Effect of Substituting Fishmeal with Sesame Seed Cake on Growth and Feed Utilization on *Heterobranchus longifilis*

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Absract: **The effects of substituting fish meal with sesame seed cake in diets for *Heterobranchus longifillis* fingerlings were investigated for 85 days in aquarium. The best weight gain (25.17), percentage weight gain (188.29%), specific growth rate (SGR %) (0.51%) and protein efficiency ratio (PER) (0.49) were obtained in the diet with 5% sesame seed cake. The bestpercentage survival (90.00%) in the Diet 2 with 5% sesame seed cake . This is suggesting that sesame seed cake can replace fishmeal more than 5% without adverse repercussion on fish growth and survival.**

Key words: Heterobranchus longifilis, **feed cost, feed utilization, fingerlings, growth, Sesamum indicum, Cluipied**

I. INTRODUCTION

The high cost of fish meal has been a major factor affecting the growth of fish culture in Nigeria. To reduce the use of fish meal without adversely displeasing the quality of fish feed, some plants and animal sources of protein have been investigated (Eyo and Olatunde, 1996; Fagbenro and Fasakin, 1996; Absalom et al., 1999, Fasakin et al., 2000). Generally, the referenced protein sources are less expensive compared with fish meal. However, they often have deficiencies or excesses of essential nutrients required for normal fish activities. Beniseed (Sesamum indicum Linn.) is one of the most important oil seed crops in the world. Not only as a source of edible oil, but also the seeds provide nutritious elements for human and livestock. With adequate heat involvement and extraction of oil, reduction in seed toxicants is achieved and nutritive values also improved. The crude proteins level ranged from 21.71 – 50.00% and the lipids content from 46.30 - 57.00% (Gohl, 1975; Adv.Res.Biol.Sci. 32 Nagaral, 1991; Olukunle, 1996). Sesame seed cake is rich in methionine, arginine, high nitrogen free extract (NFE), some essential fatty acids and its apparent digestibility in fish is very high (Mukhopadhyay and Ray, 1999). It is cultivated and used in over 15 States in Nigeria (Falusi, 1999), and there has been a re-awakening to the production of this noble seed in Nigeria as more hectares are now being put to the crop (NCRI, 1991). Dahak and Fali (1993), Dac Hum (1999) and Mukhopadhyay and Ray (1999) reported that there is gross reduction in anti-nutritional factors (Tanin and Phytic acids) when the seed is heat treated or fermented with lactic acid bacteria or and when the oil is pressed or rid-off. The main trust of this study therefore is to find a way of reducing the use of highly competitive and expensive fish meal ingredient by substituting sesame seed cake in catfish diets, with the aim of cheapen feed and fish production costs in catfish farming and improve fish proteins consumption in the tropics.

II. MATERIALS AND METHODOLOGY

Sesame Seed Cake Preparation

Sesame seed cake(Beniseed Sesamum indicum) was purchased from New Bussa, Kainji, Niger, State, Nigeria; toasted in an electric oven at 100°C in 30 minutes following the methods of Eyo (1999), milled with boiled water at quarter of a litter per every kilogram weight toasted seed; with a hammer milling machine. The milled paste obtained was put in a nylon sieve-clothing material, tied with rope and placed on clean galvanised netting material with clean bowl placed underneath. Beniseed oil was extracted locally by placing heavy object on the milled paste tied on wire netting material and pressed to drain the oil content for 3 hours. The left-over paste was used as cake in the test diets at 5%. 10%,15%,20% and 25% respectively and the control was without sesame cake (0.00%).

III. EXPERIMENTAL FISH AND DESIGN

One hundred and eighty(180) *heterobranchus longifilis* fingerlings were obtained from a private fish breeding farm in New Bussa. Prior to the commencement of the experiment, fish were acclimatized to the new environmental condition for two weeks.

Eighteen (18) rubber aquarium each measuring 60×60×30 cm3 filled with borehole water to ¾ of holding capacity were randomly allocated for the six diet treatments in triplicates of 10 fingerlings (mean weight 13.50±0.01 g) per tank to form a completely randomised design. Electric aerators with air stones were attached to all tanks for aeration purpose to improve the dissolved oxygen in waters. The fingerlings were fed 5.00% of fish biomass shared and given twice daily morning and night. Successive weight measurement were taken fortnightly to determine the growth rate and survival rate. Physico-chemical parameters of Water, proximate analysis of feed and carcass, feed evaluation parameters ,samples of diets , sesame seed cake and carcass

were analysed for nutrient contents using standard methods (AOAC)at the end of the study.

