THE EFFECT OF PAWPAW (*CARICA PAPAYA*) LEAVE MEAL ON THE GROWTH PERFORMANCE AND BLOOD PROFILE OF *AFRICAN CAT FISH.*

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Abstract:

A twelve weeks feeding trial was carried out to determine the growth performance of African Catfish (*Claria gariepinus*) fingerlings feed diets containing replacement level of fish meal with pawpaw leaf meal (*Carica papaya*). Fingerlings of *Claria gariepinus* were subjected to five different dietary treatments with varying levels of pawpaw leafmeal. The diets 1-5 contained 0%, 10%, 20%, 30%, and 40% replacement levels respectively. The experiment was carried out in a 50 litres circular plastic bowls, the treatments were in triplicate. Each bowl contained 15 fingerlings. Feeding was done at 3% body weight per day and fish were weighed every 2 weeks. Growth parameters such as mean weight gain (MWG), % weight gain (PWG) and Nutritional utilization parameters such as feed conversion ratio (FCR), Protein efficiency ration (PER) and Total Protein intake (TPI) were also determined. Haematological studies were carried out and packed cell value (PCV), Red Blood Cell (RBC), white blood cell (WBC), Mean Corpuscular volume (MCV), mean corpuscular haemoglobin concentration were determined. In all parameters measured, fish fed diet 3(20% replacement level) had the best performance while the least performance was shown by fish fed diet 5 (40% replacement level). Therefore, it can be concluded that fish meal can be replaced up to 20% with pawpaw leaf in the diet of *Clarias gariepinus* fingerlings.

Keywords: Growth, haematology, *Carica papaya*, fingerlings, replacement level.

Introduction:

African defatted pawpaw (*Carica papaya*) leaf meal is said to be a tropical herbaceous plant that grows between latitudes 32^{o} North and South. It contains appreciable

amount of macro and micro nutrients required by fish for growth and development such as protein, carbohydrate, minerals, vitamins and fat content in little to no amount.(FAO, 2001)

The result of defatted pawpaw leaf analyzed for proximate composition and functional properties suggest that pawpaw leaf meal could be profitably utilized in fish feed but it is quiet unfortunate that its usage as feed ingredient in developing countries has not been realized.

Pawpaw (*Carica Papaya*) is a tropical herbacious plant. It bears fruits which may be yellowish green, yellow or orange in colour when ripe. (FAO, 1995).

Defatted Pawpaw (*Carica Papaya)* leave meal was analyzed for proximate composition and functional properties. The meal was high in Protein (32.4%) but moderate in available carbohydrates with negligible to no amount of anti-nutrient component. The meal also contain appreciable amount of mineral such as ash and fiber contents which were 5.3% and 4.2% respectively. The protein of the pawpaw (*Carica papaya*) leaf meal was soluble at both acidic and alkaline pH, maximum solubility was at pH 9.0. Oil and water absorption capacity of the pawpaw leaf meal sample were high and it had a very good foaming and emulsifying properties. These results suggest that pawpaw leaf meal may have potential application in a number of feed formulations and fit for fish meal substitution in fish diet especially for catfish. (FAO, 2001).

Main Text:

Experimental Unit

The experiment was carried out at LAUTECH Teaching and Research Farm, Fishery unit, LAUTECH Ogbomoso for a period of twelve weeks.

Experimental Procedure

225 African catfish (*Clarias gariepinus*) fingerlings (average weight +/- 11.02g) were purchased from a reputable fish farm in Ibadan. They were acclimatized for two (2) weeks in fishery unit before the commencement of the experiment.

After this period,the fish were allotted to five varying treatments at the rate of liters, 15 fingerlings per tank(50 liters) and were fed twice daily, morning and evening 8.00 hours and 16.00 hours of the day respectively. The water used was sourced from LAUTECH Teaching and research farm bore-hole and the water was exposed for a minimum of three days for aeration.

Processing of Pawpaw (*Carica papaya*) leaf meal (PLM)

Pawpaw leaf (fresh) was obtained from LAUTECH Teaching and Research Farm, LAUTECH, Ogbomoso. It was sun dried to a constant weight. The dried pawpaw leaf was milled and stored in an air-tight container before use for diet formulation of catfish fingerlings.

