RESEARCH ARTICLE

Effect of Supplementing Fish Diet with Grasshopper Meal On Growth Parameters of African Catfish (*Clarias gariepinus*)

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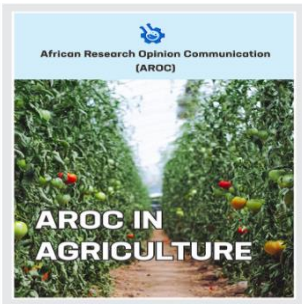

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ABSTRACT

Background: The major problem facing fish feed manufacturers and fish nutrition is the increasing competition for the same feeding stuff between man and the fish feed industry due to their conventional status. This has brought about the high price and scarcity of such feedstuffs. This research is aimed at evaluating the potentials of using graded levels of grasshopper as protein sources in the diet of African catfish. **Methods:** Four feeding trial were set up with percentage inclusions of the grasshopper meal of 0% [diet 1, 5% [Diet II], 10% [Diet III] and 15% [Diet IV]. The feed was given to the fish for 8 weeks. Fish survival rates, weekly weight gain, and length gain were recorded. **Results:** The results revealed that the. The survival rate of fish was over 90% for all experimental diets and it was significantly improved in the fish fed on 10% & 5% of grasshoppers (95.97% & 97.5%, respectively) when compared with the control group (91.04%). Percentage weight gain of the control group was significantly lower (803.00 %) compared to fish fed on 5% of grasshoppers (1092.00%). The highest fish length gain was also recorded fish fed on 5% of grasshopper (8.65 cm) while the least length gains (5.43 cm) was recorded for the control group in relation to all other fish groups which have received grasshopper at all inclusion levels. **Conclusion:** It is concluded that grasshopper inclusion in diet has the potential to enhance the survival rate and modulate growth parameters in *Clarias gariepinus*. Therefore, Grasshopper can be used as a feed additive in aquaculture to improve fish growth and production.

Keywords: *Clarias gariepinus;* grasshopper; fish diet; growth parameters

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1.0 Introduction

Aquaculture, the farming of aquatic organisms including fish, mollusks, crustaceans, and aquatic plants is necessary to meet the protein need of Nigerians. Over time, there has been increasing in fish production in Nigeria. FAO [1] reported an increase in fish production in 2005.

According to him, the artisan fish production level grew by 5.4%, aquaculture fish production by 43%, and industrial fishery through the use of trawlers by 12% over the previous years. However, of this increase in fish production, the desired result has not been attained. Quantitatively, details of fish production as of 2005 stood at 490,600 tonnes from the artisan fishery, 56,300 tonnes from industrial fishery through the use of trawlers; while fish importation stood at 61,150 tonnes. In meeting up with the growing need for fish production, aquaculture practice has been identified as a possible alternative [2].

The African catfish, Clarias, and Heterobranchus species are considered as highly-priced fish in Nigeria and Africa at large [3]. Heterobranchus species grow faster and attain bigger size than Clarias species which matures earlier [4]. Heterobranchus species are one of the

African catfish commonly cultured in Nigeria. The reason for their suitability for culture includes their ability to withstand poor water quality, high stocking density, stressed condition, and high feed conversion efficiency among others.

The growth pattern analysis has shown that cultured fish display slower growth compared to wild populations. This is probably due to low protein digestibility resulting in low feed efficiency. Hence, there is a need to address the issue of faster growth rate performance so as to meet the high demand for fish and to favor high a shorter growth span. It has been suggested that the growth performance of cultured populations could be enhanced through the addition of grasshopper to the diet to increase feed efficiency [5].

Grasshoppers (Acrididae) are insects of the order Orthoptera. They are generally rich in CP (50-65%), though some lower values (<30%) have also been reported. The DM is 23-35%. The fat content is quite variable and ranges from relatively low values (<5%) to high ones (>20%). Ca content is rather poor, as in other insect species. The "fiber" content may be significant and increases with age: adult grasshopper contains up to 22% neutral detergent fiber (NDF) *vs* 12% for the nymphs [6].

Grasshopper could be used to substitute up to 25% level of dietary protein in *C. gariepinus* juveniles without significant reduction in growth. However, higher inclusion rates decreased digestibility and performance [7].

