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Effects of Grasshoppermeal in the Diet of *Clarias gariepinus* Fingerlings

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Abstract:

A study was conducted to assess the effects of grasshopper meal in the diet of Clarias gariepinus fingerlings. The aim was to substitute fishmeal with grasshopper meal in the formulation of Clarias gariepinus fingerlings feed. Feeds were formulated using different quantities of fishmeal and grasshopper meal and were used in feeding Clarias gariepinus fingerlings. Result shows that the best growth and feed utilization indices were recorded in the fingerlings fed 20% fishmeal and 10% grasshopper meal followed by those fed 15% fishmeal and 15% grasshopper meal. The least growth rate was recorded in fingerlings fed only 30% grasshopper meal. It could be concluded that Clarias fed with diet containing 10% grasshopper meal combined with 20% fishmeal produced the best growth rate.

Key words: Growth, Grasshopper meal, *Clarias gariepinus,* Fingerling.

Introduction

Fish is the major source of protein for most Nigerians. The increasing human population and the desire to obtain a nutritionally balanced level of protein intake is a major cause of the high fish demand in Nigeria. Aquaculture which is expected

to bridge the gap between fish supply and demand is constrained generally by inappropriate technologies (Ajana, 2002).

Fish feed is presently very expensive; both imported and locally produced ones. This is among the problems facing successful aquaculture in Nigeria coupled with good quality fish Falaye (2003). This is as a result of the competing need of the agricultural produce and by-products between man and livestock Salami *et al*., (1992) and between livestock and fish in the formulation and production of the animal feed. Various protein sources have different amino acids, both essential and non-essential. A deficiency of one or more of these essential nutrients results in reduced growth rate, depressed diet, disease or even death NRC (1993).

In the last decade, much effort has been made with the use of soybean meal as a good alternative to fishmeal in the diet of *Clarias gariepinus* Balogun and Ologhobo (1989), Sadiku and Jauncy (1998a, b), Fagbenro and Davies (2002), Fagbenro and Davies (2003), Eyo (1990, 1999) and Davies *et al.,* (1999). Many researchers have attempted to use varied substitutes to fishmeal in *Clarias gariepinus* production with varying results. Faturoti and Oyelese (1989) found yellow maize and sweet potato as a good energy source in the diet of *Clarias gariepinus* while, Eyo (1999) obtained poor growth rate while feeding *Clarias anguillaris* with soybean diet. Ufodike and Ekokotu (1986) confirm that excess levels of dietary protein might retard fish growth due to energy expenditure in deamination and excretion of excess protein. Ofojekwu and Ejike (1984) also obtained poor results with cottonseed meal in Clarias food.

Edible Grasshoppers and locusts which include Nomadacris septemfasciata, Kraussaria sp., Katantop sp., Anacridium sp., Cataloipus sp., Hieroglyphycus sp., Gelestorhinus sp., and Locusta sp. are found to invade most of the North-eastern and Central States of Nigeria at a particular season of the year causing great consequences on crops Sharah

(2012). These grasshoppers also serve as a delicacy to nation of North Eastern Nigeria during these invasions. These grasshoppers are as rich as the fishmeal in terms of its amino acid profile.

Table 1: Comparative Amino acid profile of the proteins of fishmeal and grasshopper meal

Amino acid	Fish meal	Grasshopper meal
Lysine	7.85	5.87
Histidine	2.22	4.24
Arginine	5.82	7.62
Aspartic	9.35	9.32
Threonine	4.55	4.08
Serine	4.55	5.22
Glutamic	13.3	15.21
Proline	4.35	5.02
Glycine	5.90	4.78
Alanine	6.34	5.29
Cysteine	0.70	1.79
Valine	5.65	3.47
Methionine	2.84	1.96
Isoleucine	4.85	4.21
Leucine	7.35	5.30
Tyrosine	3.45	2.88
Phenylalanine	4.35	4.50

SOURCE: Okoye(2003).

Encouraged by the similarity in the quality of the amino acid profile of fish and grasshopper meal, this research decided to replace fishmeal with grasshopper meal to ascertain if these qualities of the grasshopper can compare favorable in growth production of *Clarias gariepinus* as that obtained or fishmeal in the same species.