Preparation of the Experimental diets

Feed ingredients were purchased from a reputable feed mill, Ogbomoso. The ingredients used were yellow maize, wheat offal, groundnut cake, fishmeal, blood meals, vegetable oil, oyster shell, bone meal, salt, premix and lysine. Five experimental diets were formulated: diet 1 contained 0% PLM and serves as control, diet 2(10% PLM), diet 3 (20% PLM), diet 4 (30% PLM), diet 5 (40% PLM) and the experiment was replicated 3 times.

The ingredients were weighed according to their calculated weight. Mixed thoroughly and then palletized to reduce dustiness and for proper acceptance by the fingerlings. The pellets were sun dried to prevent deterioration and stored in an air tight contain

Table 1: Gross Composition of the Experimental Diets

Ingredients	Diet 1	Diet 2	Diet3	Diet 4	Diet 5
Replacement level	0%	10%	20%	30	40%
Yellow maize	24.45	23.45	21.95	20.45	20.45
Rice brain	12.23	11.23	10.73	9.73	7.23
GNC	14.58	15.58	16.08	17.83	19.58
Blood Meal	7.29	8.29	9.79	10.54	11.29
Fish Meal	36.45	32.80	29.16	25.51	21.87
Pawpaw leaf Meal	-	3.65	1.29	10.94	14.58
Oyster shell	1.50	1.50	1.50	1.50	1.50
Bone meal	1.50	1.50	1.50	1.50	1.50
Mineral	1.00	1.00	1.00	1.00	1.00
Primix (lysine)	0.50	0.50	0.50	0.50	0.50
Vegetable oil	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total	100%	100%	100%	100%	100%
% crude protein	40%	39.83%	39.84%	39.68%	39.64%

Feeding and Management of the Fingerlinge.

The fingerlings were fed 3% of their total body weight daily. Feeding was done twice daily at 08.00 hours and 16.00 hours. The feeding regime was adjusted with respect to body weight every two weeks.

Data Collection

The parameters of interest were specific growth rate, mean weight gain, feed conversion ratio, percentage weight gain, average daily weight gain, protein intake, protein efficiency ratio.

Mean Weight Gain (MWG) = Final mean weight (g) - Initial mean weight (g);

Average Daily Weight Gain (ADWG) = Mean weight gain (g) / length of feeding trial (days);

Percentage Weight Gain (PWG) = Mean weight gain (g) / Initial mean weight; x 100

Specific growth rate ($_{SGR}$ % /day) = $100[(Log_eW_2 - Log_eW_1)/N_O$ of days

Feed conversion ratio (FCR) = total feed fed (g) / net weight gain (g);

Protein Intake (PI) = total feed consumed X % Crude protein in feed

Feed intake (FI) = This is the amount of feed throughout the period of the experiment ;

Protein Gain (PG) = mean protein intake (g) / length of feeding trial (days);

Protein Efficiency Ratio (PER) = Net weight gain (g) / Amount of protein fed (g) while

Protein productive Value (PPV) = protein gain in fish (g) / Protein in food (g) x100.

Chemical Analysis

The proximate analysis of the diets and fish carcass were done for moisture, crude protein, ether extract, crude fiber, ash and nitrogen free extract as recommended by AOAC (1990)

Blood Sample Collection

Blood samples for haematological analysis were obtained by cutting through the caudal peduncle of the fish laid on its side with a sharp blade. EDTA (Ethylene Diamine Tetra Acetate) was added to the exposed dorsal aorta to prevent clotting of blood and blood was drawn into heamatocrit tubes that also contain ethylene diamin tetra acetatc.

Haematological Studies

The following haematological parameters Packed cells volume (PCV), red blood cells (RBC), white blood cells (WBC), haemoglobin (Hb) were determined used to assess the effect of dietary treatment on the blood of *Clarias gariepinus* at the end of the feeding experiment.

