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Utilization of Copra Meal in the Nutrition of African Cat Fish

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ABSTRACT

A twelve week nutritional study was conducted to investigate the effect of replacing soybean with copra meal on the growth performance of *Clarias gariepinus*. Two hundred and ten Juveniles of *Clarias gariepinus* with mean weight+/- 14.43g were stocked at a rate of (14) fourteen juveniles per treatment and replicated three times. The fish were subjected to five different dietary treatments with varying levels of copra meal replacing soybean at 0%, 10%, 20%, 30% and 40%. Feeding rate of 3% body weight per day was adopted. Fish growth was monitored regularly by weighing every two weeks. The mean weight gain(MWG), specific growth rate (SGR), percentage weight gain (PWG) were significantly different ($p< 0.05$) and highest values (14.28g, 98.96% 68.79%/day) were recorded respectively for fish fed diet 5 (40% copra meal) while fish fed diet 3 (20% copra meal) had the least values of MWG, PWG and SGR (60.52g,83.16% and 60.52%/day) respectively.Treatment 5 had the least feed conversion ratio (FCR) of 1.93, showing this treatment to be highly efficient while treatment 1, 2, 3 and 4 had the highest values ranging between 2.10 – 2.11 The protein efficiency ratio (PER) and gross feed conversion efficiency (GFCE)were significantly different ($P<0.05$). Highest values of PER and GFCE (1.73, 51.80%) were recorded for treatment 5 and least values of 0.84 and 47.30% were found in treatment 3 respectively. The positive relationship observed between the growth parameters and the level of copra meal in the diet showed that African cat fish can utilize Copra meal efficiently to improve growth.
It was therefore concluded that up to 40% copra meal could adequately and efficiently replace soybean meal without any adverse effect on *Clarias gariepinus* diets.

Introduction

A great set back in the development and expansion of aquaculture in Nigeria and Africa at large has been associated with the cost of fish feed, particularly fishmeal, soybean and palm-kernel cake which are the major sources of protein in animal feeds There is however limitation in the use of these feed ingredients as a result of their relevance in human consumption as well as the cost which has actually contributed to the drastic decline in fish production (FAO, 2006). Therefore, it is imperative to find alternative protein sources.

One of the most promising alternatives is the use of wastes as feed sources such as feeding fish with rumen content (Olaniyi,2010), feather meal (Omitoyin, 1995) as well as utilization of plantain peel in cat fish diet (Oloruntuyi, 1997).

According to Federal Ministry of Agriculture and Natural Resources (1997) Nigeria recorded, a great increase in coconut production between 1986 and 1996 from 104, 000 metric tons to 151,000 metric tons respectively. Although, Philippines and Indonesia are the major producing countries of coconut (Swick 1999). Corpra is a by-product obtained from coconut fruit after been processed mechanically to release the oil and the copra meal left as residue can be used as feed ingredient (Kim *et al*.,2001)

Inspite of its great importance as feed ingredient, Copra has poor quality protein(Thorne *et al*., 1990),contain tannin a major anti- nutrient (Mukhopadhyay and Ray, 1999) and deficient in important essential amino acids such as Lysine, Methionine, Threonine and Histidine but high in Arginine, which has antagonizing effect on lysine utilization (Swick 1999). However, research has proved that supplementing Lysine and Methionine to fish fed copra meal limits antagonism effect of Arginine (Hertrampf *et al*., 2000) Likewise,. Soaking copra at room temperature for 16hours period reduces tannin content from 2.50% to a minimal level of 10.86% in raw copra meal (Olude *et al*., 2008). Thereby, improving its utilization as a cheap source of protein in the diets of fish (Kim *et al*., 2001).

Clarias gariepinus is of high commercial interest (Faturoti, 2000) and capable of withstanding adverse environmental condition more than other culturable species such as Tilapia, and Carp (Pillay, 1992). The fish is omnivorous and coupled with it fast growth rate has made it attractive to the fish farmers in Nigeria.

This study therefore determined the nutritive values of soaked copra meal, and the replacement level of soy bean meal with soaked copra meal in the diet of *Clarias gariepinus*.

Materials and Method

Experimental Site

The experiment was carried out at the Fishery Unit, Teaching and Research Farm of Ladoke Akintola University of Technology Ogbomoso.

