GROWTH AND COST BENEFITS OF *Clarias gariepinus* FINGERLINGS FED GRADED LEVELS OF OVEN-DRIED AFRICAN FAN PALM *(Borassus aethiopum)* SHOOT MEAL DIETS AS DIETARY ENERGY SOURCE

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ABSTRACT

One kg fresh African fan palm shoots were purchased and divided into four equal-parts. 750g were ven-dried and 250g untreated; both were analysed for proximate composition. Oven-dried African fan palm shoot meal (ODAFPMS) was substituted for Maize meal at five graded levels of 0%, 25%, 50%, 75% and 100% and diets were coded ODAFPMS1, ODAFPSM2, ODAFPSM3, ODAFPSM4 and ODAFPSM5 and fed to *Clarias gariepinus* fingerlings of mean weight (2.92±0.10g) and length (5.70±0.50 cm) stocked at fifteen fingerlings per circular tank of 50 litres each in triplicate for 70 days. Weekly weight and length were recorded and data generated were analyzed using ANOVA. The results of the experiment showed fibre was lowered in oven-dried compared to the raw AFPS. ODAFPSM1 gave the highest mean weight gain of 12.73g/fish followed ODAFPSM4 with 6.60g/fish and lowest was from ODAFPSM5 having 5.18g/fish. The feed conversion ratio ranged from 0.50 – 1.06 which are significantly different ($p<0.05$). The final condition factor ranged from 0.68 -1.33; highest from ODAFPSM1 and lowest from ODAFPSM5 and these are significantly different ($p<0.05$). Similarly, highest net profit, profit index and benefit cost ratio of 332.20, 6.31, and 4.27 respectively were from ODAFPSM 1 followed 285.39, 5.97 and 4.01 respectively from ODAFPSM 2. This study recommended ODAFPSM2 and ODAFPSM3 to supplement for maize which is a conventional ingredient for optimum growth performance and economic benefit in sustainable aquaculture.

INTRODUCTION

Development of fish feed production has been identified as a rational way of augmenting the dwindling feed supply from feed production. African fan palm shoot can be used to reduce production cost of fish and nevertheless its high effect as a binder in the fish feed ingredients. The need to solve the problem of feeding in aquaculture has been demonstrated through various researches in the utilization of vegetable source and agricultural waste such as cassava peel, fermented shrimp head waste meal. Poultry offal (Fasakin, 2008), Water hyacinth meal (Sotolu, 2008), Maggot meal (Sogbesan, 2014), and Duck weed (Sogbesan *et al.,* 2015) were used for feed formulation of least cost fish feed towards ensuring profitable fish business. In Nigeria today, the number of fish farmers is on increase as a result of positive returns from aquaculture ventures while catfish, *Clarias gariepinus* is widely cultured because of its hardy nature, can feed on different ingredients and grow faster to bigger sizes. Yet lack of good quality and relatively cheap feedstuffs is still a constraint to fish farmers in some parts of the country.

The critical area of research that requires urgent attention with respect to fish production is production of local feeds that will meet the nutrient requirements of the culturable fish at cheaper cost production. This study aimed at the growth and cost benefits of substituting maize with Oven-dried African Fan Palm Shoot meal in the diet of *Clarias gariepinus* as a source of dietary energy

MATERIALS AND METHODS

The experiment was carried out in the Teaching and Research Fish Farm, Department of Fisheries, Modibbo Adama University of Technology (MAUTECH), Yola.

Preparation of African Fan Palm Shoot Meal

One kg fresh African fan palm shoots were purchased from Girei market, washed cleaned and divided into four equal-parts. 750.0g were oven-dried at temperature of 50-60^{0}c for 24hours according to Sogbesan and Ekundayo (2015). The dried sample was pulverized into powder using pestle and mortar; then sieved and stored until when needed for analysis and feed production to replace maize as a source of dietary energy.