Statistic Analysis

The experimental result were subjected to one way analysis of variance (ANOVA) using computer package of SAS (2001) and mean will be separated by DUNCAN multiple range of the same computer package.

RESULTS

Growth Response

Table 2 shows the parameters observed and recorded in the growth performance and nutrient utilization of *Claria gariepinus*_fed with replacement levels (0%,10%, 20%, 30%, and 40%) of *Carica papaya*_leave meal in the diets.

The mean weight gain across the treatments were significantly different ($P<0.05$). Diet 3 had the highest mean weight gain of 11.46g and the lowest mean weight gain was shown in diet 4 which is 6.22g. Total feed fed was significant across the treatment, where diet 3 had the highest value of 2.61g and the lowest total feed fed was shown in diet 5 (2.03g).

The percentage weight gain observed in treatments showed that all formulated diets were nutritionally adequate. The percentage weight gain was significant across the treatments.

Diets 3 (20% *Carica papaya* leave meal replacement level) had the highest percentage weight gain (107.13%) however, diet 4 (30% *Carica papaya* leave meal replacement) recorded the lowest percentage weight gain (53.81%) which shows that there was significant differences ($P<0.05$) between the percentage weight gain obtained from the diets.

The average daily weight gain was significant across the treatments, the highest average daily weight gain was show by the fish fed diet 3 with the values of 0.14 g/day however the lowest value of 0.07g/day was recorded for diet.

The average daily weight gain values showed significant differences ($P<0.05$) across the treatments. The highest total protein intake was shown in diets 3 with the value of 1.04, however the lowest value of 0.81 was showed in diet 5(40% replacement level). The total protein intake across the treatment were significantly different ($P<0.05$).

The FCR was not significant across the treatment, the highest FCR were showed diet 4 with the value of 0.36 however diet 3 showed the lowest FCR value of 0.23.

The PER of diet 3 was the highest with the value of 10.94 while the lowest PER was shown in diet 4 with the value of 7.29. The PER was significant across the diets.

This clearly indicates that fish fed diets 3 will efficiently utilize protein in the diet. There was significant differences ($P<0.05$) between the PER value obtained from treatments.

Haematology

Table 3 shows the results of haematological studies of the blood collected from the fish fed diet 1 to 5 after the experiment. The RBC, WBC, HB and PCV value were not significantly different ($P>0.05$) across the treatments.

The MCV was significant across the treatments where diets 3 (20% replacement level) gave the highest MCV value of 31.50 and the lowest MCV value was obtained from diet 1(0% replacement level) which was 27.20. 28.80, 27.30, 27.80 which was MCV value of diet 2, 4 and 5 respectively were not significant because they are with same superscripts.

The MCH was significant across the treatments. The highest MCH value (11.15) was obtained from diets 3, however the lowest MCH value (8.15) was recorded for diet 5 (40% replacement level). 8.80, 8.85 and 9.00 were obtained from diet, 1, 2 and 4 respectively and they were not significant because they were with the same superscript.

The MCHC was not significant across the treatments, we had 35.25 as the highest MCHC value in diet 3 while 29.25 was recorded as the lowest MCHC value in diet 5 (40% replacement level).

Fish Carcass

Table 5 shows that the highest moisture content was recorded in Fish fed diet 1 (4.49%) while fish fed diet 2 has the lowest moisture content (3.78%). The dry matter, crude protein and crude fat content of the fish fed diet 2 was the highest with the value of 96.21%, 66.85% and 8.44% respectively while diet 1 recorded the lowest dry matter content and crude fat (95.50% and 7.96%) respectively and diet 3 recorded the lowest crude protein 62.02%. fish fed diet 1 has the lowest crude fiber and total ash of 1.65% and 14.24% respectively. However the highest crude fiber was recorded in fish fed diet 5 (1.77%) as well as the highest total ash content (16.05%) was recorded in fish fed diet 3.

Test Ingredient

The proximate analysis of the test ingredient showed a crude protein value of 32.4%, moisture content of 6.72%, ether extract of 12.63, crude fiber of 4.20%, Ash content of 5.30%, Nitrogen free extract of 38.46% and P^H value of 9.0 in table 6 which is in agreement with that of FAO (2001).