Preparation of Test Ingredients

The copra meal was obtained from a local coconut industry in Lagos State, Nigeria and soaked for about 16 hours to reduce the level of tannin as prescribed by Mukhopadhyay and Ray, (1999a, b. and c). After which, it was sun dried before used.

Experimetal Procedure

A total number of 210 Juvenile *Clarias gariepinus* were obtained from a reputable fish farm in Ogbomoso, Oyo State. One hundred and forty juvenile used for this study were acclimatized for two weeks prior the commencement of the experiment. The fish were randomly divided into five groups and distributed into fifteen rectangular tanks (40litres) and fed

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with 3% body weight of five different diets (contained 40% crude protein) formulated with different varying levels of soaked copra meal. The feeding was done twice daily (morning and evening) at 8.00hours and 17.00hours for the period of twelve weeks. The weight of the fish were taken every two weeks for twelve weeks and the record of feed consumption were taken at the beginning using an electronic digital weighing scale.

Data collection

The parameters measured were Weight Gain; Average Daily Weight Gain; Feed intake;

Each of these parameters was measured at 2 weeks interval. Performance characteristics were evaluated according to the method of Olvera- Novoa*et al*, (1990) as follows:

Mean Weight Gain (MWG) = Final mean weight (g) - Initial mean weight (g);

Average Daily Weight Gain (ADWG) = Mean weight gain (g) / length of feeding trial (days);

Percentage Weight Gain (PWG) = Mean weight gain (g) / Initial mean weight; x 100

Specific growth rate (SGR % /day) = $100[(Log_eW_2 - Log_eW_1)/N_O$ of days

Feed conversion ratio (FCR) = total feed fed (g) / net weight gain (g);

Protein Intake (PI) = total feed consumed X % Crude protein in feed

Feed intake (FI) = This is the amount of feed throughout the period of the experiment ;

Protein Gain (PG) = mean protein intake (g) / length of feeding trial (days);

Protein Efficiency Ratio (PER) = Net weight gain (g) / Amount of protein fed (g) while

Protein productive Value (PPV) = protein gain in fish (g) / Protein in food (g) x100.

Proximate analysis

Proximate composition of the diets, carcass of fish samples taken before and after the experiment was carried out according to the methods of Association of Analytical Chemist A.O.A.C (1995).

Statistical Analysis

All data collected were subjected to one way analysis of variance (ANOVA) using completely randomized design (CRD) in accordance with SAS (1999) and Duncan's multiple range tests was employed to reveal significant differences among the treatment mean.

Results

Growth performance of *Clarias gariepinus* fed varying levels of soaked copra meal is presented in table 4 and fig.1and 2. All the experimental fish gained weight at the end of the feeding trial and there were no mortalities throughout the experiment.

Final mean weight were significantly different ($p<0.05$) which ranged from 28.71g to 26.50g. Fish fed diet3 (20% copra meal) had lowest mean weight compared with fish fed other diets. The highest value were obtained for the fish fed diet5 (40% copra meal) and fish fed diet1 (control 0% copra meal) 28.71g and 27.86g respectively. Mean weight gain per day were also significantly different ($p<0.05$) ranges fell between 170.00mg to 142.86mg. Fish fed diet5 recorded the highest value (170.00mg). However, fish fed diet 2, 3 and 4 were not significantly different ($p>0.05$) having least value of 143.69mg, 142.86 and 144.94mg respectively. There were significant differences ($p<0.05$) among Specific Growth Rate, fish fed diet5 had the highest value of 68.79g while SGR for Fish fed diet2, 3 and 4 show no significant difference ($p>0.05$). Feed conversion ratio also showed significant differences ($p<0.05$). Fish fed diet2, 3 and 4 had the highest value of 2.11, 2.11 and 2.10 respectively while fish fed diet 5 has the least value of 1.93 and was significantly different ($p<0.05$). The Gross feed conversion efficiency values ranges from 51.80% to 47.30%. Fish fed diet 5 had the highest value of 51.80% and was significantly different ($p<0.05$) while fish fed diet3 had the least value of 47.30%. There were also significant differences ($p<0.05$) in the values of the protein intake and protein efficiency ratio, diet 5 had the highest values of 11.15 and 1.28 respectively while other diets are having the least values with no significant differences ($p>0.05$).

