain (%)	34.56	23.86	25.92	68.8	100.1	33.33
Specific growth rate	2.67	2.18	2.23	0.93	2.25	2.62
Food conversion ratio	0.35	0.45	0.45	1.12	0.85	0.40
Survival (%)	95.00	93.33	95.00	73.33	100.00	91.66

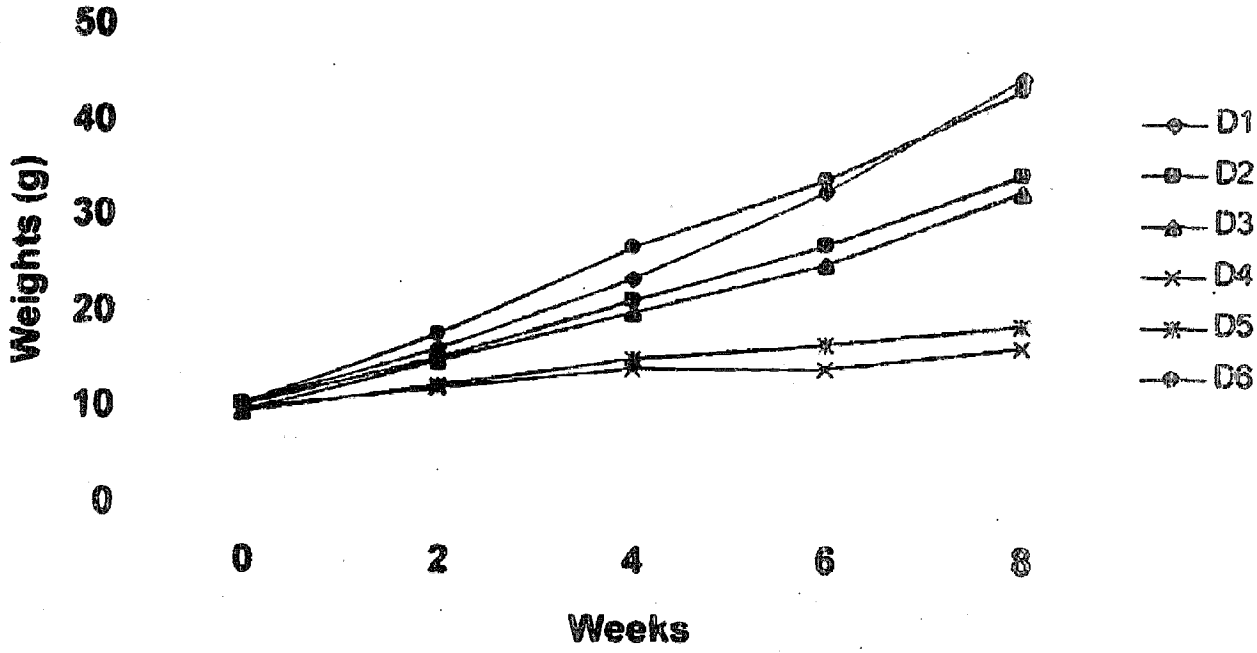

Fig. 1 Cumulative weight increases of C. gariepinus fed fingerlings experimenta diet for 8 weeks.l

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