Research Article

Nutrition and reproductive performance of African catfish fed bitter kola (Garcinia kolal)

Olaniyi CO*, Akimoju O, Sokunbi AE and Olayiwola O.O

Department of Animal Production and Health, Ladoke Akintola University of technology, PMB 4000, Ogbomoso, Oyo State, Nigeria

Abstract

A ten weeks feeding trial was conducted to evaluate the effect of bitter kola on the growth performance, hematology and sperm quality of juvenile African catfish (Clarias gariepinus). Six diets of 40% crude protein were formulated with different inclusion levels of bitter kola seed meal. Diet1 (control) has 0g/kg of the seed meal while Diet2, Diet3, Diet4, Diet5 and Diet6 contained 50g/kg, 100g/kg, 150g/kg, 200g/kg, 250g/kg bitter kola seed meal (BKSM) respectively. A total of sixty (60) healthy juvenile Clarias gariepinus were randomly selected and distributed into twelve (12) plastic tanks at stocking rate of 25 fingerlings per tank and the experiment was replicated twice. Fish were fed twice a day, morning (8:00hr) and evening (17:00hrs) for ten weeks. At the end of the feeding period, blood samples were collected from the fish samples for haematological analysis and growth rate were determined.

FMW, MWG, PWG, SGR, AFI, FCR PI and PER were significantly different across the treatment groups (p<0.05). Fish fed dietary treatment T2 (100g/kg BKSM), has the highest values of PWG (83.40%) and PER (0.22) while the lowest values of PWG (11.00%) and PER (0.04) were obtained in dietary treatment T6 (250g/kg BKSM) However, the least value of FCR (0.74) was recorded in fish fed dietary treatment T2 (100g/kg BKSM) while dietary treatment T6 (250g/kg BKSM) had the highest FCR value (1.01).

Haematology of African catfish ranging from HB, PVC, WBC, RBC, MCH, MCHC to lymphocyte were not significantly affected by varying levels of Kola in the diets.

It has been found that fish growth reduced while sperm quality increased with increased levels of bitter kola. Therefore, it can be concluded that bitter kola can be included in the diet of African catfish at the rate of 150g/kg BKSM (T4) for improving the sperm quality and 50g/kg BKSM (T2) for optimum growth performance.

Introduction

Fish serves as a major source of protein for human, providing significant portion of nutrient to a large proportion of people particularly in the developing world [1]. The global production of fish and other aquatic animals for human use occurs either by commercial fishing or through aquaculture and farming techniques. According to FAO [2], the world production of fish in 2005 consists of 93.2 million tons captured by commercial fishing in wild plus 48.1 million tonnes produced by fish farms. Despite the outrageous increase in numbers of people yearly with the production rate of fish, Nigeria, like most third world countries, is not able to meet her animal protein requirement which is traceable to our fish production which has fallen below expectation. Many fish hatcheries in Nigeria are functional at low capacity; producing only a total some of 30 million fingerlings per year, although the total existing capacity could easily be 1 billion fingerlings per year. Based on 1992 United Nations Development Project (UNDP) assisted base line study in the total annual fingerlings requirement for Nigeria was 250,000 million, while the domestic production stood at 7.2 million [3]. In Nigeria, the most common fish reared are tilapia and catfish because they are mostly found in fresh water habitat. Therefore, in fish reproduction under controlled conditions, attempt are made to obtain sperm from the fish with high quality seeds although, several factors affect fish seed quality such as different strains, genetics, nutrition, content of feed and deposition of organic matter, chemical fertilizer into water used for cultured medium and for hatchery purposes [4]. According to [5], there are some common hatchery practices such as handling, cleaning, use of chemicals and water quality problems which do have negative effect on fertilization success in artificial reproduction thereby producing low quality fish seeds Therefore, the need to research into various ways of enhancing fish fertility to meet the growing demand.
The use of medicinal plants as fertility enhancer has now gained much ground in aquaculture. Plants such as bitterleaf, kigelia [6], Garcinia kola [7], have been used to enhance fertility and it is generally accepted that medicine derive from plant products are safer than their synthetic counterparts [8]. Bitter kola (Garcinia kola) belonging to the family of Clusiaceae highly esteemed by the native of Africa as Negroes chewed and it is a widespread tree of evergreen forest valued in Nigeria for its medical nuts [9]. Negroes chewed it as a powerful aphrodisiac and anti-viral properties [11]. Therefore, considering the effect of Garcinia kola on the growth performance haematology and sperm quality of African catfish.

Materials and methods

Experimental site

The experiment was carried out at the Fishery unit of Teaching and Research farm Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Oyo State, Nigeria.

Experimental fish and management

A total number of ninety (90) healthy African catfish were procured from a reputable farm at Ibadan, Oyo State, Nigeria. The fish were acclimatized for two (2) weeks in tanks containing aerated water and they were fed floating feeds to empty their gut so as to maintain a uniform stomach condition in preparation for the experiment. At the end of the acclimatization period, a total number of sixty (60) male fish were randomly distributed into twelve plastic tanks at stocking density of 5 fish per tank and replicated two times. The fish were fed twice daily, both in the morning and evening (9:00 hours and 17:00 hours), weighed every two weeks and the daily feeding rate (5% of the total biomass) were adjusted.