Materials and Methods

Preparation of grasshopper meal

Samples of edible grasshoppers and locusts were collected from the market located in Maiduguri irrespective of their sizes and species. The samples were dewinged, all appendages removed, sundried and crushed into powder with milling machine.

Proximate analysis of the powdered samples was performed using standard methods AOAC (1995). Fibre content was assessed according to Cullison (1979). The protein was measured by calorimetric method (Vanadomolybdale yellow method) with a varian 634UV visible spectrometer. Crude protein was calculated as total Kjeldahl N x 6.25.

Experimental Diet

The feedstuffs used were obtained locally within Maiduguri town. The soybean was toasted for 15minutes according to Eyo (1999). Other ingredients such as groundnut cake, fishmeal, yellow maize, maize bran were obtained and ground into powder with the toasted soybean and grasshopper. A 45% cp feed was obtained from the combination of the feed ingredient in the diet and mixed with the premix.

Different diets (those containing only fishmeal and those containing grasshopper meal at various inclusion levels) were formulated using different treatments which include feed containing only fishmeal, feed containing only grasshopper meal and feed containing both fishmeal and grasshopper meal. The feed was pelleted using kitchen hand cranker. The pelleted feed was crushed into crumbles before administering them to the fish.

Table 2: Product file for formulating 45% crude protein for *Clarias gariepinus*

FEEDSTUFFS	%INCLUSION LEVEL
Yellow maize	10.11
Groundnut cake	25.80
Soybean meal	25.80
Fishmeal/grasshopper meal	30
Cassava tuber starch	5
Premix (vitamin)	2
Salt	0.29
Bone	1
Total	1oo.oo

Experimental Design and Treatments

Fingerlings weighing between 15 -20g were obtained from the hatchery and conditioned in net hapa (1m x 1m x 1.2m) installed in 11m x 10m x 1.2m concrete tank for 48hours. The fish were stocked at 10 fish per meter square. Five different diets were tried with two replicates for each treatment for a period of 56 days. Below is a table showing the different treatments inclusion level.

Table 3: Experimental Design with Grasshopper/ Fishmeal inclusion in the diets

Treatments	Fishmeal inclusion (%)	Grasshoppermeal Inclusion (%)
1	30	-
2	20	10
3	15	15
4	10	20
5	-	30

Fish in all treatments were fed 5% of their body weight daily split into two feeding frequency and the weight were recorded bi-weekly. Feeding rate was adjusted weekly based on body weight. Water quality parameter such as temperature and pH were monitored.

At the end of the research, weight gained (g), daily average growth rate (ADG), specific growth rate (SGR), food conversion rate (FCR) and protein efficiency ratio (PER) were calculated.

Data analysis

Data obtained from the trials were subjected to one way analysis of variance and statistical different between the means were separated using Turkey-HSD at 95% degree of confidence using SPSS 15.0 statistics package.

Results

Table 4: Proximate analysis of Grasshopper meal

Sample	%dry matter	%moisture content	%crude protein	%ether extract	%Ash	%Crude fibre	%NFE
Grasshopper meal	94.9	5.1	64.51	12.0	1.0	17.0	5.49

Table 5: Essential mineral content of Grasshopper meal

Sample	%calcium	%phosphorus	%sodium	%potassium
Grasshopper meal	0.55	0.12	0.1	0.73

Table 6: Feed utilization and survival of *Clarias* fingerlings fed with five different diets for 56days

Treatment	Initial weight(g)	Final weight(g)	Weight gain(g)	TFC(g)	ADG(g)	SGR(g)	FCR(g)	PER(g)	%Survival rate
1	15.60	60.50b	44.90b	85.12d	0.80b	0.024b	1.90d	0.99	80a
2	19.45	71.75a	52.30a	118.72a	0.93a	0.024b	2.26b	1.16a	70b
3	16.50	65.65b	49.15b	107.8b	0.88b	0.025a	2.14c	1.10b	75b
4	19.10	58.80c	39.75c	92.26c	0.71c	0.020d	2.32a	0.89d	65c
5	16.35	53.90c	37.55c	79.10c	0.67d	0.022c	2.10c	0.84d	80a

KEY:
TFC=Total Feed Consumed, ADG=Average Daily Growth, SGR= Specific Growth Ratio, FCR=Food Conversion Ratio and PER=Protein Efficiency Ratio.
Means with the same superscripts along columns are not significantly different ($p>0.05$).

