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Utilization of graded levels of ripe and unripe banana in the diet of hybrid catfish, Heteroclarias (*Heterobranchus longifilis* X *Clarias gariepinus*).

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INTRODUCTION

The success of any fish farming operation depends largely on the provision of suitable and economical fish feed through which optimum growth can be obtained (Eyo, 1994). Fish feed accounts for about 60 -70% of the running cost of a farm, so care needs to be taken in feed production (Gabriel et al., 2007). However, the need to reduce this high running cost of feeding through cheap, good quality and effective diet is of utmost importance. Quite a number of works have been done on the need to replace the expensinve conventional feed ingredients with cheap and good quality non-conventional feed ingredients. In the present study, the use of banana was tested in the diet of hybrid heteroclarias juveniles. Although, banana is consumed by humans, it is readily available for feed production due to its high production, at times of bumper harvest coupled with poor preservation techniques in developing countries (Karunatilake, 2010).Banana is the second fruit crop in the world in terms of production behind African oil palm, with 70,629,047 MT or 155 billion Ibs(FAO, 2004).Bananas are very digestible fruits, rich in components that stimulate digestion, as well as appetite stimulant. Banana has a great nutritional significance. The fruit is composed mainly of water as well as carbohydrates which provides energy in the human body.Due to the above reasons, the effect of feeding banana to heteroclarias juveniles was checked on growth, economic and haematological parameters.

MATERIALS AND METHODS

The experiment was carried out at the Nutrition Unit of the Department of Marine Sciences, Faculty of Science, University of Lagos, Akoka, Nigeria.Ten (10) Heteroclariasjuveniles of average weight 7.6g were stocked in plastic tanks(52.5cm × 33.5cm ×21cm). The tanks were covered with nettings to prevent the fish from escaping. A total of 270 juveniles catfish were stocked in 27 plastic tanks, with three replicates per experimental diet. The experiment lasted for ten (10) weeks, water was changed every other day to maintain good water quality parameters of air temperature, 29-30^{o}C, water temperature 27.5- 29.5^{o}C, dissolved oxygen level of 4.5-4.8mg/l, and pH of 7.3- 8.0 (Aderolu and Akpabio, 2009). Proximate analysis of the test ingredients (Table 1) were done to formulate nineexperimental diets; the control diet (without the test ingredients), other test diets contained ripe (RP) and unripe (URP) banana used to substitute for maize at graded levels (5%, 10%, 15%, 20%) for each of the test ingredients (Table 2). The fish were fed to satiation by hand twice daily (900 and 1700 hrs).

The haematological parameters of the fish were determined using the method of Joshi *et al.* (2002). Growth was estimated in terms of mean weight gain and specific growth rate (Bagenal, 1978), while nutrient utilization indices were estimated according to Wilson (1989). The economic evaluations were analysed in terms of cost of feed (COF), value fo fish (VOF), and incidence cost (IC). They were calculated according to Mazid *et al.* (1997). Data were subjected to analysis of variance (ANOVA) and the significant in means were separated using Duncan's multiple range test (Duncan, 1955).

Table 1: The Proximate Analysis of Ripe and Unripe Banana

Samples	Ripe banana	Unripe banana
%Dry matter	75.30	70.45
%Crude protein	5.27	4.19
% Ash	5.38	3.95
%Ether extract	1.00	2.0
%Crude fibre	1.00	1.50

Table 2: The Feed Composition of Experimental Diet (kg)

INGREDIENT	DIET1 CTR	DIET2 5%RP	DIET 3 10%RP	DIET 4 15%RP	DIET 5 20%RP	DIET 6 5%URP	DIET7 10%URP	DIET 8 15%URP	DIET 9 20%URP
MAIZE	25	20	15	10	5	20	15	10	5
BANANA	0	5	10	15	20	5	10	15	20
SBM	30	28	25	26	25	28	25	26	25
GNC	15	17	19	17	17	17	19	17	17
FISH MEAL	27	27	28	29	30	27	28	29	30
FISH PREMIX	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
DCP	1.0	1..0	1..0	1..0	1..0	1..0	1..0	1..0	1..0
SALT	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
PALM-OIL	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
CALC. CP %	41.29	41.06	41.13	41.08	41.09	41.11	41.24	41.24	41.30
CALC.ENERGY (KCAL/KG)	2,911.7	2,851.86	2,793.62	2737.79	2680.75	2856.12	2802.14	2750.57	2697.79

KEY: CTR: Control, RP: Ripe banana, URP: Unripe banana, SBM: Soybean meal, GNC: Groundnut cake, DCP: Dicalcium phosphate, EE: Ether extract, CP: Crude protein.