TABLE 1: PERCENTAGE COMPOSITION OF EXPERIMENTAL DIETS

Ingredients	Control	5% of SSC	10% of SSC	15% of SSC	20% of SSC	25% of SSC
Fish Meal	25.00	20.00	15.00	10.00	5.00	-
Sesame Seed Cake	-	5.00	10.00	15.00	20.00	25.00
Groundnut Cake	29.00	33.62	39.29	40.29	44.39	46.39
Soyabeans	28.09	28.09	26.09	26.09	23.09	21.09
Wheat afal	3.70	3.70	2.50	1.50	1.75	1.75
Maize bran	9.00	4.38	1.91	1.91	0.56	0.56
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Mathionine	0.20	0.20	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20	0.20	0.20
Premix	0.50	0.50	0.50	0.50	0.50	0.50
Starch	2.00	2.00	2.00	2.00	2.00	2.00
Bone	1.00	1.00	1.00	1.00	1.00	1.00
Vitamin C	0.03	0.03	0.03	0.03	0.03	0.03
B. Complex	0.02	0.02	0.02	0.02	0.02	0.02
Oil	1.00	1.00	1.00	1.00	1.00	1.00
Enzyme	0.01	0.01	0.01	0.01	0.01	0.01

Table2: Growth response and nutrient utilization of heterobranchus longifilis fingerlings fed diet containing varied levels of sesame seed cake for 85 days.

Parameters	DT_1	DT_2	DT_3	DT_4	DT_5	DT_6
Mean Initial Weight (g)	13.53±0.00[a]	13.56±0.31[a]	13.57±0.[21a]	13.50±0.10[a]	13.57±0.15[a]	13.53±0.15[a]
Mean Final Weight (g)	30.5±9.39[a]	38.73±15.74[a]	30.17±1.81[a]	33.27±17.21[a]	26.44±6.54[a]	29.79±3.56[a]
Weight Gain (g)	17.07±9.39	25.17±15.69	16.60±1.65	19.77±17.12	12.87±6.66	16.26±3.49
% Weight Gain	126.47±69.53	188.29±121.16	122.28±10.78	145.81±125.98	94.89±48.12	120.06±25.36
Feed Conversion Ratio (FCR)	0.32±0.11[a]	0.30±0.12[a]	0.30±0.03[a]	0.36±0.18[a]	0.43±0.10[a]	0.39±0.05[a]
Specific Growth Rate (SGR%)	0.40±0.17	0.51±0.03	0.41±0.03	0.40±0.32	0.33±0.13	0.40±0.07
Protein Efficiency Ratio (PER)	0.34±0.19	0.49±0.31	0.28±0.03	0.33±0.29	0.22±0.12	0.32±0.07
Survival %	80.00±0.00	90.00±0.00	80.00±0.10	80.00±0.10	80.00±0.10	80.00±0.10
Cost of Feed(kg/#)	220.00	216.08	210.11	204.46	196.73	189.23

Values in rows with same superscrips are not significantly different(P>0.05)

The mean initial weight,mean final weight and feed conversion ratio were not significantly different (P>0.05)

The effects of substituting fish meal with sesame seed cake in diets for *Heterobranchus longifillis* fingerlings were investigated for 85 days in aquarium. The best weight gain, percentage weight gain (188.29%), specific growth rate (SGR %) (0.51%) and protein efficiency ratio (PER) (0.49) were obtained in the diet with 5% sesame seed cake. The best percentage survival (90.00%) were obtained in the Diet 2 and Diet 6 with 5% and 25% sesame seed cake respectively. This is suggesting that sesame seed cake can replace fishmeal up to 25% without adverse repercussion on fish growth and survival.