Table 2: Growth parameter of *Clarias gariepinus* fingerlings fed various replacement levels of *Carica papaya* leaf meal.

Parameters	1	2	3	4	5	SEM
Initial wt (g)	10.85	11.81	10.86	11.46	10.24	0.33
Final wt (g)	17.18^{b}	18.68^{ab}	22.32^{a}	17.68^{b}	16.66^{b}	0.73
MWG (g)	6.34^{b}	6.87^{b}	11.46^{a}	6.22^{b}	6.43^{b}	0.00
TFF (g)	2.09^{b}	2.26^{ab}	2.61^{a}	2.10^{b}	2.03^{b}	0.08
PWG (%)	60.66^{b}	58.19^{b}	107.13^{a}	53.81^{b}	63.41^{b}	0.6
ADWG (g/day)	0.08^{b}	0.08^{b}	0.14	0.07^{b}	0.8^{b}	0.01
TPI	0.84^{b}	0.90^{ab}	1.04^{a}	0.84^{b}	0.81^{b}	0.03
FCR	0.34	0.33	0.23	0.36	0.33	0.01
PER	7.83^{ab}	7.61^{b}	10.94^{a}	7.29^{b}	7.81^{ab}	0.51

Means in the same row are significant different ($P<0.05$).

MWG- Mean weight gain,

TFF- Total feed fed,

PWG- Percentage weight gain,

ADWG- Average daily weight gain,

TPI – Total protein intake,

FCR – Food conversion ratio,

PER – Protein efficiency ratio

D1, D2, D3, D4 and D5 represent 0%, 10%, 20%, 30% and 40% replacement level of *Carica papaya* leafmeal in the diet fed *Clarias gariepinus* fingerlings.

SEM – Standard error of mean

Table 3: Haematological parameters of *Clarias gariepinus* fingerlings fed various replacement level of *Carica papaya* leaf meal

Parameters	1	2	3	4	5	SEM
RBC (10^6/µ)	12.62^{ab}	13.38^{a}	9.41^{b}	13.21^{a}	13.71^{a}	0.72
WBC(10^3/µ)	15.40b	18.95^{a}	16.20^{b}	17.60^{ab}	14.90^{c}	0.76
HB	10.95^{b}	12.20^{a}	10.20^{b}	11.90^{a}	11.05^{ab}	0.35
PCV (%)	34.30^{b}	38.50^{a}	29.15^{c}	36.00^{ab}	38.20^{a}	1.74
MCV(µ)	27.20^{b}	28.80^{ab}	31.50^{a}	27.30^{ab}	27.80^{ab}	0.64
MCH (µg)	$8.80A^{b}$	8.85^{ab}	11.15^{a}	9.00^{ab}	8.15^{b}	0.43
MCHC (%)	32.35^{a}	30.70^{ab}	35.25^{a}	33.10^{a}	29.25^{b}	0.92

RBC-red blood cell, WBC-white blood cell, HB-haemoglobin, PCV-packed cell volume, MCH-mean corpuscular volume, MCH-mean corpuscular haemoglobin MCHC- mean corpuscular haemoglobin concentration.

TABLE 4:

Proximate composition of the diet fed to *Clarias gariepinus fingerlings*.

composition	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Moisture content (%)	4.97	6.27	6.70	6.22	6.13
Dry matter (%)	95.03	93.73	93.30	97.78	93.87
Crude Protein (%)	20.56	24.06	25.37	28.21	25.15
Crude fat (%)	9.75	10.76	10.89	11.48	10.24
Crude fiber (%)	6.55	5.70	5.70	5.90	6.35
Total Ash (%)	19.61	14.91	16.58	15.93	20.27

TABLE 5:

Proximate carcass composition (% dry weight basis) of experimental fish sample at the beginning and the end of the feeding trials.

