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# Growth and Gonad Quality of *Clarias Gariepinus* (Burchell, 1822) Broodstock Fed Varying Dietary Protein Levels.

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***Abstract***

*Growth performance and gonad development of female broodstock of Clarias gariepinus was investigated in the study for 70 days. Fish were fed diets with varying crude protein levels; 30, 35 and 40% in triplicates with imported feed as control. Proximate analysis of feeds, fish and eggs were done and data were collected on fish growth and nutrient utilization efficiency fortnightly. Results showed that fish fed diets with 35% crude protein exhibited superior ($P<0.05$) growth rate, feed conversion ratio and apparent net protein utilization than fish fed diet with 40% crude protein. Fish fed diets with 35 and 40% crude protein had higher crude protein values for carcass and for eggs while both were significantly higher ($p<0.05$) than the crude protein content in the carcass and eggs of diet with 35% crude protein. Egg development was however higher in fish fed 40% crude protein diet but with marginal differences as compared to the values obtained in fish fed 35% crude protein diet. Result showed that diet with 35% crude protein produced good growth rate in catfish brood stock and better nutrient utilization as well as improved egg development and maturity than fish fed diet with 30% crude protein.*

***Keywords:*** *Growth performance, Clarias gariepinus, Female broodstock, Crude protein, Gonad.*

## Introduction

*Clarias gariepinus* (Burchell, 1822) is one of the culturable fin fish species in Nigeria that is of high commercial interest (Faturoti, 2000). It is known to be capably of withstanding adverse environmental condition more than other culturable species such as tilapia (Pillay, 1990). This, coupled with its fast growth rate has made it attractive to catfish farming in Nigeria for the past two decades.

African catfish hardly reproduces in captivity (Howerton, 2001) but with the popular induced breeding (artificial method of spawning, incubation and hatching of eggs under controlled environmental conditions) technique, it has been possible to produce fish seed all year round (Ayinla, 1988). Although the technique for induced breeding has been developed (Aluko and Ali, 2001), the problem of low egg hatchability and larva survival rate remains a major hindrance to the success of its mass production.

Nutritional deficiency has been identified as a great factor affecting artificial spawning of fish (Hogendoorn and Vismans, 1980). The work of El-Sayed *et al* (2003), Coward and Bromage (2000) and Chong *et al* (2004) have further emphasized the importance of bloodstock nutrition for the enhancement of reproductive performance of cultured fish species especially, dietary protein level (Muchlisin *et al.,* 2006). National Research Council-NRC (1983) and Kent (2002) reported that, there are differences in the nutritional requirements of the growth-out fish and the brood fish. This study therefore is an attempt to investigate the effects of different dietary protein levels on female catfish brooders over its reproductive aptitude.

**Materials and Methods**

This study involved the use of three levels of dietary protein (30, 35 and 40%) feeds as test diets under a completely randomized experiment. The protein sources used in formulating the feeds include fishmeal, blood meal and soybean meal (Table 1). In addition to the three formulated diets an imported brood fish diet was used as the control making a total of four test diets (Table 2). All formulated diets were made into pellets of 6mm size after homogenous mixing in a Hobart mixer. One hundred and twenty catfish female broodstocks of 1.29± 0.04kg average weight were evenly distributed in twelve concrete tanks of 2 x 2 x 1.5m and are allowed to acclimatize for seven days before the commencement of the experiment. All test diets, fish carcass and eggs were chemical analyzed for crude protein, crude fiber, crude lipid, nitrogen free extract, ash and moisture according to AOAC (2000). Fish were fed *ad libitium* between 08:30 – 09:00 hours and 16:30 – 17:00 hours. Feeding of fish per treatment was done in triplicates for ten weeks. Water quality parameters (Dissolved oxygen, pH and ammonia) were kept constant during the culture period in tanks by regular changing of the water half volume on weekly basis. At the end of the experiment all fish were sacrificed for carcass analysis while eggs were equally analyzed separately. Data collected on fish growth at fortnights were computed for nutrient utilization assessment (Protein efficiency ratio, feed conversion ratio, Apparent net protein utilization, specific growth rate and total protein intake) and they were all subjected to analysis of variance test of the one way ANOVA using SPSS and significant mean differences were separated at 0.05 probability level according to Steel *et al*, (1997).

**RESULTS**

All test diets were readily accepted by experimental fish but at varying degrees. Table1 Shows gross ingredients and the experimental diets formulated while the proximate composition of all the test diets is presented in Table 2.

