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RESEARCH ARTICLE

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GROWTH PERFORMANCE OF *CLARIAS GARIEPINUS* FINGERLINGS FED GRADED LEVELS OF DIETARY COOKED *JATROPHA CURCAS* SEED MEAL-BASED DIETS

ABSTRACT:

The effect of dietary inclusion of *Jatropha curcas* on the growth performance of African Catfish (*Clarias gariepinus*) was evaluated. Juveniles of *Clarias gariepinus* 225 in numbers were acclimatized for a week, weighed and allotted into five dietary treatments where soybean meal was replaced by cooked *Jatropha curcas* seed meal at 0, 25, 50, 75 and 100%. The diets (40% crude protein and 12% crude lipid) were isonitrogenous and isolipidic. Each treatment was replicated three times with fifteen fish per replicate. Fish were fed 5% body weight on two equal proportions per day for 56 days. Growth data were collected on two-week interval basis. Growth performance was evaluated using weight gain (g); specific growth rate (%/day); feed conversion ratio (FCR) and protein efficiency ratio as indices. The results from the study indicated that there was significant difference ($p>0.05$) in the weight gain, percentage weight gain, and other growth performance parameters among the fish exposed to different dietary treatments. Growth of *Clarias gariepinus* reduced with increasing inclusion of cooked *Jatropha curcas.*

KEY WORDS:

Jatropha curcas, Feed Ingredients, *Clarias gariepinus*, Protein Source

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INTRODUCTION:

Wide utilization and availability challenge of fishmeal and other conventional protein source feed ingredients for fish feed calls for the need to look for viable alternatives. Soybean products could replace a significant portion of fish meal in fish feed without posing nutritional, environmental and economic challenges. This is because of its high protein content, high digestibility and relatively well balanced amino acid profile (Storebakken *et al.,* 2000). However, the sustainability of soybean as fishmeal replacer is restricted because of the various uses to which it is put by human being (Azaza *et al*.,

2009). Thus, the development of low-cost feed is imperative in order to witness expansion and profitability of aquaculture enterprise in Nigeria and other developing countries. Oilseed cakes are available in sub-saharan Africa on a large scale and could be considered suitable as alternative dietary protein sources for fish feed (Fagbenro *et al.,* 2003).

Jatropha carcas seed meal has nutrient density that is comparable to any other protein sources. It has a good amino acid profile with its essential amino acids level (except lysine) higher than soybean meal (Kumar *et al.,* 2010 a & b). The use of *Jatropha carcas* seedmeal in fish diets in fish feed is well documented; Kumar *et al*. (2009) used detoxified *Jatropha curcas* meal for rainbow trout; Kumar *et al*. (2010 a & b) used detoxified *Jatropha curcas* meal for carp; Fakunle *et al*. (2013) and Alatise *et al*. (2014) used boiled *Jatropha curcas* meal for *Clarias gariepinus*. This study investigates effect of dietary inclusion of cooked *Jatropha curcas* seed meals in the diet *Clarias gariepinus.*

MATERIAL AND METHODS:

Sources and Processing of Ingredients:

Sample of dried *Jatropha curcas* seeds (1 kg) were obtained in Osogbo, Osun state. The *Jatropha curcas* seeds were de-kernelled, rinsed with water and boiled for 15 minutes after which they were sundried (29-31^{0}C) for three days and then ground in a hammer mill to produce a meal. The meal was thereafter analysed for its proximate composition (AOAC, 1990). Fish meal, soybean meal and other feedstuffs obtained from commercial sources in Nigeria were separately milled and screened to fine particles size. Samples were taken in triplicates and analysed for their proximate composition (AOAC, 1990).

Experimental Diets:

The experimental diets were formulated (Table 1) using the nutrient composition of the feedstuffs shown in table 2. The experimental diets contained full-fat soybean meal which was replaced by cooked *Jatropha curcas* seed meal at the rate of 0, 25, 50, 75, and 100%. The diets were isolipidic and isonitrogenous containing 40% crude protein and 12% lipid with fish meal, full fat soybean meal, fish oil, vitamin premix and starch serving as ingredients. Starch serves the purpose of binder and filler. The feedstuffs were ground and water was added to aid binding after which it was introduced into a mixing and pelleting machine to obtain a homogenous mass and then passed through a mincer to produce 2 mm size pellet which was immediately sundried at 30 - 32°C. After drying for three days, the diets were kept in a cool place.

