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ASSESSMENT OF COTTON-SEED (*Gossypium* species) MEAL AS INGREDIENT IN THE DIET OF *Clarias gariepinus* JUVENILES

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Abstract
The effect of feeding graded levels of cotton GossypiumSpp. seed meal as an inclusion in the diet of Clariasgariepinus juveniles for growth performance was analysed in comparison with the conventional commercial fish feed. Six experimental rations formulated were cotton-seed Gossypium spp. meal replaced fish meal at graded levels of 20%, 30%, 40% 50%, and 100% and were fed to Clariasgariepinus juveniles for 56 days. The experiment was conducted in six outdoor concrete tanks in the Department of Biological Sciences Garden, Ahmadu Bello University, Zaria, Nigeria. Data for each parameter were subjected to Analysis of Variance (ANOVA) and the means for various experimental diets were compared for significant differences at 0.05% level of inclusion. The results showed that fish fed with diet contained 20% cottonseed meal ($D_{1)}$ gave the best Body Weight Gain (81.28g), Specific Growth Rate (2.23), and Condition Factor (1.49), while diet contained 30% cottonseed meal ($D_{2)}$ gave the least Weight Gain (49.67g), Specific Growth Rate (1.58) Conversion Ratio (3.64) and Condition factor (0.79). The results were significantly different ($p<0.05$) for both growth and feed utilization parameters. Therefore, cotton-seed meal can be used as a replacement for fish meal at 20% level of inclusion. The results established significant reduction in production cost while optimal production is achieved.

Keywords: Cotton-seed (Gossypium species), Diet, Growth performance, Clarias gariepinus juveniles

INTRODUCTION

Commercial fish feeds are usually expensive because the traditional or conventional protein source ingredient such as fish meal, soyabean meal, groundnut cake, maize, millet, guinea corn, vegetable oil e.t.c are competing for human and livestock consumption (Madu *et al.,* 2003). Fish feed constitute for about 60-80% of management cost in agricultural production (Igonifagha, 1979). Periodic scarcity and high cost of conventional fish feed cause a dramatic increase in cost of fish. For the production of conventional fish feed at cheap price and available, there is need for commercial fish feed producers in the country to use less expensive fish feed with good growth and better cost values (Oreshegun and Ayinla, 2001).

The effective production and growth of fish in culture system depend on feeding complete diet feed at level not exceeding the dietary requirement of the fish (Ayinla, 1992). There is an absolute need to intensify effort in order to supply culture species with adequate diets to supply their nutrients requirements qualitatively and quantitatively in order to achieve fast growth and high fish yield (Wee and Aminu, 1986).

A wide range of Agricultural product and Agro-industrial by product has been studied and are known to possessed nutrients for fish feeding (Okoye and Eyo,1989; Ashiru, 2011). Some of the product include; millet bran, groundnut cake, cotton-seed cake, wheat bran, cassava peel, blood meal, grasshopper, baobab leaves which are formed to be abundant and cheap in the northern zone of Nigeria (Okoye and Eyo., 1989). The non-conventional resource used for fish feed could be of plant or animal original and may be classified under the three major resource group:

i. Aquatic and terrestrial plants and animals (mainly macrophytes, invertebrates, and amphibians).
ii. Agricultural by-products of plants or animals origin.
iii. Industrial waste product (food processing and poultry industrial) (Madu *et al.,* 2003).

Large proportion of Nigerian fish supply is derived from capture fisheries, which has still not been able to satisfy fish demand in the country. In order to intensify fish production through aquaculture, adequate fish feed would be required for attaining high fish yield (Eyo, 1994). Therefore, there is a pressing need to search for alternative cheaper fish feed stuff from non-conventional sources.

(Alegbeleye *etal.*, 2001). Feedstuff used in fish feed formulation are composed mainly of natural product as well as many of the by-product of processing or milling industries but the proportion in which these components are present differs between feeds (Ashiru, 2011).