Experimental diet formulation and Preparation

The experiment was designed as a complete randomized design (CRD) replicated three times. The feed ingredients comprised of milled oven-dried African fan palm shoot and others as shown in Table 1 to formulate 42.0% crude protein experimental diets in which oven-dried African fan palm shoot meal was used to replace maize at 0%, 25%, 50%, 75%, 100% inclusions and coded ODAFMPS 1 –ODAFMPS 5. The ingredients were mixed and warm water was added to prepare dough that was pelleted into suitable size pellets. The pellets were collected, air-dried and fed to the fish for 10 weeks.

Experimental Fish

Two hundred and twenty-five healthy fingerlings of *Clarias gariepinus* of average mean weight (2.92±0.1 g) and length (5.70±0.50 cm) were obtained from Department of Fisheries, fish farm. They were held in five different circular plastic tanks for one week to condition them to experimental diets before the commencement of full experiment and stocked at the rate of fifteen (15) fingerlings per plastic bowl in triplicate into 15 plastic bowls for feed-growth trials. The experiment was set-up in the semi flow-through unit and covered with net to avoid predators. The fish were fed twice daily at 5% body weight and feed intake adjusted based on new weekly weights. Each treatment was monitored for survival; dead fish were removed, recorded and discarded.

The water quality parameters (Temperature, dissolved oxygen and pH) were recorded twice a week before feeding.

The growth parameters (such as weight gain, specific growth rate, relative growth rate, and condition factor), feed intake, feed conversion ratio and cost benefits (Net Profit, profit index and cost benefit ratio) were computed. Raw data were treated with descriptive statistic while means were separated with one-way Anova using Graphpad Instat package windows 10.

Table 1. Compositions of Experimental Diets Oven-dried African Fan Palm Shoot Meal (ODAFPSM) on Dry matter Basis

Ingredients / Graded levels	ODAFPSM 1 0%	ODAFPSM 2 25%	ODAFPSM 3 50%	ODAFPSM 4 75%	ODAFPSM 5 100%
Soybean meal	24	24	24	24	24
Fishmeal	20	20	20	20	20
Groundnut cake	24	24	24	24	24
Maize meal	30.0	22.5	15.0	7.5	0.0
DOAFPSM	0.0	7.5	15.0	22.5	30.0
Lysine	0.15	0.15	0.15	0.15	0.15
Methionine	0.15	0.15	0.15	0.15	0.15
Vitamin C	0.1	0.1	0.1	0.1	0.1
Salt	0.1	0.1	0.1	0.1	0.1
Vitamin premixes	0.3	0.3	0.3	0.3	0.3
Dicalcium Phosphate	0.2	0.2	0.2	0.2	0.2
Palm oil	0.1	0.1	0.1	0.1	0.1
Total	100	100	100	100	100
Calculated Protein	42.00	41.66	41.33	40.99	40.65

RESULTS AND DISCUSSION

The calculated protein reduces as the ODAFPSM percentage increases (table 1) although the values, 40.65% to 42.00% crude protein are the required protein for the fingerling of *Clarias gariepinus*, hence cannot result into changes in growth of fish fed. The crude protein and lipid of ODAFPSM were significantly higher ($p<0.05$) than the raw AFPSM while the crude fibre and Ash were significantly lower (table 2); these observations could have been as a result of heat treatments and were within the range for cultured tropical fish (NRC, 1993) and Similar observations were also made by Michael *et al*. (2019). Highest final weight gain of 11.15g/fish was recorded in fish fed ODAFPSM1 followed by 9.98g/fish from ODAFPSM2 and least of 7.11g/fish from ODAFPSM3 and these were significantly different ($p<0.05$). The Relative Growth Rate ranged from 381.9% to 235.4% within ODAFPSM1 and ODAFPSM2. The Specific growth rate ranged between 0.98%/day to 0.75%/day and final condition factor were from 1.33 to 0.68 and these were also significantly different ($p<0.05$). These results corroborates with the findings of Sotolu (2008) that control diet fed experimental fish performed better than those fed other diets. This indicated that maize apart from been higher in crude protein than oven-dried African fan palm fan meal although the protein values of the experimental diets were not significantly different ($p0>.05$)