Table 1. Gross composition of experimental diets (g/100g dry matter) containing Jatropha curcas Seed meal fed to *Clarias gariepinus*

Feed Ingredients	D1 (0%)	D2 (25%)	D3 (50%)	D4 (75%)	D5 (100%)
Fishmeal	33.33	33.33	33.33	33.33	33.33
Yellow maize	10.00	10.00	10.00	10.00	10.00
Full fat JSM	-	12.36	24.72	37.08	49.44
Full fat SBM	50.00	37.50	25.00	12.50	-
Fish premix	5.00	5.00	5.00	5.00	5.00
Starch	1.67	1.81	1.95	2.09	2.23
Total	100	100	100	100	100

JSM- Jatropha curcas Seed meal

SBM- Soybean meal

Each 1Kg Premix Contains:: Vitamin A ;4000000 IU, Vitamin D3;800000 IU, Vitamin E; 40000 IU, Vitamin K3; 1600 mg, Vitamin B1; 4000 mg, Vitamin B2; 3000 mg, Vitamin B6; 3800 mg, Vitamin B12; 3 mcg, Nicotinic acid;18000 mg, Pantothenic acid; 8000 mg, Folic acid; 800 mg, Biotin; 100 mcg, Cholin chloride; 120000 mg, Iron; 8000mg, Copper; 800 mg, Manganese; 6000 mg, Zinc; 8000 mg, Iodine; 400 mg, Selenium; 400 mcg, Vitamin C(coated); 40 mg, Inositol; 60000 mg, Cobalt; 10000 mg, Lysine; 150 mg, Methioline; 10000 mg, Anti-oxidant; 25000 mg.

Table 2. Proximate composition of feed ingredients

Parameters	Fish meal	Soybean Meal	*JSM	Corn Meal
Moisture	9.75	10.70	3.90	10.48
Crude protein	72.4	38.74	30.34	9.87
Crude Lipid	10.45	16.68	45.89	4.28
Crude Fiber	-	5.10	8.41	5.78
Ash	8.32	4.48	4.42	6.73
NFE	-	24.30	7.04	62.35

*Jatropha seed meal

Experimental Fish and Design:

The experiment was conducted at the Nutrition Unit of the Department of Fisheries Technology, Federal College of Animal Health and Production Technology, Moor Plantation Ibadan. *Clarias gariepinus* fingerlings (2.61 ± 0.02 g) 225 in number were obtained from a reputable fish farm in Ibadan, Oyo state and transported live to the project site in an aerated bag. The *Clarias gariepinus* fingerlings were acclimated for 7 days prior to the feeding trial while being fed on a commercial pelleted diet. 15 fingerlings were allotted into each of the fifteen 25 litre rectangular tanks containing 20 litres of water. Experimental diets were assigned randomly to the tanks with three replicates per treatment. Fish in each tank were fed 5% body weight per day in two equal proportions between 9.00 –10.00 am and 5.00 – 6.00 pm for 56 days.

Growth Performance Evaluation:

Growth performance of fish was determined following the method of Jimoh *et al.* (2014) from data collected from two-weeks

interval periodic weighing. Final Individual Weight, Specific Growth Rate (SGR%/ day), Feed Conversion Ratio, (FCR) and Protein Efficiency Ratio (PER) served as the indices of growth responses. The parameters were calculated as

$$\%\ \text{Weight Gain} = \frac{\text{Final weight of fish} - \text{Initial weight of fish}}{\text{Initial weight of fish}} \times 100$$

$$\text{Specific Growth Rate} = \frac{\ln(\text{Final weight of fish}) - \ln(\text{Initial weight of fish})}{\text{Time (in days)}}$$

$$\text{Feed Conversion Rate} = \frac{\text{Dry wieght of feed fed}}{\text{Fish weight gain}}$$

$$\text{Protein EFficiency Ratio} = \frac{\text{Fish weight gain}}{\text{Protein Fed}}$$

Water Quality Monitoring:

Water quality was monitored every week throughout the feeding trials. Water temperature (°C) and pH were measured daily with a combined digital pen meter, while dissolved oxygen (mg/l) was measured using Dissolved Oxygen (DO) meter.