**Table 1: Percentage composition of ingredients for experimental diets**

| | Diet | | |
|---|---|---|---|
| **Ingredients (g/100g)** | **1(30% CP)** | **2(35%CP)** | **3(40% CP)** |
| Fishmeal (72%) | 10.0 | 12.7 | 15.0 |
| Blood meal | 8.5 | 11.5 | 11.4 |
| Soybean meal | 35.3 | 35.8 | 37.3 |
| Brewers grain | 14.0 | 14.0 | 14.0 |
| Yellow maize | 26.2 | 20.0 | 16.3 |
| Dicalcium phosphate | 2.0 | 2.0 | 2.0 |
| Common salt | 0.5 | 0.5 | 0.5 |
| Soya salt | 1.5 | 1.5 | 1.5 |
| *Vitamin/mineral premix | 2.0 | 2.0 | 2.0 |

*Biomix fish vitamin/mineral providing per kg of diet at 5kg per Ton inclusion: 20,000 IU Vit A, 200 IU Vit $D_3$, 200mg Vit E, 8mg Vit $K_3$, 20mg Vit $B_1$, 30mg Vit $B_2$, 12 mg Vit $B_6$, 50mg Pantothenic acid, 0.8mg Biotin, 150mg Niacin, 0.05mg Vit $B_{12}$, 160mg Vit. C, 4.0mg Cobalt, 40 mg Iron, 5.0mg Iodine, 30mg Manganese, 4.0mg Copper, 40mg Zinc, 0.2mg Selenium, 100mg Lysine, 100mg Methionine, 100mg Anti-oxidant.

**Table 2: Proximate composition of experimental diet on wet basis**

| **Nutrient (%)** | **T(Control)** | **2(30%CP)** | **3(35%CP)** | **4(40%CP)** |
|---|---|---|---|---|
| Crude protein | 30.91 | 30.21 | 35.03 | 40.12 |
| Crude fiber | 3.44 | 3.81 | 3.61 | 3.58 |
| Ash | 11.97 | 10.40 | 10.32 | 11.65 |
| Crude lipid | 26.23 | 24.55 | 22.83 | 20.17 |
| Moisture | 14.82 | 14.47 | 13.75 | 13.33 |
| Nitrogen free extract | 13.23 | 15.56 | 14.46 | 12.15 |
| Energy (Kcal/kg) | 3028.71 | 2970.16 | 3014.06 | 3014.45 |

Fish were able to utilize the test diets at varying degrees but weight gain and specific growth rate of fish were only marginally different ($P>0.05$). Total feed intake was highest in treatment 3 and lowest in treatment 2 but PER was significantly higher ($P<0.05$) in treatment 2 (2.41) than in treatment 3. (1.41). FCR was least in the control (treatment 1) which was marginally different from treatment 2 but values of FCR for treatment 2 (1.42) and 4 (1.41) were significantly lower than those treatment 1(1.35) and 2 (1.37). ANPU was highest in the control (0.36) and least in treatment 4(0.22) and their statistical relationship with other treatments followed the same path with PER and FCR. No mortality was recorded in all treatments as survival rate was 100% throughout (Table 3).

Fish carcass protein increased from the initial value of 63.07 in all treatments while the reverse is the case for crude lipid (Table 4). Weight of egg increased throughout in all the treatments from 71.20g to 98.04g in treatment 4 and similarly for the crude protein

values which increased from 68.45% to 73.77% crude lipid however decreased from the initial value of 14.33% to 10.08 in treatment 4 while crude fiber was not detected in all Table 5.

**Table 3: Growth and nutrient utilization assessment of *C. gariepinus* broodstocks during 70-day feeding trial.**

| **Indices** | **Experimental Diets** | | | | **SEM*** |
|---|---|---|---|---|---|
| **(Mean Values)** | **1(Control)** | **2(30%CP)** | **3(35%CP)** | **4(40%CP)** | |
| Initial weight (g) ($x10^3$) | 1.27[a] | 1.25[a] | 1.33[b] | 1.30[b] | 0.73 |
| Final weight (g) ($x10^3$) | 1.49[b] | 1.46[b] | 1.54[a] | 1.52[a] | 0.89 |
| Weight gain (g) ($x10^2$) | 2.15[a] | 2.08[b] | 2.13[a] | 2.11[b] | 1.10 |
| SGR (%/day) | 0.22[a] | 0.22[a] | 0.21[a] | 0.21[a] | 0.37 |
| Feed intake (g/day) | 41.40[b] | 40.65[b] | 43.10[a] | 42.39[a] | 0.64 |
| Total feed intake (g) ($x10^3$) | 2.90[b] | 2.85[b] | 3.02[a] | 2.97[a] | 0.24 |
| PER | 2.40[a] | 2.41[a] | 1.41[b] | 1.77[c] | 0.33 |
| FCR | 1.35[b] | 1.37[b] | 1.42[a] | 1.41[a] | 0.30 |
| ANPU | 0.36[a] | 0.31[a] | 0.28[b] | 0.22[c] | 0.02 |
| SR (%)*+ | 100 | 100 | 100 | 100 | - |