Table 2: Proximate Compositions of Raw, Oven-dried African Fan the ingredients used

Ingredients	Dry Matters %	Crude Protein %	Crude Lipid %	Crude Fibre %	Ash %	NFE %
Raw AFPSM	96.34^{a}	4.19^{c}	0.02^{b}	13.9^{a}	1.06^{b}	77.17^{a}
Oven-dried AFPSM	92.90^{b}	5.60^{b}	3.20^{a}	10.6^{b}	0.10^{c}	73.40^{b}
Maize	90.30^{b}	10.10^{a}	3.56^{a}	3.47^{c}	1.94^{a}	71.20^{b}

Means on the same column with different superscripts are significantly different ($p<0.05$)

Table 3. Growth Performance and Cost Benefits of *Clarias gariepinus* Fed Oven-dried African Fan Palm Shoot Meal Diets for 70 days

Parameters	ODAFPSM 1	ODAFPSM 2	ODAFPSM 3	ODAFPSM 4	ODAFPSM 5
Mean initial weight (g/fish)	2.92^{a}	2.91^{a}	2.90^{a}	2.97^{a}	3.02^{a}
Mean initial length (cm/fish)	5.80^{a}	5.80^{a}	5.80^{a}	5.90^{a}	5.90^{a}
Mean final weight (g/fish)	14.07^{a}	12.89^{bc}	11.98^{bc}	11.64^{b}	10.13^{a}
Mean weight gain (g/fish)	11.15^{a}	9.98^{ab}	9.17^{b}	8.67^{bc}	7.11^{c}
Mean final length (cm/fish)	10.20^{b}	10.10^{b}	10.00^{b}	10.60^{a}	10.20^{b}
Increase in length (cm)	4.40^{b}	4.30^{b}	4.20^{b}	4.70^{a}	4.30^{b}
Relative Growth Rate (%)	381.9^{a}	343.0^{ab}	316.2^{b}	291.9^{bc}	235.4^{c}
Specific Growth Rate (%)	0.98^{a}	0.92^{ab}	0.88^{b}	0.85^{b}	0.75^{c}
Initial condition factor (K1)	1.50^{a}	1.49^{a}	1.49^{a}	1.45^{a}	1.47^{a}
Final condition factor (K2)	1.33^{a}	1.25^{b}	1.21^{b}	0.97^{c}	0.68^{d}
Survival rate (%)	100.0^{a}	93.3^{ab}	86.6^{b}	86.5^{b}	80.0^{b}
Feed Conversion Ratio	1.06^{a}	1.05^{a}	0.99^{a}	0.99^{a}	0.80^{b}
Net profit	322.2^{a}	285.39^{b}	243.66^{bc}	206.49^{c}	189.82^{d}
Profit index	6.31^{a}	5.97^{b}	4.69^{c}	3.69^{d}	3.39^{d}
Benefit cost ratio	4.27^{a}	4.01^{a}	3.74^{b}	2.66^{c}	2.32^{c}

Mean of Data on the same row with different superscripts are significantly difference ($p<0.05$)

The net profit of 332.20 was recorded as highest value in ODAFPSM1 and 189.82 which is lowest was recorded in ODAFPSM5, the profit index of 6.31 was recorded highest in ODAFPSM1 and 3.39 was recorded in ODAFPSM5 as the lowest value and lastly highest benefit cost ratio of 4.27 was recorded in ODAFPSM1 and lowest, 2.32 ODAFPSM5. Although, none of these values were below 1.0 which means that the fish can be fed with replacement values up to 100% (Sogbesan and Ekundayo, 2015). It is recommended that Oven-drying helped to reduce the fibre content and increase protein and lipid content of ODAFPSM. Maize can be replaced up to 100% without compromising the weight although the control gave the best results for growth and profit maximization; this notwithstanding, maize can still be replaced up to 50% since it is a conventional ingredient.

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