Table 5. showed the proximate composition of the fish carcass at the beginning and the end of the feeding trial. The fish fed copra meal at different levels of inclusion gained more protein and fat compare with the fish at the initial stage (beginning of the experiment. However, fish fed diet 5 gained more protein and fat compared to other fish that were not fed copra meal (control diet).

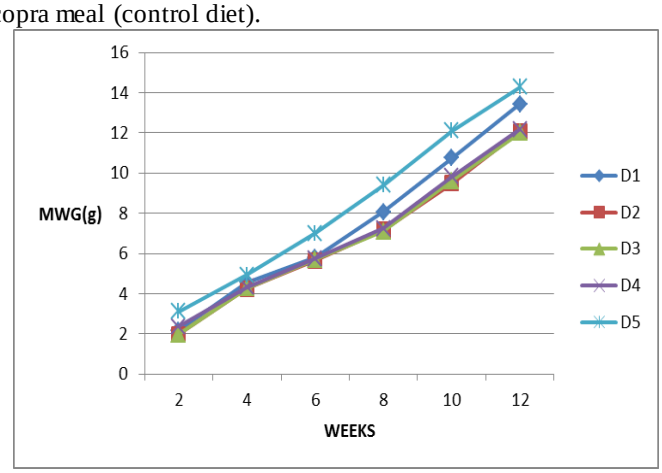

Figure .1 showing the relationship between the Mean weight gain and weeks

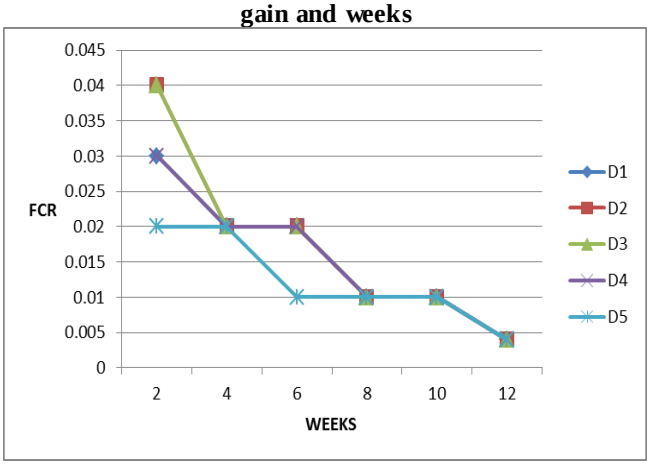

Figure 2. showing the relationship between feed conversion rate and the weeks

Discussion

The present study demonstrates that soaked copra meal could be used to partially replace soybean in feed for *Clarias gariepinus*. Replacing soybean with 40% soaked copra meal will enhance the growth performance and feed utilization efficiency. The results of the present study were in agreement with the work of Mukhopadhyay and Ray (1999a and b) who recommended 30% and 40% inclusion levels respectively for *Labeo rohita* fed treated copra meal and sesame seed meal. However, 40% inclusion level recommended in this study, disagreed with the report of Olude *et al*., (2008) who recommended 30% copra meal inclusion in *Oreochromis niloticcus* diet.

Table 1. Gross composition of experimental diets

Ingredients	Diet 1(control) 0%	Diet 2 10%	Diet 3 20%	Diet 4 30%	Diet 5 40%
Yellow maize	10.51	9.49	8.41	7.33	6.19
Wheat bran	5.25	4.75	4.21	3.67	3.10
Groundnut cake	26.06	26.57	27.11	27.65	28.22
Fish meal	26.06	26.57	27.11	27.65	28.22
Soy bean	26.06	23.91	21.68	19.36	16.93
Copra meal	-	2.66	5.68	8.30	11.29
Vegetable oil	0.5	0.5	0.5	0.5	0.5
Salt	0.05	0.05	0.05	0.05	0.05
Methionine	2.00	2.00	2.00	2.00	2.00
Lysine	2.00	2.00	2.00	2.00	2.00
Vitamin premix	1.5	1.5	1.5	1.5	1.5
Total	100	100	100	100	100

Table 2. Proximate Composition of Copra Meal

Parameters	Dry matter	Crude Protein	Crude fat	Crude fiber	Ash	Nitrogen extract
%	89.25	20.57	3.95	12.46	7.14	45.13