A major problem facing fish feed manufacturers and fish nutrition is the increasing competition for the same feeding stuff between man and the fish feed industry due to their conventional status. This has brought about the high price and scarcity of such feedstuffs. Various studies have been done in fish feeding [8].

Since the use of fish meal in fish feed formulation is not cost-effective, efforts are being directed globally towards discovering unconventional, cheaper, readily available, and highly digestible alternative protein sources of feedstuff for fish. This will help to forestall the problem of feed wastage and water deterioration [9].

However, attempts at searching for these unconventional sources as supplements or total replacement is a difficult task [10]. Alternative animal protein sources used in Nigeria to supplement feeds for fish production include the use of maggots, termites, and earthworms in formulating fish feed [11]. In China, Silkworm pupae have been used traditionally to feed fish while in Western Thailand maggots produced from pig manure have been used as fish feed [12]. In view of all the aforementioned, this research intends to explore the potentials of using graded levels of grasshopper as protein sources in the diet of African catfish

2.0 Materials and Methods

2.1 Experimental Fish

Fishes were procured from, Nigeria and stocked into concrete ponds. Four different practical diets were prepared according to standard procedure. The fish were fed twice daily (8.00 am and 16.00 pm).

2.2 Collections of materials for processing, formulation and preparation of diets

Samples of Locust (Grasshopper) were purchased from the local market in Biddah Local government area of Niger state. The purchased samples were dewinged, sundried, and crushed into powder with milling marching. All other ingredients including soybeans meal, maize meal (Yellow), rice bran, fish meal, vegetable oil, vitamin and mineral premix, and salt were bought from Lapai market Niger State.

The feed ingredients were ground into powder form, weighed accurately using an electronic weighing balance, and blended with a blending machine to achieve a thorough combination of the mixture. The percentage inclusions of the grasshopper meal were varied at 0% [Diet I], 5% [Diet II], 10% [Diet III] and 15% [Diet IV]. Thereafter, the paste was made into a pellet using a pelleting machine. Proximate analysis of the powdered sample was carried out

2.3 Experimental setup and management:

The Fingerlings weighing between 15-20 g were obtained from the hatchery and conditioned in net hapa (1 m x 1 m x 1.2 m) installed in an 11 m x 10 m x 1.2 m concrete tank for 48 hours. 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 60 days. Fish were fed at 5% body weight twice daily.

The mode of feeding was manual by simply dropping the feed into the baths. The fecal

materials were siphoned and water completely changed every other day. The fish was weighed at the beginning of the experiment and after every week for a period of 8 weeks. The quantity of feed was adjusted based on the new bodyweight of the fish in each bath. Mortalities were recorded accordingly.

2.4 Data collection

Once every week in the rearing period of 8 weeks, the fish fry from each concrete tank was harvested by using a seine net, placed in 10L buckets, and taken to hatchery building where they were weighed using an analytical balance and recorded. The following formulae were used to determine fry performance as outlined by Kang'ombe *et al.* [13].

a) Weight gain (g):

Weight gain (g) = Final mean weight (g) - Initial mean weight (g) (6)

3.0 RESULTS

3.1 Growth Parameters

Survival (%) & growth indices of *Clarias gariepinus* that were fed on the test diets that contain three concentrations of a grasshopper for 8 weeks are summarized in Table 1. Weekly body weight changes are presented in figure 1. The grasshopper-fed fish groups were compared against the control fish group that had received no grasshopper. The survival rate of fish was over 90% for all experimental diets and it was significantly improved in the fish fed on 10% & 5% of grasshoppers (95.97% & 97.5%, respectively) when compared with the control group (91.04%) and those fed 15% grasshopper. Percentage weight gain of the CTR group was significantly lower (803.00 %) compared to fish fed on 5% of grasshoppers (1092.00%). The highest fish length gain was also recorded fish fed on 5% of grasshopper (8.65 cm) while the least length gains (5.43 cm) was recorded for the CTR group in relation to all other fish groups which have received grasshopper at all inclusion levels

Table 1: Survival & growth indices of *Clarias gariepinus* fed on grasshopper supplemented test diets