Values with the same superscript along the same row are not significantly different (p>0.05)
*SEM = Standard error of the means *+Survival rate (SR) not statically analyzed

**Table 4: Carcass proximate composition of *C. gariepinus* broodstocks fed varying dietary protein levels for 70 days**

| **Treatments** | **Crude protein** | **Crude lipid** | **Moisture** | **Ash** | **Crude fiber** |
|---|---|---|---|---|---|
| Initial | 63.07±1.14[a] | 7.92±0.62[a] | 4.34±1.46[b] | 4.83± 1.53[a] | ND |
| Diet 1 | 66.26±0.07[b] | 5.84±0.18[b] | 6.35±0.22[a] | 4.46±0.42[a] | ND |
| Diet 2 | 65.94±0.22[b] | 6.02±0.13[b] | 6.97±0.13[a] | 4.72±1.13[a] | ND |
| Diet 3 | 66.10±1.11[b] | 6.16±0.46[b] | 6.76±0.07[a] | 4.43±1.09[a] | ND |
| Diet 4 | 65.86±0.04[b] | 5.98±0.12[b] | 6.99±0.14[a] | 5.12±0.33[a] | ND |

Values with the same superscript along the same row are not significantly different (p>0.05)
ND = Not Detectable

**Table 5: Wet weight and proximate composition of broodstocks eggs fed varying dietary protein levels for 70 Days**

| **Parameters** | **Initial values** | **Diet 1** | **Diet 2** | **Diets 3** | **Diet 4** |
|---|---|---|---|---|---|
| Weight of Egg(g) | 71.20±0.04[c] | 92.80±1.10[b] | 94.40±0.19[b] | 95.03±0.17[b] | 98.04±0.23[a] |
| Crude protein (%) | 68.45±0.16[b] | 72.71±0.43[a] | 72.68±0.27[a] | 73.60±0.36[a] | 73.77±0.02[a] |
| Crude lipid (%) | 14.33±0.20[a] | 10.47±0.18[b] | 10.54±0.47[b] | 11.05±0.11[b] | 10.08±0.14[b] |
| Ash (%) | 1.72±1.10[a] | 1.01±1.03[a] | 1.22±0.72[a] | 0.44±0.30[b] | 0.58±0.25[b] |
| Moisture (%) | 10.84±0.12[a] | 9.75±0.31[a] | 8.79±0.66[a] | 6.54±1.12[b] | 6.74±0.02[b] |
| Crude fiber (%) | ND | ND | ND | ND | ND |

Values with the same superscript along the same row are not significantly different (p>0.05)
ND = Not Detectable

## Discussion

Generally utilization of good quality feeds in fish production form an integral part of successful fish production. The present study indicated that fish weight gain increased between treatment 2 and 3 and there was a slight decrease in diet 4 which has higher protein value and indicating a low utilization level. This is an important contribution of dietary protein level toward improved broodstock performance which relates to the effect on body size. Earlier reports by El-Sayed (2003) and Chong *et al*., (2004) relate body size to maturation of gonads and that egg occur earlier in larger broodstocks. Fish fed 30% protein diet had the lowest carcass protein composition, suggesting that this level is insufficient to fulfill the nutritional requirements of the female broodstock and hence, the need to utilize body nutrient reserves for gonadal development. This observation is similar to the reports of Gunasekara *et al.* (1996) and Muchlism *et al.* (2006) where high values of fish egg weight were recorded with increasing dietary crude protein contents. From the nutrient utilization assessment in the present study, higher feed intake was recorded for fish fed higher dietary protein diets but, with lower SGR and PER values indicating inefficient utilization of the diets. The reports of Bamimore (1994), Lim *et al.* (2001) and Ramezani (2009) indicated that female catfish broodstock would apparently utilize diets with 30 – 35% crude protein better for growth than diets with 40% crude protein. SGR and PER and important parameters in assessing diet utilization efficiency in fish thus, the observed lower SGR and PER in diet with 40% CP in the study may suggest that it was not maximally utilized for growth. The study further revealed that, increased dietary protein level of catfish diet up to 40% would produce best gonadal development which is similar to the reports of Sotolu (2010) who observed that dietary protein level affect catfish broodstock performance. However the present study further indicated that, the same quality of gonad development could be achieved at 35% crude protein dietary level thereby maximizing protein utilization efficiency of the feed for fish growth and development.

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