Available online at www.elixirpublishers.com (Elixir International Journal)

Biosciences

Elixir Biosciences 162 (2022) 55933-55936

ISSN: 2229-712X

Comparative Feeding Effects of Maggot Meal and Coppens Feed on the Growth Rate and Survival of the African Catfish *(Clarias Gariepinus)*

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ARTICLE INFO

Article history:
Received: 2 December 2021;
Received in revised form: 20 December 2021;
Accepted: 6 January 2022;

Keywords
Growth,
Coppens Feed,
Maggot Meal,
Catfish and Feeds.

ABSTRACT

This study was to compare the effect of maggot meal and coppens feed on the growth and survival rate of African catfish *(Clarias gariepinus)* fingerlings. The feeding trial lasted for 85 days with 135 specimens of African catfish *(Clarias gariepinus)* fingerlings of average initial weight of 1.33g, fed with 5% of their total body weight twice daily with maggot meal, coppens feed and a combination of maggot meal and coppens feed. The study was completely randomized and had three treatments and three replicates in the ratio (50:50). The result for growth showed mean final weight of 24.12g, 21.92g, 22.89g for maggot meal, coppens feed and control diet respectively. Mean weight gains of 22.77g, 20.59g and 21.57g for maggot meal, coppens feed and control diet, was not statistically significant at P<0.05. it also showed that there was an increase in length of fish from a mean initial length of 5.49cm, 5.32cm 5.37cm for maggot meal, coppens feed and control diet to a final length of 17.5cm, 16.13cm and 16.21cm for maggot meal, coppens feed and control diet, mean length gains of 12.01cm, 10.80cm and 10.84cm for maggot meal, coppens feed and control diet respectively, was not statistically significant at P<0.05. The mean specific growth rate (SGR) was 3.39, 3.28 and 3.33 for maggot meal, coppens feed and control diet respectively but not statistically significant at P<0.05. The feed intake was 46.57g, 43.91g and 44.96g for maggot meal, coppens feed and control diet respectively was not statistically significant at P<0.05. The feed conversion ratio 0.51, 0.52 and 0.52 for maggot meal, coppens feed and control respectively was not statistically significant at P<0.05. The result further showed that maggot meal performed better than coppens feed but not statistically different at P<0.05. This shows that maggot meal can replace coppens feed in the culture of the African catfish *(Clarias gariepinus)* fingerlings. Therefore, farmers are encouraged to grow maggots in large quantity so far it can be used to culture *Clarias gariepinus.*

Introduction

Food and Agricultural Organization (FAO), (2002) reported that an estimated 840,000,000 people lack adequate access to food and about 25% of these are in sub-saharan Africa (Inoni, 2007). As the population grows and more pressure on natural resources, more people will probably become food insecure, lacking access to sufficient amount of safe and nutritious food for normal growth, development and an active/healthy life (Inoni, 2007).

In Nigeria, catfish has taken the center stage of aquaculture sub-sector, the demand for Catfish is far from being met. However, it is also important to note that for the last twenty years, tremendous growth on Catfish production has been witnessed. This tred has been achievable because of drastic improvement in the better understanding of fish nutrition (Adekoya, 2001).

The common housefly,(musca domestica Linnaeus 1758) is the most common fly (Diptera) species,lives in close association with people all over the world.the insects feed on human foodstuffs and wastes where they can pick up and transport various disease agents,as both and larvae (maggots) and the adult flies feed on manure and decaying organic wastes.The ability of housefly maggots to grow on a large range of substrates can make them useful to turn wastes into valuable biomass rich in protein and fat.Producing housefly maggot biomass in controlled conditions to feed farm animals has been investigated since the late 1960s(Adenji,2007).

In Nigeria, the feeding of catfishes *(Clarias and Hetero branchus)*species with compounded feed is already being practiced by many fish farmers but the quantitative effect on growth development or the comparative effects of non-conventional feeds have not been adequately accessed and documented. Therefore, the aim of this study is to determine growth performance of *Clarias gariepinus* (fingerlings) using coppens feed and maggot meal to carry out proximate composition of maggot meal and coppens feed.