Statistics:

Data obtained from the experiment was expressed in mean ± SE and it was subjected to one-way Analysis of Variance (ANOVA) using SPSS 16.0 version. Where the ANOVA reveals significant difference ($P < 0.05$) Duncan multiple range test was used to compare differences among individual treatment means.

RESULTS AND DISCUSSION:

Table 3 shows the proximate composition of experimental diets containing graded levels of *Jatropha carcass* seed meal. The results showed that the diets were isonitogenous and isolipidic as there was no significant difference ($p > 0.05$) in the crude protein of the different dietary treatments.

Table 3. Proximate Composition (g/100g dry matter) of The Experimental diets containing boiled Jatropha curcas seed meal fed to *Clarias gariepinus*

	D1	D2	D3	D4	D5
Moisture	9.76 ± 0.26	9.88 ± 0.62	9.70 ± 0.47	9.99 ± 0.72	9.61 ± 1.39
Crude protein	40.20 ± 0.20	40.18 ± 0.19	40.23 ± 0.34	40.13 ± 0.19	40.10 ± 0.13
Crude lipid	12.03 ± 0.05	12.04 ± 0.07	12.02 ± 0.09	12.12 ± 0.18	12.19 ± 0.13
Crude fiber	5.06 ± 0.08^{c}	5.10 ± 0.09^{bc}	5.43 ± 0.29^{b}	5.83 ± 0.11^{a}	5.99 ± 0.24^{a}
Ash	4.24 ± 0.25	4.19 ± 0.57	4.21 ± 0.21	4.12 ± 0.07	4.22 ± 0.19
NFE	28.72 ± 0.26	26 ± 0.77	26.41 ± 0.74	27.80 ± 0.82	27.89 ± 1.14

Mean on the same row without superscript are not significantly different ($p>0.05$) from each other.

The growth performance of *Clarias gariepinus* fed diets containing *Jatropha curcas* seed meal is as presented in table 4. The initial weight of the fish at the beginning of the feeding trial was not significantly different ($p > 0.05$) from each other. However, significant variation ($p < 0.05$) existed in the weight gain, percentage weight gain and other growth performance parameters among the fish exposed to different dietary treatments of *Jatropha carcass* seed meal. Figure 1 depicts the growth curve of fish exposed to different dietary treatments of *Jatropha carcass* seed meal. The average values of all the recorded water quality parameters were not significantly different ($P > 0.05$) from one another across the different dietary treatments and were within a suitable range for the normal growth of *Clarias gariepinus* (Boyd, 1990).

Table 4. Table Growth Performance of Clarias gariepinus fed diets containing Jatropha curcas seed meal

	D1	D2	D3	D4	D5
Initial weight	2.62 ± 0.01	2.60 ± 0.02	2.62 ± 0.03	2.61 ± 0.03	2.60 ± 0.02
Final weight	12.36 ± 0.13^{a}	10.83 ± 0.11^{b}	9.25 ± 0.53^{c}	6.92 ± 0.05^{d}	5.12 ± 0.17^{e}
Weight gain	9.74 ± 0.13^{a}	8.32 ± 0.09^{b}	6.63 ± 0.51^{c}	4.33 ± 0.32^{d}	2.52 ± 0.15^{e}
% W G	371.75 ± 4.63^{a}	316.54 ± 1.95^{b}	252.94 ± 16.9^{c}	166.25 ± 1.73^{d}	96.90 ± 5.10^{e}
SGR	2.77 ± 0.02^{a}	2.55 ± 0.01^{b}	2.25 ± 0.09^{c}	1.75 ± 0.10^{d}	1.21 ± 0.05^{e}
Feed fed	11.46 ± 0.20^{a}	10.42 ± 0.03^{b}	8.69 ± 0.74^{c}	6.14 ± 0.18^{d}	3.87 ± 0.30^{e}
FCR	1.18 ± 0.03^{e}	1.27 ± 0.02^{d}	1.31 ± 0.02^{c}	1.42 ± 0.03^{b}	1.53 ± 0.07^{a}
PER	2.12 ± 0.05^{a}	1.97 ± 0.03^{b}	1.91 ± 0.03^{b}	1.76 ± 0.04^{c}	1.63 ± 0.08^{d}

Mean on the same row with different superscript are significantly difference from each other ($p < 0.05$).

