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### GROWTH PERFORMANCE, NUTRIENTS UTILIZATION AND OF *Clarias gariepinus* (BURCHELL, 1822) FINGERLINGS FED WITH DIFFERENT SOURCE OF PROTEIN DIETS

\*Yola, I.A., Ilyasu, A.A., and Getso, B. U.,

\*Department of Biological sciences,  
Bayero University, Kano  
Department of Biology,  
Kano University of Science and Technology, Wudil  
P.M.B 3244, Kano-Nigeria.

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Correspondence author:

[yolai2006@yahoo.co.uk](mailto:yolai2006@yahoo.co.uk)

Phone:

#### ABSTRACT

*This study investigated the effects of different protein diets of desert locust, clupeoid fish and groundnut cake on nutrients utilization, growth performance and carcass quality of Clarias gariepinus fingerlings. One hundred and sixty Clarias gariepinus fingerlings with initial mean weight of 0.12 g reared for 90 days, fishes in each treatment were fed on one sole diet without any addition of other ingredients; fishes were fed at 3% body weight daily at 08:00 and 16:00 hours. Proximate composition analyses of diets and fish carcass were evaluated according to the standard method. The result showed that crude protein content was highest (65.73%) in Clupeoid fish than Desert locust (64.53%) followed by Industrial groundnut cake (51.50%) and Coppens feed had the lowest (46.00%). Nutrients analyzed from the carcass flesh showed that crude protein was highest in Clupeoid fed fishes than groundnut cake followed by control and lastly Desert locust with values of (54.78%), (51.41%), (45.53%) and (16.00%) respectively. Groundnut cake had a better FCR and PER. SGR also shown a similar pattern with Clupeoid fish treatment had the highest values then followed by G/nut, control and desert locust values of (3.04), (1.46), (1.39) and (1.21) respectively. Significant Difference at  $p < 0.01$  was observed, this results indicates that fish feed formulation with hundred percent of Desert locusts (*Schistocerca gregaria*), Clupeoids fish, and Industrial Groundnut (*Arachis hypogaea* L.) cake meal cannot be used as sole protein diets for *Clarias gariepinus* fingerlings.*

#### INTRODUCTION

One of the major factor militating against fish farming in Nigeria lack of adequate feed that are formulated to meet the nutrient requirements of culturable fish species. Nigerian fish farmers hardly use good quality fish feed pellets (Jamu and Ayinla, 2003; Omitoyin, 2000) due to high cost of fish feed ingredients particularly fish meal. Omitoyin 2000 reported that a lot of fish farmers in Nigeria depend on imported quality fish feeds which are usually expensive. Utilization of such commercially formulated feeds increases the cost of production thereby reducing the profit margin of fish farmers. This ultimately translates to high cost of fish, for

instance feed represents a high proportion 50-80% of variable cost of production (Eyo, 1990).

Over the years with the increasing popularity of aquaculture, feed has become one of the most expensive components. Feed is essential in culture of both marine and freshwater fishes and it has become one of the important factors in aquaculture to reduce expenses and increase profit, numerous studies have been focused on the alternatives feeding materials (Qin and Fast, 1996; Dong-Fang et al. 2003). Many scientists have reported the possible use of some alternative animal protein feedstuffs to replace fish meal such as Termites, Earthworm meal (Sogbesan and Ugwumba, 2006; Annune, 1990),

Toad meal (Ayinla et al. 1994), Tadpole meal (Fagbenro and Jauncey, 1995), Fermented fish silage (Ugwumba et al. 2001), Maggot meal (Fasakin et al. 2000). Poultry dung meal (Sogbesan and Ugwumba, 2006), in China Silk worm pupae have been used traditionally to feed fish while in Western Thailand maggots produced from swines manure have been used as fish feed (Madu and Ufodike, 2003).

Recent research interest include identifying and utilizing alternative locally available feed resources such as insects in formulating fish diets, unconventional protein sources such as maggot meal (Atteh and Ologbenla, 1993), termite meal and grasshopper meal (Ojewola et al. 2005) have been used to replace fish meal, these studies indicated a reduction in feed cost and increased profitability without compromising performance.

The main aim of this research work was to evaluate the use of selected plants and Animals protein source feed ingredient for *Clarias gariepinus* fingerlings.

**MATERIALS AND METHODS**

**Experimental site**

The study was conducted at the Teaching and Research Farm of Department of Forestry, Fisheries and Wild Life, FAAT, Kano University of Science and Technology wudil. Wudil is located at 11°49' North, Longitude 8°5' East and a total area of 362 km<sup>2</sup> with a population 185,189 (NPC, 2006) the climate of Wudil is the tropical wet and dry climate classification with a mean annual rainfall of 850

mm the highest rainfall occurs between May and September (Olofin, 2008).