	Moisture content (%)	Dry matter (%)	Crude protein (%)	Crude fat (%)	Crude fibre (%)	Total ash (%)
Initial	4.69	95.48	65.36	8.22	1.66	13.92
Diet 1	4.49	95.50	63.28	7.96	1.65	14.24
Diet 2	3.78	96.21	66.85	8.44	1.71	14.96
Diet 3	3.95	96.05	62.02	8.04	1.68	16.05
Diet 4	4.09	95.90	63.72	8.15	1.76	14.92
Diet 5	4.18	95.72	63.26	8.23	1.77	14.55

TABLE 6:

Proximate composition of test ingredient (*Carica papaya*) fed to clarias ganiepinus fingerlings.

	Moisture content (%)	**Crude protein (%)**	**Ether extract**	**Crude fiber (%)**	**Ash content (%)**	**Nitrogen free extract (%)**	**P^H value**
values	**6.72**	**32.40**	**12.63**	**4.20**	**5.30**	**38.46**	**9.0**

DISCUSSION

There was significant different in mean weight gain across the treatments. Diet 3 (20% replacement level of pawpaw leave meal) showed the highest mean weight gain which is in agreement with Ogle (2006). Who reported highest body weight gain in 20% replacement level of Taro leave meal as optimum in the diet of another monogastric (pig). Diet 3 has the highest feed intake (2.61) while diet 5 has the lowest feed intake (2.03).

This is in agreement with Pheng Bunta et al, (2008) who reported that feed intake reduce with reduction in palatability. The protein efficiency ratio recorded for 5 fish fed diet

3 was the highest (10.94). This indicated that at 20% replacement level, *Clarias gariepinus* will utilize the protein in the diet.

The result also showed that diet 3 (20% replacement level of leave meal) has lowest FCR being the most efficient in conversion of feed to flesh. Diet 4 has the highest FCR of 0.36. However, there is no significant difference (P> 0.05) in the FCR obtained for fish under treatment 1 to 5.

There is an increase in the protein value of fish carcass obtained at the end of the feeding trial compared at the beginning of the feeding trial.

Initial carcass has highest ash value compared to theh fi carcass at the end of the experiment. Generally, there is a reduction in the fiber content of fish carcass of treatment 1 to 5 compared with the fiber of fish carcass not fed pawpaw leave meal.

There was decline in RBC value compared with the normal value (24 x 10^6/ µ) by Adedeji et al, (2000). The reduced erythrocyte count may preclude the possibility of haemolytic anemia stated by Kelly (1974) may be due to toxic factor, infections and metabolic disease. The MCHC values obtained for the fish across the treatments still fall within the normal range of 30-35 gm/I recommended by Adedeji et al, (2000). There is a marked increase in the WBC count across the treatment compare with normal value (6.6 x 10^6/µ) recommended by Adedeji et al, (2000). Increase in total WBC may be attributed to increase in production of leucocytes in the Haemotopoietic tissues in the kidney and perhaps the spleen.

The results of these study showed that pawpaw leaf meal, can replace fishmeal up to 20% without any adverse effect on the fish, this is in support of the report of David et al, (2009) that fish fed on 25% and 50% PLM had better growth rate compared to the control diet and may have improved the nutritive value of the diets. David et al, (2009), also inferred that pawpaw leaves therefore have a great potential to be included in diets used to culture the *Clarias gariepinus*

Conclusion:

Finally, this research has actually shown that, pawpaw (*Carica, papaya*) leaf meal is very rich in nutrients required by (*Clarias gariepinus*). African catfish which showed clearly from the result obtained from diet 3 (20% replacement level of pawpaw (*Carica papaya*) leaf meal in the diet) that performed best in terms of MWG – mean weight gain, ADWG- Average daily weight gain, PWG- percentage weight gain, TFF-Total feed fed, and PER – Protein efficiency ratio, therefore it can be concluded that fish meal can be replaced with

pawpaw (*Carica papaya*) leaf meal up to 20% in the diet of (*Clarias gariepinus*) African catfish fingerlings.

RECOMMENDATION

It is advisable for fish farmers to replace fish meal with pawpaw (*Carica papaya)* leaf meal up to 20% while compounding diets for the African catfish (*Clarias gariepinus*) fingerlings. This will enhance the optimum growth of catfish (*Clarias gariepinus*) and profit maximization for the fish farmers.

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