	Weight gain	% weight gain	Length gain	% survival
5% Grasshopper	10.92 ± 0.34^{b}	1092.34 ± 5.03^{b}	8.65 ± 0.89^{b}	97.50 ± 2.34^{b}
10% Grasshopper	8.32 ± 0.95^{a}	832.35 ± 6.43^{a}	5.87 ± 0.41^{a}	95.97 ± 4.21^{ab}
15% Grasshopper	8.01 ± 0.72^{a}	801.35 ± 5.35^{a}	5.99 ± 0.52^{a}	91.04 ± 4.56^{a}
Control	8.03 ± 0.64^{a}	803.90 ± 6.43^{a}	5.43 ± 0.90^{a}	91.06 ± 3.45^{a}

Data are Mean ± SEM of replicate determinations. Value followed by different superscript alphabet are significantly different ($p < 0.05$)

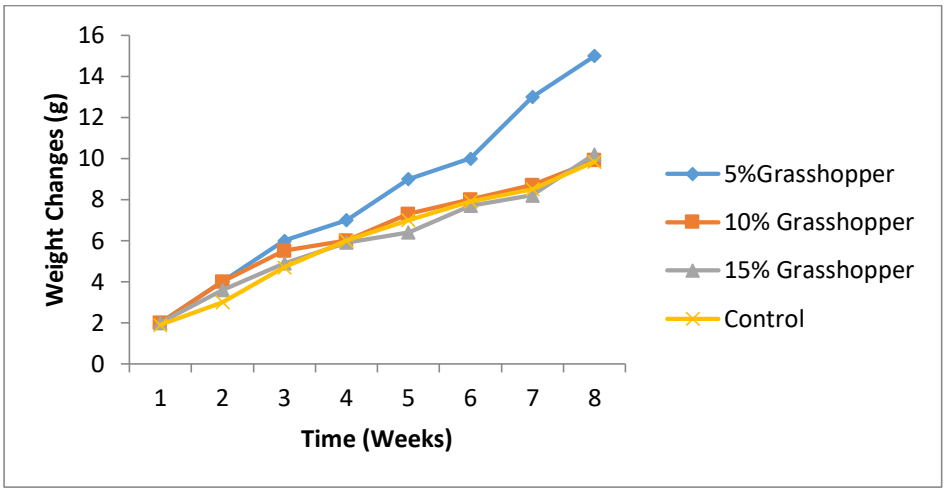

Figure 1: weekly weight changes of *Clarias gariepinus* fed on grasshopper supplemented diet.

4.0 Discussion

In the present study, Values of survival & growth indices show enhancement in fish survival & growth indices of *Clarias gariepinus* fed on grasshopper supplemented test diets for 8 weeks compared to the control fish group. The results obtained from the present study could be attributed to the fact that grasshopper contains growth-enhancing metabolite which promotes the performance of the intestinal flora, thereby improving digestion, and enhancing the utilization of energy [14]. This would then lead to improved fish growth.

These findings correlate with the studies conducted on African catfish, *Clarias gariepinus* [15), rainbow trout, Oncorhynchus mykiss [16], Swordtail, *Xiphophorus helleri* and Nile tilapia, Oreochromis niloticus where positive effects of administrating grasshopper in diets on growth and feed utilization of the above-cited fish species were reported.

The presence of grasshopper in the diet of fish also improves the survival rate indicating that the experimental diets have positive effects on the fish health during the study period. The percentage weight gain reported in this study for a fish-fed diet containing 5% grasshopper was higher than the value of 719.61% earlier reported for sea bass (*Dicentrarcus labrax*) fed grasshopper at 30g/kg diet. This is an indication that the feed had a very good potential to increase the growth rate of *Clarias gariepinus*

5.0 Conclusions

The present study reveals that dietary administration of 5.0 & 10% grasshopper for 8 weeks has the potential to enhanced the survival rate and modulate growth parameters in *Clarias gariepinus*. Therefore, Grasshopper can be used as a feed additive in aquaculture to improve fish growth and production.

Conflict of Interest

The author declared that no conflict of interest exists

Ethical Approval

Not applicable

Consent

Not applicable

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