Result and Discussion

The non-significant value of the growth parameters (Table 3) tested in the present study is corroborated by the fact that fish fed diets containing similar levels of digestible protein and digestible energy should be identical (Fagbenro and Davies, 2000). These results may be related to the high digestibility of banana as observed by Mackay and Bolinda (2001) who reported that bananas are very digestible fruits, rich in components that stimulate digestion, as well as appetite stimulant.The higher feed intake observed with the group fed ripe bananas may be due to the sweet nature of banana fruit and the ability of banana to replenish nutritional deficiencies (Forster et al. 2002). The decreased feed intake observed in the unripe group may be due to the presence of tannin; Babatunde (1992) reported varying levels of active tannins, the factor that is responsible for the astringency of raw green bananas. The level of nutrient utilization in the test diets may not be unconnected with starch converted to simple sugar which makes digestion and utilization simple especially in the ripe banana. According to Emagaet al. (2002), maturation of banana involves, increase in soluble sugar, decrease in starch and hemicelluloses, and slight increase in protein and lipid content.

Of all parameters analysed for economic indices only incidence cost (IC) recorded significant difference ($P<0.05$) (Table 4). The highest value was recorded for Diet 4 (0.55 ± 0.13).This is due to low prize of maize which influenced the cost of formulated feed.

Table 3: Gowth and nutrient utilization performance of fish graded levels of ripe and unripe Banana.

INGREDIENT	DIET1 CTR	DIET2 5%RP	DIET 3 10%RP	DIET 4 15%RP	DIET 5 20%RP	DIET 6 5%URP	DIET7 10%URP	DIET 8 15%URP	DIET 9 20%URP
AIW (g)	7.6±0.0	7.6±0.0	7.6±0.0	7.6±0.0	7.6±0.0	7.6±0.0	7.6±0.0	7.6±0.0	7.6±0.0
AFW (g)	42.0±1.0	48.6±1.3	47.0±11.2	46.63±7.25	46.17±2.75	48.74±11.4	46.95±5.48	42.45±2.93	39.37±6.31
MWG(g)	34.4±1.00	41.04±1.36	39.46±11.2	39.03±7.25	38.57±2.75	41.14±11.4	39.35±5.48	34.85±2.93	31.77±6.31
SGR(%day^{-1})	3.49±0.05	3.79±0.06	3.69±0.31	3.69 ±0.31	3.68±0.12	3.75±0.48	3.71±0.23	3.51±0.14	3.34±0.32
AFI(g)	40.51±7.68	43.31±1.28	54,17±21.5	54.73±22.7	43.87±3.39	40.87±6.70	41.57±4.50	35.06±2.34	37.40±3.36
FCR	0.87±0.16^{ab}	0.95±0.02^{ab}	0.75±0.08^{b}	0.76±0.17^{b}	0.88±0.11^{ab}	0.99±0.12^{a}	0.95±0.14^{ab}	1.00±0.12^{a}	0.85±0.11^{ab}
PI	16.61±3.15	17.76±0.53	22.21±8.83	22.44±9.34	17.99±1.39	16.76±2.74	17.05±1.84	14.38±0.96	15.33±138
PER	2.12±0.39^{ab}	2.31±0.45^{ab}	1.82±0.19^{b}	1.85±0.41^{b}	2.16±0.27^{ab}	2.42±0.28^{a}	2.32±0.35^{ab}	2.43±0.29^{a}	2.06±0.27^{ab}

Figures in each row with different superscript are significantly different ($P < 0.05$) from each other
KEY: AIW: Average Initial Weight, AFW: Average Final Weight, MWG: Mean Weight Gain, SGR: Specific Growth Rate, AFI: Average Feed Intake, FCR: Feed Conversion Ratio, PI: Protein Intake, PER: Protein Efficiency Ratio

