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Growth Response of *Clarias gariepinus* (Burchell 1822) Juveniles to Diets Containing Raw *Mucuna utilis* Seed Meal

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Abstract: Feeding trial was conducted in static water to assess the growth of *Clarias gariepinus* fingerlings fed different inclusion levels of Mucuna Seed Meal (MSM). Raw MSM was used at 10, 20 and 30% inclusion levels and the performance of fish fed, these diets was compared with the fish fed soybean-based diet (0% MSM) which contained 40% protein. All diets were prepared to be isonitrogenous and isocaloric. A four by six factorial experiment with three replicates using ten fish each of average initial weight of 6.60±g was carried out. Daily fish ration of 5% body weight was administered 2 times for 12 weeks. The Specific Growth Rate (SGR) in diet 1 (control) was significantly ($p<0.05$) higher than the other dietary groups and worsens as inclusion level increased similar trend was also observed in the Food Conversion Ratio (FCR) and Protein Efficiency Ratio (PER). The significantly lower growth performance of fish fed diets containing raw MSM might be due to the presence of anti-nutritional factors present raw MSM. The possibility of improving this trend through processing should be investigated.

Key words: *Clarias gariepinus,* mucuna seed meal, anti-nutritional factors, birth values, body weight, Nigeria

INTRODUCTION

In recent times, technological revolution has enhanced rapid and self-sustaining economic growth in the developing countries leading to reduction in death rates without a corresponding reduction in birth rates, high population growth and pressure on available natural resources. Africa has about three quarters of a billion people (Bongaarts, 2002). Its population has nearly doubled in the last 25 years and is expected to increase at least 50% in the next 25 years. This growth in numbers has been and will be one of the principal causes of rising demand for food, water and other natural resources. The pressures on available staple foods around the world growth has necessitated the need to search for new resources that can be use as alternative sources of nutrients to the ever increasing population. Most people in the world, especially developing countries are fed by about twenty cereal crops, root crops and legumes (Balogun, 1982) and competition between farm animals and man for these few food plants is very high that a dangerous situation is created where by the few food plants is over tasked resulting in acute shortage of food for humans and grains for livestock feed. In order to avert this danger, it is of utmost necessity at this time to consider the neglected or little known plant species. Attention must now be directed to the scrutiny of thousands of plants species many of which are still untested and some as yet unidentified. Legumes have been an important crop ever since, man started domesticating plants and have been part of the cultural heritage (Crespo, 1987). Many of the legumes possess multiple uses as food, fodder and pharmaceutical (Sridhar and Bhat, 2007). A wide variety of legumes have been assessed as alternatives to fish meal most of which are of limited relevance in human nutrition (Osuigwe, 2003). Soybean is used primarily as food and feed ingredient for livestock including fish. Soybean meal is a principal protein source in the diet of poultry and swine all over the world.

Mucuna, an underutilized legume is widely cultivated as a cover crop and the seeds which have relatively high protein is hardly consumed by man. Ezeagu *et al.* (2003) reported that the nutrient content of Mucuna is comparable to those in commonly consumed legumes and that the plant has potential for exploitation as food and feed. This research investigates the nutritional potential of Mucuna utilis as alternative to soybean in the diet of *Clarias gariepinus.*

MATERIALS AND METHODS

Matured seeds of *M. utilis* were obtained from the International Institute if Tropical Agriculture (IITA),

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Table 1: Proximate and mineral composition of raw Mucuna Seed Meal (MSM)

Crude protein (%)	Lipid (%)	Crude fibre (%)	Ash (%)	Moisture content (%)	Mg (%)	K (%)	P (%)	Na (%)	Fe (mg kg^{-1})	Mn (mg kg^{-1})	Zn (mg kg^{-1})
29.23	0.74	9.63	3.28	10.04	0.21	1.43	0.076	0.19	132.14	24.87	13.11

Table 2: Gross composition of experimental diet

Ingredients	D1	D2	D3	D4
Fish meal	29.41	29.41	29.41	29.41
Soybean	45.45	40.91	36.36	31.82
Mucuna	-	6.84	13.88	20.53
Starch	21.34	19.04	16.75	14.44
Bone meal	2.50	2.50	2.50	2.50
*Fish premix	0.50	0.50	0.50	0.50
Vitamin C	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25
Vegetable oil	0.45	0.45	0.45	0.45
Crude protein	40.00	40.00	40.00	40.00

*Composition: Vitamins: A (i.u.) 20×10^7, C (coated) 3×10^5, D (i.u. 4×10^7, E (mg) 2×10^5, K_3 (mg) 5×10^3, B_1 (mg) 2×10^4, B_2 (mg) 1.5×10^4, B_6 (mg) 1.9×10^4, B_{12} (mcg) 15, Nicotinic acid 9×10^4, Panthotenic acid 4×10^4, Folic acid 4×10^3, Biotin (mcg) 5×10^2, Choline chloride 6×10^5, Fe 4×10^5., Cu 4×10^3, Mn 3×10^4, Zn 4×10^4, I 3×10^4, Inositol 5×10^4, Co 1.5×10^2, Lysine 5×10^4, Methionine 5×10^4, Antioxidant 1.25×10^5, Selenium (mcg) 2×10^2

Ibadan and were de-hauled by running it 2-3 times in the rotating blades of a Popular[R] blender. The hulls were then separated from the seeds by winnowing. Seeds void of hulls were hammer milled to pass through 1 mm sieve and the resulting meal was then analyzed for proximate and mineral composition (Table 1).