TABLE 3:PROXIMATE ANALYSIS OF FISH SAMPLE

	DT1	DT2	DT3	DT4	DT5	DT6
%Moisture	6.70 ± 0.45	6.41 ± 0.39	5.49 ± 0.51	5.90 ± 0.17	6.31 ± 0.10	7.29 ± 0.34
%Ash	6.41 ±0.18	6.65 ± 0.17	4.72 ± 0.56	4.76 ± 0.25	4.46 ± 0.17	6.38 ±0.34
%Crude fibre	0.11± 0.01	0.09 ± 0.00	0.11 ± 0.o2	0.11 ± 0.01	0.10 ± 0.00	0.10 ± 0.00
%Crude protein	51.18±0.56	50.83 ± 1.27	59.89 ± 1.37	60.02 ± 1.11	57.48 ± 0.81	51.24 ± 0.15
%Crude fat	1.37 ±0.07	1.41 ± 0.04	1.86 ± 0.06	1.84 ± 0.08	1.74 ± 0.09	1.37 ± 0.06
%NFE	34.24 ± 0.78	34.64 ± 1.13	27.89 ± 1.31	27.38 ± 0.63	29.92 ± 1.00	33.62 ± 0.21

TABLE 4:PROXIMATE ANALYSIS OF FEED SAMPLES

	DT1	DT2	DT3	DT4	DT5	DT6
%Moisture	5.87 ± 0.07	6.21 ± 0.26	5.97 ± 0.18	5.94 ±0.11	5.67 ± 0.20	5.53 ± 0.25
%Ash	10.10 ± 0.92	11.36 ± 0.62	11.08 ± 1.01	9.53 ± 0.72	8.06 ± 0.27	7.21 ± 0.83
%Crude fibre	6.48 ± 0.21	5.73 ± 0.12	8.81 ± 0.15	4.05 ± 0.09	3.38 ± 0.70	3.84 ± 0.25
%Crude protein	40.07 ± 1.15	33.95 ± 0.35	37.32 ± 1.48	45.61 ± 1.13	36.67 ± 0.20	44.89 ± 0.32
%Crude fat	19.23 ± 1.10	18.05 ± 0.20	20.36 ± 0.53	17.92 ± 2.43	17.32 ± 0.86	15.89 ± 0.08
%NFE	17.35 ± 1.11	24.70 ± 0.62	20.86 ± 1.03	16.95 ± 4.25	28.90 ±0.43	22.61 ± 0.55

TABLE 5:PROXIMATE ANALYSIS OF SESAME SEED CAKE

%Moisture	4.11 ±0.16
%Ash content	4.73 ± 0.30
%Crude fibre	5.80 ± 0.35
%Crude protein	36.16 ± 0.31
% crude fat	18.80 ± 0.42
%NFE	30.40 ± 0.93

TABLE 6:HAEMATOLOGY OF *Hetarobranchus longifilis* FED DIETS CONTAINING SESAME SEED CAKE FOR 85 DAYS

PARAMETERS	DT1	DT2	DT3	DT4	DT5	DT6
WBC(×10^g/L)	106.09	1.56	2.42	36.68	5.71	6.52
LYM(×10^g/L)	103.01	1.57	2.15	36.30	5.39	5.73
RBC(×10^/l)	2.03	1.67	0.35	1.41	0.64	1.65
HGB(g/dl)	6.8	4.6	2.4	3.9	3.1	3.2
MCHC(g/dl)	25.95	25.68	58.05	26.38	48.42	38.52
MCH(pg)	33.42	27.52	68.52	27.63	48.15	38.53
MCV(fl)	128.79	107.17	118.03	104.72	99.44	87.32

The haematological analysis showed significant ($p < 0.05$) difference over the fish fed control diet with respect to haemoglobin concentration (Hb), white blood count (WBC), red blood count (RBC), Lymphocyte (LYM), mean corpuscular haemoglobin (MCH) and mean corpuscular volume(MCV). Whereas, WBC and LYM values decreased with increase in the levels of sesame seed meal in the diets, MCH and MCV increased. Hence, the inclusion of sesame seed meal up to 25% is recommended in the diet of *heterobranchus longifilis* fingerlings, since this inclusion level did not exhibit any negative effect on the fish health.

Table 7: Anti-nutritional factor in sesame seed cake

Anti-nutrient		
Hydrogen Cyanide	(mg/100g)	1.380, 1.382
Phytates	(mg/100g)	0.234, 0.231
Tanims	(mg/100g)	0.403, 0.400
Oxalate	(mg/100g)	0.178, 0.180
Trypsin inhibitor	(mg/100g)	----------
Akkaloid	(mg/100g)	0.306, 0.304

The anti-nutritional factor in sesame seed cake were very minute, therefore it has no effect on the fish health .