Table 4: Cost Analysis of *Heteroclarias*spp. Fed Graded levels of Ripe and Unripe banana

PARAMETERS	DIET 1 CONTROL	DIET2 5%RP	DIET 3 10%RP	DIET 4 15%RP	DIET 5 20%RP	DIET 6 5%URP	DIET7 10%URP	DIET 8 15%URP	DIET9 20%URP
COF/kg	202.66	256.36	334.06	403.36	471.86	256.36	334.06	403.36	471.86
VOF	17.64±0.42	20.43 ±0.57	19.76 ±4.7	19.59 ± 3.04	19.39 ± 1.17	20.47 ± 4.81	19.72 ± 2.30	17.83 ± 1.23	16.54 ±2.65
IC	.24± .04^{d}	.27±.01^{cd}	.45± .05^{ab}	.55 ± .13^{a}	.54 ± .06^{a}	.26±.03^{cd}	.36± .05^{bc}	.41± .05^{b}	.56 ± 08^{a}

Figures in each row with different superscript are significantly different ($P < 0.05$) from each other
KEY: COF: Cost of Fish, VOF, Value of Fish, IC: Incidence Cost

The PCV and Hb reduced significantly with ripe banana inclusion (Table 5). The reduction might have occurred as a result of anti-nutritional factor present in the test ingredient. Furthermore, the anti-nutritional factor act as a stressor; and during primary stages of stress the PCV changes due to the release of catecholamine, which can mobilize red blood cells from spleen or induced red blood cell swelling as a result of fluid shift into the intracellular compartment(Wells and Weber, 1990).There was a significant drop in WBC with increased inclusion level in all the diets. The increase in white blood cells of diet 2 is an indicator of a challenged or disturbed state of health of fish which is likely due to stress as reported by (Gabriel et al., 2001).In conclusion, judging from better growth, nutrient and haematological performance, graded inclusion levels of ripe and unripe banana is a better substitute for maize except for 20% inclusion level of unripe banana.

Table 5: Haematological parameters of Heteroclarias fed graded levels of ripe and unripe banana

INGREDIENT	DIET1 CTR	DIET2 5%RP	DIET 3 10%RP	DIET4 15%RP	DIET 5 20%RP	DIET 6 5%URP	DIET7 10%URP	DIET 8 15%URP	DIET 9 20%URP
PCV	31.6 ± 0.5^{ab}	30.6 ± 6.1^{ab}	24.6 ± 10.0^{bc}	17.6 ± 3.7^{c}	30.3 ± 4.0^{ab}	33.3 ± 1.5^{ab}	35.3 ± 0.5^{a}	36.0 ± 1.0^{a}	30.0 ± 4.3^{ab}
Hb	10.3 ± 0.1^{ab}	10.0 ± 1.8^{ab}	8.3 ± 3.2^{c}	6.0 ± 1.1^{bc}	9.9 ± 1.1^{ab}	10.9 ± 0.6^{ab}	11.6 ± 0.1^{a}	11.7 ± 0.2^{a}	9.8 ± 1.2^{ab}
WBC($x10^3$)	13 ± 1000^{ab}	13.3 ± 3055^{a}	12.5 ± 500^{ab}	10.6 ± 3055^{ab}	9 ± 2000^{b}	13 ± 1000^{ab}	11.6 ± 3055^{ab}	12 ± 2000^{ab}	10.3 ± 1.52^{ab}
RBC	7.6 ± 0.5	7.6 ± 2.1	7.3 ± 2.5	5.8 ± 1.0	7.2 ± 1.0	8.2 ± 1.1	8.4 ± 1.2	8.6 ± 1.6	7.1 ± 1.1
Chol	145 ± 5.0^{ab}	130 ± 10.0^{b}	130 ± 36.0^{b}	176 ± 25.1^{ab}	130 ± 10.0^{b}	173 ± 25.1^{ab}	146 ± 45.0^{ab}	176 ± 25.1^{ab}	196 ± 40.4^{a}

KEY: PCV: Packed Cell Volume, Hb: Haemoglobin, WBC: White Blood Cell, RBC: Red Blood Cell, Chol: Cholestrerol

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