Materials and Method

Study Area

The study was conducted at the Department of Animal and Environmental Biology, Faculty of Science, University of Port Harcourt and located between 4^0 53’ 41”N and 6^0 54’ 38”E.

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Experimental Fish

*Clarias gariepinus (*fingerlings*)* were obtained from a homogenous source in African Regional Aquacultural Center (ARAC) Omuihuechi Aluu, Rivers State. One hundred and fifty (150) *Clarias* fingerlings were transported in a plastic container of 50 liters between 7.00am and 8.00am, to a plastic tank of 1000-liter capacity at the Department of Animal and Environmental Biology Laboratory. The fish was allowed to acclimatize for two weeks prior to feeding trials which lasted for 85 days. The fish were fed with 0.2mm vital feed at 5% of their body weight twice daily. During the acclimatization period, the water temperature, pH and dissolved oxygen (D.O) were monitored. Water in the plastic tank was replaced every three days.

Study Design

The study design was completely randomized. The study lasted for a period of 85 days. Out of the one hundred and fifty (150) *Clarias gariepinus* (fingerlings) obtained from African Regional Aquacultural Center, a total of one hundred and thirty-five (135) fingerlings of mean weight 1.33g were randomly selected and distributed into tanks at a stocking rate of 15 fish per tank. The nine (9) tanks of 15 fish each were randomly assigned to a 3 treatments labelled as T_1, T_2, T_3 (control inclusive) at the rate of one treatment per experimental diet with 3 replicates per treatment. T_1 was for maggot meal, T_2 was for coppens feed and T_3 served as control with diet containing both coppens and maggot meal. The fish were fed at 5% of their body weight, twice a day between 6:00am -8:00am and 6:00pm – 8:00pm by hand.

Production of Maggot Meal

The Housefly maggots were produced using poultry dung as substrate in ARAC in a tank dimension of one square meter. The tank was left open for about 2 days to allow the housefly lay their eggs. After which, the poultry dung was allowed to stay for 5 days under warm temperature. At the sixth day, the maggots were harvested using a sieve which was used to sieve out the maggots. After harvesting the maggots the maggots were then used to feed the fingerlings live.

Proximate Composition of Experimental Diets

Maggot meal and Coppens feed were analyzed for proximate indices including crude protein, lipid, crude fiber, ash, moisture and energy contents following standard procedures provided by AOAC (2016) in African Regional Aquacultural Center (ARAC). Moisture was determined using the oven drying method, crude protein content was determined using the micro-Kjeldahl method, lipid content was determined by the Soxhlet extraction method, ash content was determined by incinerating at 550^0c and carbohydrate was calculated by difference.

Water Quality Assessment

A pH meter was used to measure the pH, dissolved oxygen meter was used to measure oxygen level and thermometer was used to measure the temperature. The measurement of water quality parameters was done bi-weekly, and the values for the parameters were recorded accordingly.

Weighing of Experimental Fish

The weight of fish was determined immediately after acclimatization using an electronic weighing scale. The average and total mean weights of fish per tank were recorded. The weighing continued biweekly until the experiment was terminated.

Growth Performance and Feed Utilization Parameters

Fish feed conversion ratio (FCR), feed intake (FI), specific growth rate (SGR), protein efficiency ratio (PER), percentage survival, mean weight gain, and mean length gain, was determined after the trials as follows:

i.Feed Conversion Ratio (FCR): From the weight gained and feed consumed by each of the fish, the feed conversion ratio (FCR) was calculated using the expression;

$$CR = \frac{\text{Total weight of feed consumed}}{\text{Total weight of fish}}$$ (Woke and Aleleye-wokoma, 2010)

ii. Feed Intake (FI): This was estimated by the addition of weekly feed intake during the study period.

iii. Specific Growth Rate: Specific growth rate was calculated using the formular:

$$\frac{\text{Ln log W2-Ln log W1}}{T} \times \frac{100}{1}$$ (Woke and Aleleye-wokoma, 2010)

Where:

Ln = Natural logarithm

W2 = Final weight

W1 = Initial weight of the fish

T = Culture period

iv. Protein Efficiency Ratio (PER): Protein efficiency ratio was calculated using the formular

$$\frac{\text{Weight gained (g)}}{\text{Protein consumed (g)}}$$ (Woke and Aleleye-wokoma, 2010)

v.Percentage Survival: Percentage survival was calculated using the formular

$$Ps = \frac{\text{Initial number stocked – number that died}}{\text{Initial number stocked}} \times \frac{100}{1}$$

vi.Mean Weight Gain: The mean weight gained was calculated by subtracting initial weight from the final weight. (W_2-W_1).

vii.Mean Length Gain The mean length gained was calculated by subtracting initial length from final length. (L_2-L_1).