Foodstuffs can be classified as energy feedstuffs and protein supplement. The energy feedstuffs contain high amount of carbohydrates, low to high amount of ether extracts or lipid and low amount of protein. Carbohydrates have a supporting effect on protein in artificial feeds so that fish can utilize protein efficiently for growth rather than energy (Eyo, 1994). The present study was, therefore, conducted to assess Cotton-seed (*Gossypium species*) meal in the diet of *Clariasgariepinus* fingerlings.

MATERIALS AND METHODS

Fish Source and Managements

A total of seventy two (72) Juveniles of *Clariasgariepinus* were obtained from Bangiwa Farm, Funtua Local Government, Katsina State. The fish were transported in a fifty liters (50) half filled plastic container with water. In the laboratory they were acclimatized for two weeks in two large water baths of 160 liters capacity at the rate of 36 fish per water bath. All fish were fed daily at 9.00 am and 3.00 pm. After acclimatization, the fish were distributed randomly into the experimental concrete tanks representing six treatments, each tank has twelve fish. At stocking, body weight and length of fish per tank was measured.

Source of Cotton-seed Meal

Cotton-seed meal was purchased from Nigerian Oil Mills Company, Tafawa Balewa Road, Nassarawa Local Government, Kano State, Nigeria. The meal was then incorporated into the experimental diet according to the requirement of each treatment.

Processing of cotton-seeds

The cotton-seeds were toasted locally in an open flame for ten minutes and milled.

Feed Analysis

The Association of Official Analytical Chemist AOAC (1990) methods of analyses were used to analyse the following parameters: Moisture content, Crude Protein content, crude fibre content, Oil/Lipid Content, Ash Content, and Free Nitrogen Extract for the Experimental diets.

Experimental Set-up

The experimental set-up consists of six outdoor concrete tanks of 1.3m x 0.9m x 1m capacity ($1.17m^3$). The concrete tanks were cleared and cleaned. Each tank was assigned to each of six experimental diets containing different level of cotton-seed meal, the sixth tank serve as control. The water level was maintained at 0.6m throughout the experimental period and the waste water was replaced every four days.

TABLE 1 Nutrient and Feed Formulation Table

INGREDIENTS	DIETS IN PERCENTAGE (%)					
	D1 20%	D2 30%	D3 40%	D4 50%	D5 100%	CONTROL 00%
Yellow maize	8.71	8.71	8.71	8.71	8.71	10.92
Wheat grain	13.71	13.53	13.53	13.53	13.53	16.95
Wheat offal	13.62	13.62	13.62	13.62	13.62	17.07
Cottonseed cake	12.82	17.25	25.65	32.07	64.14	00.0
Fish meal	51.31	44.89	49.41	32.07	00.0	55.06
Bone Meal	1.0	1.0	1.0	1.0	1.0	1.0
Vit. Premix	0.4	0.4	0.4	0.4	0.4	0.4
Lysine	0.3	0.3	0.3	0.3	0.3	0.3
Methionine	0.2	0.2	0.2	0.2	0.2	0.2
NaCl	0.1	0.1	0.1	0.1	0.1	0.1

D1=20% Inclusion
D2=30% Inclusion
D3=40% Inclusion
D4=50% Inclusion
D5=100% Inclusion
D6=Control

Table 2 Growth Performance Indices of C*larias gariepinus* FedDifferent Graded Levels of Cotton Seed-Meal

PARAMETERS	TREATMENTS IN PERCENTAGE (%)					
	D_1	D_2	D_3	D_4	D_5	D_6
	20%	30%	40%	50%	100%	00%
No of fish	12	12	12	12	12	12
Mortality rate(%)	09	00	00	03	00	03
Average Initial weight (g)	33.72	34.63	33.96	32.65	34.40	37.25
Average Final weight (g)	118.0	84.3	93.87	98.12	98.33	98.91
Weight gain (g)	87.28^{a}	49.67^{d}	59.91^{cc}	65.47^{b}	63.83^{bc}	61.66^{c}
Percentage life Weight Gain (PWG%)	284.11	143.43	176.41	200.52	187.91	165.53
Average Initial Standard Length. (cm)	13.63^{d}	15.10^{bd}	16.06^{a}	15.69^{b}	14.52^{c}	15.33^{bc}
Average Final Standard Length (cm)	19.90	22.00	21.94	22.30	22.90	22.99
Average Increase in Standard length (cm)	6.27^{c}	6.90^{c}	5.88^{d}	6.61^{d}	8.38^{a}	7.66^{b}
Average Initial Total Length (cm)	13.63	16.20	17.26	17.05	15.83	16.88
Average Final Total Length (cm)	22.24	24.18	22.73	24.56	25.48	25.27
Average Increase in Total Length (cm)	8.61	7.98	5.47	7.51	9.65	8.39
SGR	2.23^{a}	1.58^{d}	1.80^{a}	1.96^{b}	1.87^{c}	1.58^{d}
Fish survival rate	91	100	100	97	100	97

