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Effect of the replacement of soyabean with *Leucena leucocephala* on growth performance of African catfish (*Clarias gariepinus*) fingerlings

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Abstract
This study examined the utilization of *Leucaena leucocephala* seed meal (LSM) by *Clarias gariepinus* fingerlings. five isonitrogenous; 40% crude protein diets were formulated where LSM replaced Soya bean meal (SBM) at 0%, 25%, 50%, 75% and 100% inclusions. Catfish fingerlings (5.21 ± 0.14 g) stocked at 5 fish/40 liters tanks were fed diets in triplicates three times daily for 70 days. Data from the completely randomized experiment were subjected to ANOVA and analysis was separated at 5% probability level. The mean weight gain, feed Intake, relative weight gain, Specific growth rate as well as Feed conversion ratio decreased with increase in Leucena seed inclusion in the diet. The control diet with 0% Soyabean replacement level recorded the highest mean value while the least mean value was recorded in treatment V. ANOVA showed that there was significant difference (P<0.05) between Treatment I and the other four treatments. For Feed intake, Treatment I had the highest feed intake value of 5.40g while the least feed intake value (3.34g) was recorded in Treatment V. Control diet also had the highest relative weight gain value of 30.10 and this was significantly different from other treatments. The least Relative weight gain value of 10.15 was recorded in Treatment V with 100% Leucena inclusion level. In the present study it was observed that leucena seed meal can replace Soyabean in the diet of *Clarias gariepinus* fingerlings but for optimum production Total use of Soyabean is still preferred as the control diet with 100% Soyabean meal performed best among the Treatments.

Keywords: catfish feed, *Leuceana* and nutrition

Introduction
Substantial effort has been expended over the past decades in evaluating a wide range of potential alternatives to fishmeal and fish oils for use in aquaculture diets. The need for finding suitable and cost-effective alternatives must be with resultant efficiency and effectiveness in both environmental and industrial perspectives [1]. Alternative ingredients can generally be classified into those being derived from either plant origin or terrestrial animal origin. Many studies have been conducted to determine the suitability of animal and plant based ingredients such as poultry-by-product meal [2], shrimp head waste meal [3], soya bean meal [2], rice husk meal [4] Grasshopper meal [5] and others to replace fish meal in the diets of the different life stages of African catfish. Several studies have shown that vegetable protein sources have high potentials for supplying fish with required protein needed for their maximum productivity [6]. However, in the compounding of fish ration with plant protein sources, cautions need to be exercised as to their inclusion levels in fish diets as well as ensuring their proper processing for effective utilization [7]. The need for such recommendations have been due to the presence of certain limiting factors in those ingredients such as high crude fibre content [6], anti-nutritional factors [5]. Studies have shown that, excessive consumption of plant protein sources by fish could cause slower growth rates and poor performance which may result in mortalities if condition persists [7]. This study was carried out to determine the effect of dietary toasted *Leuceana* seed meals on the growth and feed utilization on the Clariid catfish, *Clarias gariepinus.*

Materials and Methods
Experimental diets: Fishmeal, soyabean seed, *Leuceana*, bone meal and vitamin premix were bought from retail outlet in Benin City, Nigeria. The seeds of the *Leuceana* seed were toasted on a well heated pot for twenty (20) minutes to minimize the effect of toxins and protein

inhibitors. All ingredients were finely ground in a domestic blender. The resultant flour was subsequently passed through a 0.34 mm sieve. After the addition of palm oil, each dietary component was thoroughly mixed to homogeneity. The constituent corn meal in each diet was gelatinized (boiled in water) to serve as binder in the pelleted feed ingredients. The composition of the experimental diets is shown in Table 1.

Table 1: Composition of the experimental diets

Ingredients	Treatments				
	I	II	III	IV	V
	0%	25%	50%	75%	100%
Fishmeal (65.5% CP)	25.00	25.00	25.00	25.00	25.00
Soybean meal (38.8% CP)	44.00	33.00	22.00	11.00	0.00
Leucaena seed meal (40% CP)	0.00	11.00	22.00	33.00	44.00
Maize (9.5% CP)	5.00	5.00	5.00	5.00	5.00
Wheat offal (12.6% CP)	3.00	3.00	3.00	3.00	3.00
Palm oil	8.36	8.36	8.36	8.36	8.36
Bone meal	0.04	0.04	0.04	0.04	0.04
Vitamin premix	0.60	0.60	0.60	0.60	0.60
Vitamin E-gel	0.04	0.04	0.04	0.04	0.04

Feeding trials: The experimental design consists of five (5) dietary treatments with three (3) replicates each laid out in a Complete Randomized Design. Diet 1 with 0% *Leucaena* inclusion served as control. The experiment was conducted in 15 aerated aquaria tank (38 X 28 X 28cm). Clariid catfish fingerlings from the same broodstocks were stocked randomly at five (5) fingerlings per aquarium in 40 litres of domestic water. The fingerlings were fed crumbled 2.0mm size pellet of experimental diets twice daily to satiation between 8.00-9.00 hrs. and 15.00-16.00 hrs. Feeding was monitored for each unit to ensure that fishes were not underfed or overfed. Experimental units were cleaned daily while changing the total water, Weekly weight gain and feed consumption were monitored for 10 weeks. *Clarias gariepinus* fingerlings with initial mean body weight of 2.68 ± 0.76g were obtained from outdoor fish tanks of Forestry Research Institute and used for the study.