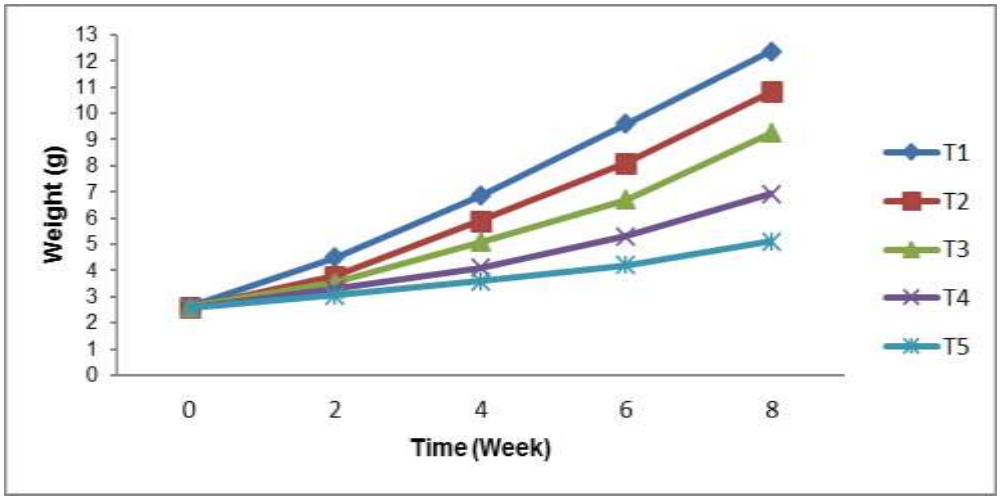

Fig. 1. Growth Curve of Clarias gariepinus fed diets containing varying levels of cooked Jatropha curcas meal.

The performance variation recorded at the end of the experiment among the different dietary treatments was due to the effect of inclusion of dietary JSM on feeding behaviour, growth performance was significantly affected by dietary inclusion of JSM to the diet of *Clarias gariepinus.*

A reduction in growth performance of *Clarias gariepinus* with increasing level of inclusion of JSM was also reported by Workagegn *et al.* (2013) for Nile Tilapia juveniles fed the same when replacing soybean meal. Kumar *et al.* (2010a) reported inclusion of cooked jatropha seed meal in the diet of carp was unsuitable at inclusion levels of 50%. Various factors responsible for poor growth was explained as including presence of anti-nutritional factors, poor digestibility of protein and energy which limit the bioavailability of nutrients (Domingues *et al.*, 2003; Glencross *et al*., 2007; Makkar *et al.*, 2008). Higher concentration of the anti-nutritional factors reduces the digestibility of protein in the diets Kumar *et al.* (2009) and the high crude fibre which hinders the protein utilization of the diets containing boiled *Jatropha curcas*. The same observation was made by Jimoh *et al.* (2014) when maize was replaced with *Chrysophyllum albidum* seed meal. It was reported that high fibre in diets limits the rate of digestion and nutrient absorption (Zaid and Ganiyat, 2009). Keembiyehetty and De Silva (1993) reported that high fibre in diets could result in increased weight of excreta and reduced nutrient absorption. Moreover, that catfish could not tolerate high level of plant based proteins in their diets due to their low palatability, higher fibre and anti-nutritional content. Buddington *et al.* (1997) reported that carnivorous and omnivorous fish take longer time to digest plant protein based diets hence the significant differential growth recorded.

CONCLUSION AND RECOMMENDATION:

It is evident from the present study that soybean meal can only be replaced by JSM at lower level (below 25%).

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