Statistical Analysis

The data for each parameter collected were subjected to analysis of variance (ANOVA) using statistical package for social sciences (SPSS) software to determine significance of the variations between parameters examined at ($P<0.05$).

Result and Discussion

The physico-chemical parameters of water, proximate composition of maggot meal and proximate composition of coppens feed used in this study are presented in table 1, 2 and 3 while Bi-weekly measurement for maggot meal, coppens feed and control diet, and mean value of maggot meal, coppens feed and control diet are presented in table 4 and 5 respectively.

Table 1. Physico-chemical Parameters of water during the study period

	Treatments		
Water Parameters	Maggot meal	Coppens feed	Control
Temperature (oc)	27.30 ± 1.155	27.97 ± 0.707	28.25 ± 0.366
Dissolved oxygen (Mg/L)	5.02 ± 0.752	3.80 ± 0.057	4.13 ± 0.549
pH	7.14 ± 0.913	8.14 ± 0.102	7.80 ± 0.534

Values are Mean ± S.D

Table 2. Proximate composition of Maggot meal used in this study

Proximate Indices	Value
Moisture %	86.0
Crude protein %	48
Crude fat %	37.8
Crude fiber %	5.89
Ash content %	3.61
Carbohydrate %	

Table 3. Proximate composition of Coppens feed used in this study

Proximate Indices	Value
Moisture %	8.15
Crude protein %	45
Crude fat %	10.82
Crude fiber %	1.9
Ash content %	8.63
Carbohydrate %	25.5

Discussion

Physico-Chemical Parameters

The values obtained for temperature, dissolved oxygen and pH were within the acceptable limit recommended for rearing and culture of the African catfish *(Clarias gariepinus)*. It agrees with previous work done by Lucy, (2014) and FAO, (2006).

Proximate Composition of Diets

Proximate analysis on the diets shows that maggot meal had moisture content of 86%, crude protein content of 48%, crude fat content (37.8%), crude fiber content (5.89%), ash content (3.61%) and carbohydrate content (4.70%). these values correspond to a large extent previous work done by Odesanya *et al.,* (2011). Coppens feed had a moisture content(8.15%), crude protein content (45%), crude fat content(10.82%), crude fiber content(1.9%), ash content (8.63%), and carbohydrate content(25.5%). the crude protein content analyzed is 45% lower than that of the crude protein value 52% recorded on the nutritional value of the manufacturer.

Growth Performance

Result of growth performance of the catfish *(Clarias gariepinus)* fingerlings was observed that the feeds were accepted by the fish and were utilized for growth. Weight and length of the fish were not statistically significant at (P<0.05) by the treatment at the 2nd, 4th, 6th, 8th and 12th week of age.

The fish achieved final weight of 24.12g, 21.92g and 22.89g respectively after 12 weeks trial for maggot meal, coppens feed and control diet.

Maggot meal had a higher numerical weight in majority of the weeks even though not statistically significant at (P<0.05). the same trend occurred for the final total body length of 17.5cm for maggot meal as against 16.21cm for coppens feed and control respectively.

The mean weight gain, maggot meal, coppens feed and control diet had 22.77g, 20.59g and 21.57g respectively. For mean length gain, maggot meal, coppens feed and control diet had 12.01cm, 10.80cm, and 10.84cm respectively. Maggot meal produced numerically higher mean weight gain and mean length gain than the others but no significant difference at (P<0.05).

Feed Utilization

The feed intake was numerically higher in maggot meal even though there were no statistically significant difference at (P<0.05). protein efficiency ratio for maggot meal, coppens feed and control diet were 1.02, 1.29 and 1.06 respectively while the feed conversion ratio was 0.51, 0.52 and 0.52 respectively for maggot meal, coppens feed and control diet.Maggot meal had a better protein efficiency ratio, followed by the control diet and coppen feed. But were not statistically significant at (P<0.05). the same trend occurred in the feed conversion ratio.