Growth and nutrient utilization indices

Weights of fish and feed consumption were obtained at weekly intervals. From the fish weights and feed consumption, the following were determined:

Weight gain = $W_1 - W_0$ (g)

Relative weight gain (RWG %) = $(W_1 - W_0) / W_0 \times 100$ (%)

Specific growth rate (SGR %) = $\frac{(\ln W1 - \ln W0)}{T} \times 100$ (%/week)

Where;
W_0: mean initial weight (g)
W_1: mean final weight (g)
T: time in 7 days between weightings

Feed conversion ratio (FCR) = $\frac{\text{feed intake (g)}}{\text{wet weight gain}}$ (g)

Protein efficiency ratio (PER) = $\frac{\text{weight gain}}{\text{protein intake}}$

Net protein utilization (NPU) = $\frac{BP1 - BP0}{CP} \times 100$

Where;
BP_0: Initial body protein content (g)
BP_1: Final body protein content (g)
CP: Protein intake (g)

Statistical analysis

The data on weight gain; feed conversion ratio and survival rates for the dietary treatments were analysed using one-way ANOVA (Analysis of variance) using GENSTAT version 12 software. The differences in mean values were compared by Duncan Multiple Range Test. All test was carried out at 5% probability level.

Results

Table 2: Treatment

Parameter	Treatment				
	I	II	III	IV	V
	0%	25%	50%	75%	100%
Mean weight gain (g)	2.09a	1.43b	1.45b	1.40b	1.32b
Relative weight gain (%)	30.10a	22.40b	14.70c	11.70d	10.15d
Specific growth rate (%)	3.49a	2.75b	2.40b	1.51c	1.27c
Feed intake (g)	5.40a	4.84b	3.80c	3.66cd	3.34d
Feed conversion ratio	1.54a	1.83b	2.09c	2.50d	2.45d
Protein efficiency ratio (%)	1.40a	0.63b	0.90ab	0.70ab	0.68ab

The mean weight gain decreased with increase in Leucena seed inclusion in the diet. The control diet with 0% Soyabean replacement level recorded the highest mean weight gain of 2.09g while the least mean weight gains of 1.32g was recorded in treatment V. ANOVA showed that there was significant difference ($P<0.05$) between Treatment I and the other four treatments.

The Feed intake value followed similar trend like that of mean weight gain. Treatment I had the highest feed intake value of 5.40g while the least feed intake value (3.34g) was recorded

in Treatment V. ANOVA showed that Treatment I was significantly different ($P<0.05$) from other treatments.

The relative weight gain value also reduced with increase in leucena inclusion level. Control diet had the highest value of 30.10 and this was significantly different from other treatments. The least Relative weight gain value of 10.15 was recorded in Treatment V with 100% Leucena inclusion level

The Specific growth rate also followed similar trends with other parameters. The highest value (3.49) was recorded in Treatment I while the least value was recorded in Treatment V. ANOVA showed that there was no significant difference ($P>0.05$) between Treatment IV and V as well as between Treatment II and III. However, Treatment I was significantly different ($P<0.05$) from other treatments.

The feed conversion ratio performance declined with increase in inclusion level. The least FCR value which connote better feed conversion was recorded in Treatment I with a value of 1.54 while the highest value connoting poor feed conversion was recorded in Treatment V with a value of 2.45.

Discussion

The reduced growth rate that was highest in *Leucaena* replaced diets may be as a result of the presence of heat resistance anti nutrients [5] which might not have been totally removed with toasting and the non-inclusion of essential amino acid methionine which is known to be limiting in both test ingredients (Soybean and *Leucaena*) [8]. This observed pattern could also probably be a result of persistent consumption of *Leucaena* meals which could retard animal growth rate as reported by Jones [9], and further buttressed by Tangendijaja *et al.* [10] who recorded progressive depressed growth rate in rabbit fed increasing graded levels of *Leucaena* leaf meal based-diet. Nutrient utilization (feed conversion) of fish decreased as level of LSM inclusion increases in the diets.

The poor nutrient utilization may not totally be hinged on the fibre content of the test diets as this was generally less than 10% as recommended by Aladetohun [11], who stated that the main factor in the digestibility of feed is the fibre content. The variation in growth and nutrient utilization by fish with increasing inclusion levels is in agreement with Sotolu and Faturoti [12], who reported that the growth and nutrient utilization of diets by fish decreased as level of LSM inclusion increases in the diets.

The result of the PER is not in conformity with what was stated by Sotolu and Faturoti [13] who reported that similarity in the PER of *Clarias gariepinus* has a direct link with feed intake. These relatively high value of crude protein could be viewed alongside the work of Alegbeleye *et al.* [5] who reported that effective utilization of Bambara groundnut at varying rates was responsible for variations in *Heteroclarias* carcass protein and lipid. The non-detection of crude fiber in the fish carcass composition was the same in all treatments and this had been said to be associated with effective utilization of diets according to Sotolu and Faturoti [12]. Base on this study, it has been observed that fish with lower LSM inclusion levels had better health status than those of higher LSM inclusions based on earlier submissions of Alegbeleye [14], Ochang *et al.* [15] and Sotolu and Faturoti [13].

Conclusion

In conclusion, the present study has shown that leucena seed meal can replace Soyabean in the diet of *Clarias gariepinus* fingerlings but for optimum production Total use of Soyabean is still preferred as the control diet with 100% Soyabean meal performed best among the Treatments.

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