Discussion

The result of the nutrient composition shows that grasshopper meal has high crude protein of 64.51. This is a very high value that could completely replace fishmeal in fish feed. The value compares favorably with the result obtained by Njidda and Isadahomen (2010) which was 64.32%cp. This value of grasshopper compares with that of fishmeal obtained by Okoye (2003) from clupeid with 68.47%cp. The ether extract was 12.0 and closely related to that reported by Njidda and Isadahomen (2010). The value of the ether extract of grasshopper meal is greater than that obtained in fishmeal. This is good as it is

being used as component of encapsulment of feed nutrient meant for fish to prevent loss of water soluble nutrients such as proteins and amino acids because of its insoluble property in water Lopez-Alverado et al., (1994). The crude fibre content was high due to the fact that grasshopper has an exoskeleton made of chitin Okoye and Nnaji (2004). The Nitrogen free extract was 5.49 which is the small amount of carbohydrates that can be digested easily because of its solubility Falayi (2009). The dry matter of grasshopper meal is very high 94.9 with low moisture content of 5.1. This implies quick drying of the feed compared to dry matter of fishmeal 90.0 and moisture content of 10% according to Eyo (2001b).

The calcium content is greater than those obtained from soybean meal and groundnut cake. It compares favorably with that of bloodmeal and less than that of fishmeal Haruna (2003). The phosphorus content is low due to low ash content. The sodium content compares favorably with that of soybean meal and yellow maize which has being used to replace fishmeal obtained by different researchers. The potassium content compares favorably with that of fishmeal obtained by Haruna (2003). The above nutrients composition of grasshopper meal and its quality makes it a good dietary supplement in fish feed production.

The result of the study shows that Treatment 2 (20% fishmeal and 10% grasshopper meal) has the highest weight gain, Average daily weight gain(ADG), Specific growth rate(SGR), Protein efficiency ratio(PER) and high Food conversion ratio(FCR) compared to other treatments despite the fact that they were of the same crude protein levels(45%cp). These might be attributed to good odour, colour and stability in water in line with Dupree and Haylor (1994) who reported that color and odour attract cultured organisms to pelleted feed.

High weight gain, Protein efficiency ratio, Food conversion ratio, Average daily weight gain and highest Specific growth rate was recorded from fish fed Treatment 3(15%

fishmeal and 15% grasshopper meal). This is related to Gbadamosi et al., (2007) who recorded high weight gain, specific growth rate and food conversion ratio from *Clarias gariepinus* post juvenile fed with ration of 42% crude protein at 50% mixture level. Treatment 4 (10% fishmeal and 20% grasshopper meal) and Treatment 5 (30% grasshopper meal) have a lower weight gain, protein efficiency ratio, food conversion ratio, specific growth rate and average daily weight gain when compared with Treatment 1,2 and 3.

Okoye and Nnaji (2004) reported that the inclusion of 10% grasshopper meal with 30% fishmeal gave a better growth performance than the diet with 40% fishmeal and no grasshopper meal. This is as a result of good quality essential amino acid present in both feedstuffs when combined.

Little mortality was recorded in all the treatments as a result of improper acclimatization and low temperature during the first 2weeks (which was between 21-23^{o}C) of the study. This is in line with Falayi (2009) who say that warm water fish grows best at temperatures between 25-32^{o}C.

Conclusion

A lot of research had been carried out on suitable substitutes for fishmeal in fish diet. Grasshoppermeal has been shown to contain most of the essential amino acids in higher proportions than other protein feedstuff like bloodmeal, groundnut cake and soybean meal.

The growth performance of Clarias gariepinus fed with five different diets containing grasshoppermeal at varying inclusion level was monitored for 56days in net hapas installed in concrete tank. The overall best performance was obtained in treatment 2 and 3 respectively. This is an indication of the potentials of grasshopper meal to substitute fishmeal for *Clarias gariepinus* to achieve optimal growth.

Based on the result obtained, more studies should be carried out on other conventional feedstuffs of least cost for growth performance of *Clarias gariepinus* and possibly other aquacultural fish.

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