**Experimental design**

Three experimental diets of sole deserts locust meal, clupeoid fish meal and groundnut cake meal were fed to the fingerling of *C.gariepinus* as the treatments and Commercial feed (Coppens 3mm) as control. Complete randomised block design was used and each treatment was replicated three times. Concrete ponds of 1m<sup>2</sup> was used at stocking rate of 10 fish per m<sup>2</sup> diet were fed at 3.0% body weight twice a day between 8.00 – 9.00 am and 4.00 – 5.00pm for period of 90 days during the months of June, to August 2013.

Mean weight gain (MWG) was estimated according to the method of (Adewolu et al., 2008), Specific growth rate (SGR) was estimated from the logarithmic difference between final and initial mean weight of fish per time (Aderolu et al., 2010).

Food Conversion Ratio (FCR) = feed intake per fish / weight gain per fish

Protein Efficiency Ratio(PER). This was computed as reported by (Adewolu et al., 2008).

PER = weight gain/protein intake.

The proximate analyses of the samples of sole protein diets and fish carcass were evaluated to determines Crude protein, Crude lipid, Ash and Moisture according to the standard method of AOAC (1990).

**Statistical Analysis**

All data were subjected to analysis of variance (ANOVA) and Duncan multiple range tests for mean separation using SAS computer software.

**RESULTS**

**Table 1:** Mean values of Proximate Composition of the Experimental Diets

Proximate composition	Desert locust	Clupeid	G/nut cake	Control
Crude protein	64.53	65.73	51.50	46.00
Lipid	16.89	20.74	14.09	16.53
Ash	4.80	8.60	3.80	6.80
Moisture	4.00	14.00	12.00	12.00

Table 1 shows the result of proximate composition of the diets, crude protein was higher in Clupeid meal diet, the moisture content was generally low

with the range of 4 - 12% and lipid was within the range of 14.09 – 20.74 and the ash values were within the range of 3.80 to 8.60.

**Table 2:** Shows the mean values of Nutrients utilization and Growth performance of *Clarias gariepinus* fingerlings fed with different source of protein diets.

Parameters	Treatments			
	Trt <sub>1</sub>	Trt <sub>2</sub>	Trt <sub>3</sub>	Control
Mean Initial weight(g)	0.12	0.12	0.12	0.12
Mean Final weight(g)	0.75	6.36	0.59	0.82
Mean Weight gain(g)	0.63	6.24	0.47	0.70
Average daily growth (g/days)	0.011	0.111	0.008	0.012
Total feed intake	3.49 <sup>b</sup>	3.40 <sup>c</sup>	3.15 <sup>d</sup>	3.84 <sup>a</sup>
Specific growth rate (g / days)	1.39 <sup>c</sup>	3.04 <sup>a</sup>	1.21 <sup>d</sup>	1.46 <sup>b</sup>
Feed conversion ratio	0.17 <sup>b</sup>	0.08 <sup>c</sup>	0.22 <sup>a</sup>	0.17 <sup>b</sup>
Protein efficiency ratio	0.97 <sup>c</sup>	9.49 <sup>a</sup>	0.91 <sup>d</sup>	1.52 <sup>b</sup>
Survival rate (%)	55.00 <sup>c</sup>	7.50 <sup>d</sup>	70.00 <sup>a</sup>	57.50 <sup>b</sup>

<sup>abcd</sup> Mean in the same row with same superscript are not significantly different at (p < 0.01)

The Nutrients utilization, growth performance and survival rate of *Clarias gariepinus* fingerlings, Mean weight gain (MWG), Average growth rate (AGR) and specific growth rate (SGR) were presented in Table 2. Fishes fed Clupeoid fish meal in Treatment<sub>2</sub> as a sole protein source gave the highest MWG of 6.24 g than control treatment 0.70g, follow by fishes in treatment<sub>1</sub> with 0.63 g and fishes fed Groundnut cake meal in Treatment<sub>3</sub> has lowest value of 0.47 g, AGR was also highest in treatment<sub>2</sub> than Control treatment, followed by treatment<sub>1</sub> and lowest in treatment<sub>3</sub> with values of 0.11g/day, 0.012g/day, 0.011g/day and 0.008g/days respectively, SGR also showed a similar pattern with treatment<sub>2</sub> having the highest value than Control treatment followed by treatment<sub>1</sub> and lastly treatment<sub>3</sub> with values of 3.04, 1.46, 1.39 and 1.21 respectively.