Proximate composition of MSM was analyzed by using standard methods of AOAC (1990). The mineral content was determined by atomic absorption spectrometry as described by Osuigwe (2003). Phosphorus content was determined following the development of colour which was determined following the development of colour with ammonium molybdate on spectronic 20 spectrophotometer. Four 40% crude protein isonitrogenous diets were then formulated from the meal with MSM substituting soybean meal at 0, 10, 20 and 30% and these were labelled D1-D4, respectively (Table 2).

Juveniles of *C. gariepinus* of average weight 6.6 g were obtained from Olly Bee farms, Iyana Offa, Ibadan and transported to Bunmbola farms, Osogbo where they were acclimated for 10 days before starting the feeding trial. A total of 120 fish were divided into 4 groups and each group had 3 replicates. Ten fish per replicate were used in 38 L plastic aquaria filled with 18 L of water replaced every day. At the commencement of the trial, fish were bulk weighed with CS300[R] sensitive scale to the nearest gram and subsequently, every 2 weeks until the end of the 12 weeks study period. Fish ratio was 5% of fish biomass administered twice daily. Data generated at the end of the study from weight measurements were subjected to analysis of variance and the significance of the difference between means determined by least square difference ($p<0.05$).

Table 3: Growth and nutrient utilization of *Clarias gariepinus* fed raw MSM based diets

Parameters	D1 (0%)	D2 (10%)	D3 (20%)	D4 (30%)
Initial mean weight (g)	6.60	6.60	6.60	6.60
Final mean weight (g)	27.58	24.64	24.38	15.16
Mean weight gain (g)	20.08^{e}	17.30^{cd}	17.17^{bcd}	12.69^{ac}
SR (%)	86.66	76.66	86.66	80.00
SGR	11.91^{c}	10.89^{b}	10.71^{b}	6.89^{a}
FCR	2.81^{a}	3.41^{ab}	3.82	6.05
PER	0.50^{a}	0.43^{b}	0.43^{b}	0.32^{c}

NB: Means with the same superscripts along the same row are not significantly different ($p>0.05$)

RESULTS AND DISCUSSION

The proximate composition of *M. utilis* obtained in the present study compares favourably with other researchers (Ezeagu *et al*., 2003; Rajaram and Janardhanan, 1991; Siddhuraju and Becker, 2001) on *M. cochinchinensis*, *M. gigantea* and *M. pruriens*, respectively but slightly differ from the report of Adebooye and Phillips (2006) on *M. urens* (Table 1). The result obtained from the feeding trial is shown in Table 2. The best weight gain was recorded in the control diet. Mean weight gain decreased as inclusion level increased thus, the diet with highest inclusion of MSM (30%) gave the poorest performance in SGR value that is significantly lower than the other diets.

There was no significant difference in SGR value between diets 2 and 3. The best FCR value 2.81 was obtained in the control diet and this was not significantly different ($p<0.05$) from the value recorded for diet 2. However, FCR values for diet 3 and 4 were significantly different. There was no significant difference in the survival rate of fish fed raw MSM.

Similar result was obtained by Osuigwe (2003) who fed raw and heated *M. cochinchinensis* to *H. longifilis* and reported that his observation was unconnected with the presence of some antinutritional factors that were not completely detoxified in the seeds.

Esonu *et al*. (2001) fed raw Mucuna seed meal to weaner pigs and reported deleterious effects on the performance, a result linked to the presence of anti-nutrients and Emenalom reported that raw seed meal of *M. pruriens* was poisonous to pigs at 15% dietary inclusion. However, Siddhuraju and Becker (2001) reported that fish fed up to 13% raw or autoclaved Mucuna seed diet produced growth performances similar to respective control group and feed utilization of carp but the sensitivity of carp to antinutritional factors of Mucuna seed meal resulted in low growth performance (Table 3).

CONCLUSION

In the present study, the inclusion of MSM in the diet of *C. gariepinus* generally produced worse result when compared to soyabean- based diet. However, inclusion of MSM in the diet at 10 and 20% dietary level produced similar results and the fish grew relatively well. There is the need to investigate the role of processing that is aimed at detoxifying Mucuna seed in the utilization of the seed by fish.

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