RESULTS

Table 2 shows the growth assessment of *Clariasgariepinus* fed different graded levels of cotton-seed meal.The number of fish was 12 in all the tanks at the beginning; Fish mortality was experienced in tanks 1, 5, and control. The number of mortality are, 2,1,1 for the tanks respectively. Control which contains zero amount of cotton-seed meal recordedthe highest average initial body weight followed by fish fed D_5, D_2, D_3, D_4, and D_1 respectively. Fish fed D_1 recorded the highest average final weight which was 118.0g followed by the fish in control D_5, D_4, D_3, and D_2 respectively. Fish fed D_1 which has 20% inclusion of cotton-seed meal recorded the highest mean body weight gain of 87.28g, followed by the fish fed D_4: 65.47g, D_5: 63.83(g), control 61.66(g), D_3: 59.91g and D_2 recorded the lowest mean body weight gain of 49.69g respectively. The statistical analysis showed that there was significant difference ($p<0.05$) between the treatments in average fish body weight gain with fish fed D_1 which has 20% inclusion of cotton-seed meal been the best, and D_2 which has 30% inclusion of cotton-seed meal was the least. Fish fed D_4 and D_5 performed better than the control. Fish fed D_2 has no significant difference ($p\geq0.05$) with the control treatment.The average increase in standard length of fish among the treatments were 6.27 cm, 6.90cm, 5.88 cm, 6.61cm, 8.38 cm, and 7.66cm, for Fish fed D_1, D_2, D_3, D_4, D_5 and control respectively. However, statistically there was no significant difference ($p\leq0.05$) between the treatments.

The Specific Growth Rate shows that fish fed D_1 had the highest SGR of 2.23 while Fish fed D_2 and control had lowest SGR of 1.58. The SGR for fish fed D_4, D_5, and D_3 had SGR of 1.96, 1.87 and 1.80 respectively. The statistical analysis however showed significant different ($p\leq0.05$) between Fish fed D_1 and D_2, Fish fed control, D_3, D_4 and D_5. There was no significant difference ($p>0.05$) between Fish fed control and D_2. Fish Survival Rate among the treatments was generally high, ranging from 100% for fish fed D_2 D_3 and D_5 while Fish fed D_1, D_4 and control had 91% 97% and 97% respectively. Statistically, there was no significant difference ($p<0.05$) in the Survival Rate among Fish in different treatments tanks. The Specific Growth Rate (SGR) shows that fish fed D_1 had the highest SGR of 2.23 while Fish fed D_2 and control had lowest of SGR 1.58. The SGR for fish fed D_1, D_5, and D_3 had the SGR of 1.96, 1.87 and 1.80 respectively. The statistical analysis however showed significant different ($p<0.05$) between D_1 and D_2, control, D_3, D_4 and D_5.

While there was no significant difference ($p>0.05$) between Fish fed control and D_2. Nitrogen metabolism (NM) was highest with fish fed D_1 with values 1,604.37 and lowest with Fish fed D_2 with values 763.52 while fish fed D_3, D_4, D_5 and control had the values 920.93 1,006.40 and 947.37 respectively. Statistically, there was significant different ($p<0.05$) among the treatments. According to this study, fish fed D_1 had significantly greater mean body weight gain (87.28g) than those of $D_{2,,}$ D_3 D_4 D_5 and control that had 49.67g, 59.19g, 65.47g, 63.83g, 61.66g, respectively. This suggested greater protein utilization in Fish fed D_1 which had 20% inclusion of cotton-seed meal in the diet of *Clariasgariepinus* juvenile. This means were significant, indicating the possibility of partial replacement of fish meal by cotton-seed meal at 20% with the adverse effect on final body weight of *Clariasgariepinus* and similar trained was also observed for Specific Growth Rate and Feed Conversion Ratio.