Table 3. Proximate composition of experimental diets

Diet Number						
Components	1	2	3	4	5	SEM
Dry matter	90.66^{a}	90.22^{bc}	90.31^{c}	90.60^{ab}	90.53^{a}	0.05
Crude protein	40.82^{b}	41.31^{a}	39.70^{e}	40.21^{c}	40.44^{c}	0.18
Ether extract	3.74^{d}	4.82^{cb}	4.73^{c}	4.89^{b}	5.08^{a}	0.16
Crude fibre	3.03^{e}	3.58^{b}	3.28^{d}	3.40^{c}	3.70^{a}	0.78
Ash	12.68^{b}	13.35^{a}	12.69^{b}	12.99^{ab}	12.90^{ab}	0.09
Nitrogen free extract	30.40^{a}	27.38^{c}	29.92^{a}	29.12^{b}	28.56^{b}	0.336

Means with different superscript are significantly different ($p<0.05$

Table 4. Growth performance of *Clarias gariepinus* fed varying levels of soaked copra meal

	Diets Number					
Parameters	1	2	3	4	5	SEM
Initial weight(g)	202.00	202.00	202.00	202.00	202.00	0.00
Final weight	390.00^{b}	371.00^{c}	370.00^{c}	372.50^{c}	402.00^{a}	4.233
Mean weight gain (g)	13.43^{b}	12.07^{c}	12.00^{c}	12.18^{c}	14.28^{a}	0.31
Specific growth rate(%/day)	65.77^{b}	60.79^{c}	60.52^{c}	61.18^{c}	68.79^{a}	1.12
%weight gain	93.04^{b}	83.65^{c}	83.16^{c}	84.38^{c}	98.96^{a}	2.14
Average daily weight gain/day(mg)	159.83^{b}	143.69^{c}	142.86^{c}	144.94^{c}	170.00^{a}	3.67
Feed conversion ratio	2.10^{a}	2.11^{a}	2.11^{a}	2.10^{a}	1.93^{b}	0.02
Gross feed conversion efficiency	50.20^{b}	47.45^{c}	47.30^{c}	47.67^{c}	51.80^{a}	0.61
Protein intake	10.92^{b}	10.51^{c}	10.07^{c}	10.27^{c}	11.15^{a}	0.23
Protein efficiency ratio	1.23^{b}	0.89^{c}	0.84^{c}	0.84^{c}	1.78^{a}	0.01

Means with different superscript are significantly different ($p<0.05$)

Table 5. Proximate carcass compositions (% dry weight) of *Clarias gariepinus* sample at the beginning and end of the feeding trials

	Diets						
Components	1nitial	1	2	3	4	5	SEM
Dry matter	96.40^{c}	93.47^{b}	93.49^{b}	93.42^{b}	94.14^{a}	93.35^{b}	0.10
Crude protein	5230^{d}	55.30^{c}	59.87^{b}	59.86^{b}	61.39^{a}	61.53^{a}	0.76
Ether extract	5.01^{c}	6.11^{c}	6.20^{bc}	6.51^{a}	6.38^{ab}	6.48^{a}	0.56
Crude fibre	0.26^{ab}	0.16^{b}	0.23^{ab}	0.27^{ab}	0.26^{ab}	0.35^{a}	0.24
Ash	10.78^{d}	10.76^{d}	11.50^{c}	12.06^{a}	11.50^{c}	11.74^{b}	0.14
Nitrogen free extract	21.16^{a}		15.69^{b}	14.72^{c}	14.62^{c}	13.25^{d}	0.92

Means with different superscript are significantly different ($p<0.05$)

In the same vein, Olude *et al*., (2008) also observed improved performance where soybean was replaced over the fish fed whole soybean meal (100% soybean meal). Oil seeds and by product are usually major source of dietary protein in fish feed for warm water species (Akiyama, 1991) however high inclusion levels could be limited by the presence of anti-nutritional factors such as tannins, which form complexes with protein thereby reducing its nutrients availability and digestibility (Mole and waterman, 1987) likewise, deficiency of lysine and methionine (Tacon *et al*., 2009) in copra meal also limit its efficiency.