Survival and Specific Growth Rate

The highest percentage of survival rate was recorded in maggot meal and control diet followed by coppens feed although not statistically significant at (P<0.05). the same trend occurred in the specific growth rate.

However, the good performance recorded in maggot meal in this study may not be unconnected with adequate provision of the essential nutrient required for growth such as crude protein and critical essential amino acids. This agrees with Hwangbo *et al* (2009) that maggot meal is a good source of animal protein in fish and also reported that crude protein of maggot varied from 47.1%-64%, this is in line with crude protein obtained in maggot meal in this study.

According to Helfrich and Craig (2002) report that proper nutrition is one of the major factors influencing the ability of fish to attain genetic potential for growth, reproduction and longevity. Based on the weight gain, feed consumption and specific growth rate, the highest weight gain, feed consumption and specific growth rate observed in maggot meal agrees with superiority of maggot meal reported by Adewolu *et al.,* (2010) that maggot meal could replace 50% of fish meal without adverse effect on weight gain, specific growth, feed conversion and protein efficiency ratio.

Table 4. Bi-weekly Measurement for Maggot meal, coppens feed and control diet.

	Maggot meal		Coppens feed		Control	
	Weight(g)	Length(cm)	Weight(g)	Length(cm)	Weight(g)	Length(cm)
Week 0 (Initial)	1.33	5.49	1.33	5.32	1.33	5.37
Week 2	3.02	6.49	2.66	6.02	2.8	6.28
Week 4	5.99	10.48	5.13	9.94	5.65	10.16
Week 6	14.04	13.1	13.68	11.97	13.79	12.56
Week 8	20	14.68	19.43	13.18	19.77	14
Week 10	22.14	16.07	20.5	14.86	21	15.55
Week 12 (Final)	24.12	17.5	21.92	16.13	22.89	16.21

Values are mean.

Table 5. Mean value of Maggot meal, Coppens feed and control diet.

Parameters	Maggot Meal	Coppens Feed	Control
Mean Weight gain (g)	22.77 ± 3.90^a	20.59 ± 4.52^b	21.57 ± 4.76^c
Mean Length gain (cm)	12.01 ± 2.23^a	10.80 ± 0.75^b	10.84 ± 1.10^c
Specific growth rate (g)	3.399 ± 0.19^a	3.28 ± 0.23^b	3.33 ± 0.26^c
Feed intake (g)	46.57±7.65a	43.91±8.55b	44.96±8.65c
Protein efficiencyRatio	1.019 ± 0.007^a	1.299 ± 0.373^b	1.061 ± 0.0399^c
Feed conversionRatio	0.514 ± 0.0004^a	0.519 ± 0.1216^b	0.516 ± 0.0027^c
Percentage survival (%)	91.11 ± 7.698^a	88.89 ± 7.698^b	91.11 ± 3.849^c

Values with dissimilar superscript in each row are not statistically significant at P<0.05. Values are mean ± S.D

Also based on the findings of Ogunji and Manfred (2001) on alternative protein source as substitute for fish meal in the diet of young fish, one may draw a conclusion that maggot meal was the best in the dietary treatment even though coppens feed had almost equivalent result with maggot meal.

Conclusion

The result of this study compared the effect of maggot meal and coppens feed on growth rate of *Clarias gariepinus* fingerlings has provided an adequate information on the alternative protein source that gave rise to good performance interval of nutrient utilization, growth and survival. Consequently, the farmers will benefit economically through the utilization of this cheaper feed cost that provides nutrient for rapid fish growth. Maggot meal haven been identified as suitable and valuable sources of protein for several livestock production systems including fish (De Foliart, 2002; Odesanya *et al, 2011;* Van Huis *et al.,* 2013).

With the performance on growth rate of fish interval, of mean weight gain, feed conversion ratio and specific growth rate, maggot meal gave the best result toward the end of the experiment, although coppens feed and control diet increase in weight. But upon that, maggot meal is recommendable.

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