Discussion

Simon *et al.* (2008) obtained 91.29g for fish fed with 15% inclusion level of cotton-seed meal of *Clarias gariepinus* juveniles also recorded mean body weight gain of 67.18g and 48.13g for *Clarias* fed 45% and 60% inclusion of level of cotton-seed meal respectively. Balogun *etal.,* (2004) reported that, weight gain and standard length increases are known to be the most essential parameters for measuring fish responses to experimental treatments and liable indicator of growth, using *Delonix regia.* Sanz *etal*. (1994) evaluated the nutritive potential of sunflower meal protein as compared to soyabean meal and fish meal protein in trout diets. They found that, sunflower meal protein could be replaced up to 40% of fish meal protein or soybean meal protein in the diet at the sametime replacing percentage in trout diets without any negative impact on body weight. In another study, Abdul-Aziz *etal*. (1999) showed the possibility of partial substitution of soybean protein with sunflower protein up to 50% without adverse effect on body weight of Nile tilapia fingerlings.

Some attempts were made to replace the high cost of animal protein source with sunflower meal (low costs plant protein). Fagbenro and Davies (2000) stated that, replacement of 67% of fish meal by sunflower meal in tilapia diets did not significantly altered the final weight. Olvera-Novoa *et al*., (2002) showed the possibility to replace animal protein source in tilapia fry diets with sunflower seed meal up to 20% without significant effect in body weight of Nile tilapia fry while the highest replacing levels significantly decrease the body weight. In another study, El-Saidy and Gaber (2002) found that up to 50% de-hulled sunflower meal protein could be used to replace fish meal as a protein source in the diet of Nile tilapia, *Oreochromisniloticus* without significant effect on the Body Weight. Abbas *etal*., (2005) reported that the gradual rise in replacement level of fish meal by sunflower meal negatively affected growth performance of major carps and the minimum decrease in fish production was recorded at 25% replacement level while the maximum decrease was recorded at 75% replacing level of fish meal by sunflower meal, this is reverse of our findings in this study.

Conclusion

Juvenile African Catfish *Clariasgariepinus* fed 20% inclusion of cotton-seed meal had the highest, crude protein content of about 60.63%, highest Specific Growth Rate, Feed Conversion Ratio, highest Percentage Weight Gain, best Feed Conversion Ratio, highest Protein Utilization highest Condition Factor and highest amount of Nitrogen Metabolism.

Recommendations

i. Cotton-seed meal in the diets of juvenile African catfish should be within the range of 20%-30% inclusion levels.

ii. Cotton-seed meal inclusion of 20% level should be maintained in fish feed because of its high fibre content and high protein content of about 40% for the later.

REFERENCES:

Abbas, K. Ahmed, I. and Rehman, H. (2005). Growth Performance as Influence by Partial Replacement of Fish Meal with Plant Proteins in the Diet of Major Carps. *IndustrialJournal of Biological Sciences*, 2(2):219-226.

Abdul-Aziz, G. M., El-nady, M.A., Shalady, A.S. and Mohmoud, S.H. (1999): Partial Substitution of Soyabean Meal Protein by Different Plant Protein Source in Diets for Nile Tilapia Fingerlings. *Buletin of Faculty of Agriculture.* Cairo Univ., 50:189-202.

Alegbeleye, W.O.A. Oresegun, Akegbejo-Samsons and S.O. Obasa (2004). Replacement of Groundnut Cake with Rubber Seed Cake in diet for Nile Tilapia. *Journal of Aquatic Science,* Vol. 19(1) 27-30.