A progressive trend in MWG, PWG, and SGR observed in this study disagreed with the findings of Olude *et al*., (2008) who reported low performance in fish fed copra meal. This could results from the presence of lower levels of fishmeal and high level of copra meal inclusion. The carcass lipid content of fish fed higher level of copra meal was higher than fish fed control diet. This agreed with the report of Olude *et al*., (2008).

Conclusion

In this study, best performance was observed at 40% inclusion of soaked copra meal in the diet of African catfish. Therefore, this showed that copra meal could be partially used to replace soybean meal in the diet of *Clarias gariepinus*.

References

Akiyama, D.M. (1991). The use of soy products and other plant protein supplement in aquaculture feeds. In: Proceedings of the Aquaculture Feed Processing and Nutrition Workshop (Akinyama D.M and Tan R.K H editors) 199 – 206pp.

A.O.A.C (1995). Official methods of analysis. .16th edition Association of official analytical chemists Arlington V.A, U.S.A, 1018p

Duncan, D.B. (1955). Multiple range and multiple Ftest Biometrics 11 ; 1 – 42Wiley puplisher, New York.

F.A.O. (2006). Food and Agriculture Oganisation of the United nation Aquaculture,FAP report.

Faturoti, E.O. (2000). Beneath the ripples and sustainable fish production. Inaugural Lecture, University of Ibadan, Nigeria, 2000, p. 54.

Federal Ministry of Agricultural and Natural Resources (1997). Nigeria Agricultural Statistical and Time Series Data. Agricultural statistical and information management system. Dept. of planning Research and statistics. Federal Ministry of Agriculture, Abuja. 2nd Edition.140pp.

Hertrampf, J. W.; Piedad-Pascual, F.(, 2000). Handbook on ingredients for aquaculture feeds. Kluwer Academic Publishers. 624 pp.

Kim, B. G.; Lee, J. H.; Jung, H. J.; Han, Y. K.; Park, K. M.; Han, I. K., (2001). Effect of partial replacement of soybean meal with palm kernel meal and copra meal on growth performance, nutrient digestibility and carcass characteristics of finishing pigs. Asian-Australasian *Journal of Animal Sciences, 14(6): 821-830*.

Mole, S and waterman , P.G.(1987). Tannic acid and proteolitic enzymes. Enzyme inhibition and substrate deprivation phytochemistry 26:99 -102.

Mukhopadhayay N and Ray A. K (1999a).Effect of copra meal in the formulation of compound diets for rohu, *Labeorohita*, fingerlings. *Journal of Applied Ichthyology 15(3): 127-131*.

Mukhopadhayay N and Ray A. K (1999b). Effect of fermentation on the nutritive value of sesame seed meal in the diets for rohu, *Labeo rohita* , fingerlings. *Aquaculture Nutrition* 5:229 -236.

Mukhopadhayay N and Ray A. K (1999c).Improvement of quality of sesame. *Sesamum indicum* seed meal protein with supplemental amino acids in feeds for rohu, *Labeo rohita* ,(Hamilton) fingerlings. Aquaculture Research 30 (8):549 -557.

Oloruntoyin O.O. (1997) The utilization of plantain peel meal in the nutrition of *Oreochromis niloticus* (Trewavar) and *C. gariepinus* (Burchell). Ph.D Thesis University of Ibadan, Nigeria.

Pillay, T.R.V.(1992).Aquaculture and the Environment, Fishing, News Books. 189pp.

Omotoyin B.O. (1995). Utilization of Poultry by-products (feathers and offals) in the diet of African Catfish *C gariepinus*. (Burchell) Ph.D thesis University of Ibadan.

Olude, O. O.; Alegbeleye, W. O. A.; Obasa, S. O., 2008. The use of soaked copra meal as a partial substitute for soybean meal in the diet of Nile tilapia (*Oreochromis niloticus*) fingerlings. Livestock Research for Rural Development, 20(10): 169.

Swick R. A. (1999) Consideration in using protein meals for poultry and swine. American Soybean Association, Technical Bulletin.19pp.

Tacon, A. G. J.; Metian, M.; Hasan, M. R., 2009. Feed ingredients and fertilizers for farmed aquatic animals. Sources and composition. FAO Fisheries and Aquaculture technical paper, 540. FAO, Roma, Italy