IV. RESULTS

The results of the proximate analysis of the experimental diets and sesame seed cake are revealed in Table 4 and Table 5. The crude proteins in diets ranged from 33.95 – 45.61%, and are very close to that of the sesame seed cake (36.16%). The crude fat in diets: 19.23, 18.05,20.36, 17.92, 17.32 and 15.89% respectively were high and close to that of sesame seed cake (18.80%). Fish sample has highest crude protein (60.02%) contents in both Diet4 and Diet5 compared to sesame seed cake and the test diets but least in crude fat (1.86%). The moisture content in diets, sesame cake and fish sample were similar and ranged between 4.11 to 7.29%, while ash contents in feed diet (10.10,11.36,11.08,9.53,8.06 and 7.21%) were higher than the sesame cake (4.73%) and proximate analysis of fish samples(carcass) which were (6.41,6.65,4.72,4.76,4.46 and6.38%) . The crude fibbers in diets and sesame cake were similar between 3.38 – 8.81% and lower than those of fish samples which are(0.11,0.09,0.11,0.11,0.10 and 0.10%). The Nitrogen free extract (NFE) were lower in the experimental diets (17.35, 24.70, 20.86, 16.95, 28.90 and 22.61%) compared to sesame seed cake (30.40%) and the fish samples (34.24, 34.64, 27.89, 27.38, 29.92 and 33.62%).

Table 2: showed the growth response and feed utilization of *heterobranchus longifilis* fingerlings fed the experimental diets and the control without sesame seed cake. The highest weight gain (21.83g), percentage weight gain (160.87%), SGR % (0.49%) and PER (0.49) respectively, were obtained in Diet 2 having 20% fish meal inclusion. This was followed by Diet 4 with about 10% of fish meal and this group has the highest feed conversion ratio.

V. DISCUSSION

The crude proteins from the six diets are within the requirements recommended for catfish *heterobranchus longifillis* fingerlings in the tropics (Ayinla and Akande, 1988; Lovell, 1989; NRC, 1993; Eyo and Falayi, 1999). The highest growth response and nutrient utilization values observed in Diet 2 with 20% fishmeal inclusion levels. The feed consumption and survival that were similar in all treatments are evidence that sesame cake was consumed and was reasonably rid of toxicants (Mukhopadhyay and Ray, 1999).

The results obtained in this study agreed with Fasakin and Balogun (1998), and Fasakin et al. (2000) that relatively low fibbers and high protein content (as revealed in diets composition) enhance fish growth and better utilization of nutrients in diets. The study further supports Olukunle (1996), Olukunle and Falaye (1998),Ofojekwu and Kigbu (2002) and Eyo et al. (2004) which summarised that incorporation of processed sesame seed meal with fish meal, soybean meal, and or peanut cake and blood meal support fish growth and survival.

The mean water quality parameters observed revealed Dissolved Oxygen at 7.5 mg/l, Temperature at 28.20°C and pH at 7.5 and they were within the recommendations for warm water fishes (Boyd and Lithcoppler, 1979). Feed cost per kilogramme weight was highest in Diet 1 (N 220.00) which is justified by the high cost of fish meal (Fagbenro and Fasakin, 1996; Eyo and Olatunde, 1996; Sadiku and Jauncey, 1998; Falayi et al., 2009). The least feed cost (N 189.23) was obtained in Diet 6 with no fish meal while moderate costs (N 216.08,210.11,204.46,and N 189.23) were obtained in Diet 2, 3, 4 and Diet 5 respectively with sesame cake and fish meal inclusions.

VI. CONCLUSION AND RECOMMENDATION

Sesame seed cake has greater potentials as promising plant protein source than others because of the high protein, coupled with abundant methionine and arginine (EAAs) (Eyo and Olatunde, 1996; Eyo et al., 2004) which are deficient in most plants protein feedstuff. It is a rich source of lipids and essential fatty acids nutrients. With adequate heat involvement and extraction of oil, reduction in seed toxicants is achieved and the nutritive values also improved. The present study revealed that sesame cake combined with low levels of fish meal and extended soybean meal plant proteins results into better growth, cheaper feed and high survival rate of catfish *heterobranchus longifilis* fingerlings.

VII. RECOMMENDATION

More work still need to be conducted on sesame seed processing techniques to achieve the best and maximise the inclusion of sesame cake to fish meal. In order to cheapen cost of producing fish feeds and fish proteins in Africa, more people should go for mass production of sesame seed.

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