Nutrients utilization parameters evaluated includes Total Feed Intake (TFI), Feed Conversion Ratio

(FCR) and Protein Efficiency Ratio (PER). Fishes in Control treatment consumed more feed of 3.84g than fishes in treatment<sub>1</sub> 3.49g, followed by fishes in treatment<sub>2</sub> 3.40g and lowest in fishes treatment<sub>3</sub> 3.15g, Fish in treatment<sub>3</sub> has a better FCR of 0.22 than followed by fishes in treatment<sub>1</sub> and Control diet has 0.17 and fish in treatment<sub>2</sub> has 0.08. PER also showed different pattern with treatment<sub>2</sub> having the highest value then Control followed by treatment<sub>1</sub> and lastly treatment<sub>3</sub> with values of 9.49, 1.52, 0.97 and 0.91 respectively.

Survival rate of *C. gariepinus* fingerlings fed with sole protein diets, it reveal that fishes were observed to be in poor health conditions in the treatments with mean survival range from 7.50% to 70.00%, in treatment<sub>3</sub> has the highest survival rate of 70.00% then Control has 57.50%, followed by treatment<sub>1</sub> has 55.00% and treatment<sub>2</sub> has the lowest survival rate of 7.50%.

### Carcass composition

**Table 3:** Shows mean values of Carcass Proximate composition of the *Clarias gariepinus* fingerlings fed different protein diets.

Parameters	fed sole protein diets			
	Trt <sub>1</sub>	Trt <sub>2</sub>	Trt <sub>3</sub>	Control
Crude protein	16.00 <sup>d</sup>	54.78 <sup>a</sup>	51.41 <sup>b</sup>	45.53 <sup>c</sup>
Lipid	10.80 <sup>a</sup>	9.82 <sup>d</sup>	10.71 <sup>b</sup>	10.34 <sup>c</sup>
Ash	2.30 <sup>b</sup>	1.90 <sup>d</sup>	2.10 <sup>c</sup>	3.00 <sup>a</sup>
Moisture	77.66 <sup>a</sup>	77.24 <sup>b</sup>	76.08 <sup>c</sup>	75.22 <sup>d</sup>

<sup>abcd</sup> Mean in the same row with same superscript are not significantly different at  $p < 0.01$

Table 3 shows the results of carcass composition of *C.gariepinus* fingerlings after crude protein was highest in Trt<sub>2</sub> than treatment<sub>3</sub> followed by Control treatment and lastly treatment<sub>1</sub> with following values (54.78%), (51.41%), (45.53%) and (16.00%), respectively. Crude lipid content of (10.80%) was highest in treatment<sub>1</sub> than treatment<sub>3</sub> (10.71%), control treatment has (10.34%) and treatment<sub>2</sub> has the least value of (9.82%). Control treatment having the highest Ash (3.00%) than treatment<sub>1</sub> (2.30%) treatment<sub>3</sub> (2.10%) and lastly treatment<sub>2</sub> (1.90%), Treatment<sub>1</sub> having the highest moisture level than treatment<sub>2</sub>, treatment<sub>3</sub> and Control treatment with values of (77.66%), (77.24%), (76.08%) and (75.22%) respectively.

### DISCUSSION

The results of the percentage survival rates range from 7.50% - 70% recorded in this study, the result shows that the lowest survival rate of 7.50% was obtained in treatment<sub>2</sub> at harvest, this treatment recorded the biggest sizes of fish 6.36 g average mean weight gains with a mean weight of 15.9g it indicates that a lot of cannibalism was recorded

the survival of 7.50% and this confirms the report by Madu *et al.*, (2000) that the best survival of 92% was recorded in the tanks sampled weekly with zero cannibalism.

The mean weight gain shows that treatment three fed with sole protein diet of industrial groundnut cake meal had poor performance which was contradicted with the finding of Webster *et al.*, (1992) and Kaushik *et al.*, (2004) that complete or partial replacement of fish meal with plant based protein is possible without loss of growth performance and also supported the reports of Robinson and Li (2007) which state that animal proteins are needed for growing fry and fingerlings, they also further observed that no single feedstuff can provide all the nutrient needs of catfish a mixture of feedstuffs can be use.

Better Specific growth rate was achieved in treatment<sub>2</sub> fed with Clupeoid fish meal 3.04g/day compared with other two treatments Deserts locust meal 1.39g/day and Groundnut cake meal 1.21g/day, this indicated that growth performance of *C. gariepinus* fingerlings fed sole protein diets was significant difference,

Aderolu et. al. (2010) reported the ability of an organism to utilize nutrients especially protein will positively influence its growth rate, this justified my results which indicated the Specific growth rate of treatment<sub>2</sub> fed with sole Clupeoid fish meal was significant difference compare with desert locust meal and groundnut cake meal.