Ashiru, A. (2011). Assessment of Cotton-seed (*Gossypium species*) Meal as Ingredient in the Diet of *Clariasgariepinus* Juvenilis. Unpublished Thesis submitted to the department of Biological Sciences, Faculty of Science, Ahmadu Bello University,Zaria-Nigeria

AOAC (1990). AssociationofOfficialAnalyticalChemist *Official Method of the Analysis A.O A.C.14th edition* Williams(ed) Artinton V.A.P 1102.

Ayinla, O.A. (1992). *Trends in Agricultural development in Africa* (RAFR). 142.

Balogun, J.K.S.; A.S. Abdulahi; J.Auta, and O.P. Ogunlade (2004). FeedConversion, Protein Efficiency, Digestibility and Growth Performance of *Oreochromisniloticus* fed *Delonixregia*. Seed Meal. 2004. *Proceedings of the National Conference of Fisheries Society of Nigeria* (FISON). FISON. Lagos, Nigeria. 823-29

El-Saidy, D.M. and Gaber, M.M. (2002). Evaluation of Dehulled Sunflower Meal as a Partial and Complete Replacement for Fish Meal in Nile Tilapia, Oreochromis nilotocus (L) *Diets. Proccessing. 1st Animal Science. Conference. Animal. & fish Production. Mansoura,* 24-25.

Eyo, A.A. (1994). The requirement for Formulating standard artificial fish feed. *Paper presented at the 11th Annual Conference of the Fisheries Society of Nigeria* (FISON) held at the Lagos State, Auditorium Secretarial, Alausa Ikeja, Lagos State, 22nd -24th February, 1994. 15

Igonifagha, G.D. (1979). ProfitabilityofFishCulture.*National Institute of Marine Resource Occasional*. *International Fishing and Cultural Festival During the Workshop in Investment* in Kebbi State. Paper 26, p. 8

Madu, C.I. and Akilo, K.T Sogbes, A.O and Ibiyo, L.M. (2003). Some Non-conventional Fish Feed Development and Feeding Practice in Agriculture.*An abstract book ofFisheries Society of Nigeria*, Page 73.

Fagbenro, O.A. and Davies, S.J. (2000): Use of Oilseed Meals as Fish Meal Replace in Tilapia Diets. Proceeding 5th edition *International Symposium on Tilapia in Aquaculture*, Rio Dejaneiro Brasil, 3-7 September.

Olvera-Novoa, M., Olivera-Castillo, L. and Martinez-Palacion, C. A. (2002). Sunflower Seed Meal as a Protein Source in Diets for *Tilapia Rendalli (Boulanger, 1896)* Fingerlings.*Aquaculture Research,* 33: 223-229

Oreshegun, A. and Ayinla, O.A. (2001). Fish Feed development in Nigeria. Status and Options for the Next Millennium, *Journal of Feed Nutrient and Feed Technology,* vol. 4-6.

Okoye F.C and. Eyo, A.A (1989). Effect of Various Lipids Source on the Growth and Survival of *Oreochromis niloticus* Fingerlings. *Proceeding of the 17th Annual Conference of the Fisheries Society of Nigeria* (Fison) Eds, A.D. Onyia and G.N Asala: 59-65.

Simon, J. A. G., Ahmet, A. and Derya, G. (2008). Dietary Nitrogen Utilization in African Catfish, Clarias gariepinus fed Oil Seed Meal Based Diet Under Sub-Optimal Growth Conditions Consistent with a Restricted Feeding Regime. *Journal of Fisheries International* 3(4): 98-104.

Sanz, A., Morales, A. E. De la Higuera, M. and Cardenete, G. (1994): Sunflower Meal Compared with Soybean Meal as Partial Substitutes for Fish Meal in Rainbow Trout *Oncorhynchus mykiss Diets*: *Protein and Energy Utilization. Aquaculture*, 128: page 287-300.

Wee, K.L. and Aminu, N.G. (1986). Use of Cassava as an Energy Source in Pelleted Feed forTilapia *Oreochromisniloticus* L *Aquaculture and Fisheries Management,* 17: 129-138