Feed conversion ratio was highest in treatment<sub>3</sub> with a value of (0.22) despite its has low crude protein content of (51.50%) among sole protein feed ingredients used, if compared with control has (46.00%), diet<sub>1</sub> which has (64.53%) and also diet<sub>2</sub> has (65.73%), this was unsupported by the report which stated that the best growth rates and food conversion were achieved with diets containing (35-42 %) crude protein. Ojewola et. al (2005) however reported a FCR of 2.75 for tilapia fed (25%) inclusion level of grasshopper meal as replacement for fish meal. Highest feed intakes were noticed when fed with Control diet this could be due to fish meal content better feed conversion, and second in percentage of survival rate as a result of its lower protein content of (46.00%) and low feed intake when fed with groundnut cake meal with content of (51.50%) but it had the highest percentage of survival rate of (70%).

The ability of an organism to utilize nutrients especially protein will positively influence its growth rate (Sogbesan and Ugwumba, 2008), this is justified by the highest PER of 9.49, 1.52, 0.97, 0.91 and low FCR of 0.08, 0.17, 0.17, 0.22 in the treatments fed twice daily ration this suggested that fish must have efficiently converted feed consumed to growth, the lower feed conversion ratio for treatments<sub>2</sub> than treatment<sub>1</sub> and control lastly treatment<sub>3</sub> has the highest FCR the values are 0.08, 0.17, 0.17, and 0.22 respectively this was an indication that these treatments are more quality feed than treatment<sub>3</sub> 0.22, this result supports the work done by Ugwumba and Ugwumba, (2007) which state that Lower food conversion ratio indicates higher food conversion efficiency which results in higher growth, Least growth performance was recorded from fishes fed diet<sub>3</sub>, diet<sub>1</sub> but diet<sub>2</sub> has poor percentage survival, this indicates that single diet source cannot be used as a sole protein source for *Clarias gariepinus*.

Anand et al. (2008) reported that protein content of acridids ranges from 60 to 66% and Blasquezet et al. (2012) from 43.9 to 77.1%. Crude protein content of groundnut cake meals was 51.50%. This value fell within the range of 40-55% as

reported by Pillay (1993) and above values reported by Fagbenro (1999) 40.7% to 41.2%, these findings indicate that different sources of protein diets use varies with others reported by some author probably due to stages of growth and geographical locations differences of the source of experimental diets used.

Significant differences were observed in the whole body protein and lipid compositions of the fish LSD at  $P < 0.01$  significant level, the carcass flesh of fishes in Treatment<sub>3</sub> and control treatment had the lowest moisture, Treatment<sub>2</sub> had the highest protein contents than treatment<sub>3</sub> followed by control and treatment<sub>3</sub> had lowest protein content (Table 3), the highest crude lipid contents were for fishes in treatment<sub>1</sub> than treatment<sub>3</sub> followed by control and Treatment<sub>2</sub> has the lowest lipid content.

Catfish traditionally have been fed relatively high protein diets of 32-35% but they grow just as fast and convert feed as efficiently on diets containing as low as 24% protein, plant protein are recommended for growing catfish to table size but animal proteins are needed for growing fry and fingerlings, they further observed that no single feedstuff can provide all the nutrient needs of catfish a mixture of feedstuffs are used (Robinson and Li 2007).

Water quality attributes are prime factors that influence all biological productions fish survival and adequate growth performance, this study recorded the mean temperature of 28.08°C, mean pH value of 7.21 and Mean dissolved oxygen (DO) 5.97mgL<sup>-1</sup>. which are optimum for survival and growth of fishes as reported by Boyd (1981)

#### Conclusion

This study reveal that no single Sole Protein Diets can provide all the nutrient needs of African mudfish (*C. gariepinus*) fingerlings a mixture of feedstuffs most be used, this research recorded least positive nutrients utilization, growth performance and it can assist fish nutritionists to formulate fish feed at least cost with Clupeoid fish if incorporated with others local available feed ingredients source from both plants and animals at different proportions during fish feed formulation, hundred per cent inclusions of Desert locusts (*schistocerca gregaria*), Clupeoids fish species, and Industrial Groundnut (*Arachis hypogaea* L.) cake meal cannot be used as sole protein diets for *Clarias gariepinus* fingerlings.

of rearing African catfish *Clarias gariepinus*, (Burchell 1822) fingerlings and juveniles *African Journal of Food Science* Vol. 4(5), pp. 286 – 290.

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