Collection and processing of test ingredient

Bitter kola seeds were procured from a local market in Ogbomoso, Oyo State, Nigeria. The outer coats of the bitter kola were removed and the seeds were sundried, milled to a fine powder and stored in an air tight nylon prior use.

Experimental diets

The feed ingredients were obtained from a reputable feed mill in Ogbomoso, Oyo State, Nigeria. The ingredients include; Fish meal, maize, soya bean meal, groundnut cake, wheat offal, bone meal, oyster shell, vegetable oil, lysine, methionine and salt.

Six isonitrogenous diets containing 40% CP were formulated and Garcinia kola meal was included at varying levels (50, 100, 150, 200, 250g/kg) in the diets and they were represented as follows; D2, D3, D4, D5, D6 respectively. The control basal diet (D1) contained 0% bitter kola Table 1.

Data collection

Growth performance: Records of feed intake and weight gain were taken during the experimental period; hence the following parameters such as Mean Weight Gain (MWG), Percentage Weight Gain (%WG), Specific Growth Ratio (SGR), Feed Conversion Ratios (FCR) and Protein Efficiency Ratio (PER), were calculated.

\[
\text{Weight gain (WG)} = W_2 - W_1
\]

Where, \(W_1\) = initial weight gain, \(W_2\) is the final weight gain

\[
\text{Mean Weight Gain (MWG)} = \frac{\text{final mean weight (g)} - \text{initial mean weight (g)/number of fishes}}
\]

\[
\text{Feed Conversion Ratio (FCR)} = \frac{\text{feed consumed by fish(g)/mean weight gain(g)}}
\]

\[
\text{Protein Efficiency Ratio (PER)} = \frac{\text{weight gain (g)/amount of protein fed}}
\]

\[
\text{Protein intake (PI)} = \% \text{CP} \times \text{AFI or mean feed intake. Where, } \% \text{CP} = \frac{\text{Percentage crude protein}}{\text{AFI or mean feed intake}}
\]

\[
\text{Specific Growth Rate (SGR)} = \frac{\text{In final weight−In initial weight} \times 100}{\text{Number of days}}
\]

\[
\text{Percentage Weight Gain (PWG)} = \frac{\text{Mean weight gain (g)/initial mean weight (g) \times 100}}
\]

Haematology studies

Blood samples for haematological analysis were collected according to the following parameters such as Mean Weight Gain (MWG), Percentage Weight Gain (%WG), Specific Growth Ratio (SGR), Feed Conversion Ratios (FCR) and Protein Efficiency Ratio (PER), were calculated.
at the end of the feeding trial from the caudal peduncle of both the test and control fish with a sharp surgical blade, the blood samples were dispensed into tubes containing ethylene diamine tetra acetate (EDTA) and empty bottles to determine the following blood parameters.

Red Blood Cells (RBC): The blood of the fish was diluted in an improved newbauer pipette with formal citrate fluid at 1:200. The diluted blood was introduced into a newbauer counting chamber and the red blood cells counted under microscope [12].

White Blood Cells (WBC): For the white blood cell count, blood was diluted at 1:20 with diluting fluid. The resulting mixture was introduced into newbauer counting chamber and counted under the microscope [12].

Packed Cell Volume (PCV): To determine the packed cell volume, a haemocrit tube was three quarters filled with blood and the ends sealed with critaseal, the tube was then centrifuged in a microhaematocrit for 5 minutes at 2000g. The PCV was read by a microhaematocrit reader and expressed as the volume of the erythrocytes per 100 cm³ [12].

Mean Corpuscular Haemoglobin Concentration (MCHC): The mean corpuscular haemoglobin concentration was calculated as:

\[ \text{MCHC} = \frac{\text{Haemoglobin concentration (g/100ml)}}{\text{Packed cell volume}} \]

Mean Corpuscular Volume (MCV): The mean volume of each red blood cell was estimated using the following formula:

\[ \text{MCV} = \frac{\text{packed cell volume (PCV) } \times 10}{\text{Erythrocyte count}} \]

Mean Corpuscular haemoglobin (MCH): The haemoglobin content of a single red blood cell was calculated as:

\[ \text{MCH} = \frac{\text{Haemoglobin} \times 10}{\text{Erythrocyte count}} \]

Haemoglobin (Hb): The cyamethaemoglobin method was used. 0.02 cm³ of blood was placed on 4 cm³ of Drabkins reagent in a test tube and mixed. After 30 minutes, the optical density was read calorimetrically at 540 μm. Values of haemoglobin were determined by comparing with cyamethaemoglobin standards [13].

Sperm quality determination: Male fish were randomly selected from all the treatments for milt collection. The male fish were sacrificed and the testes were removed, then the sperm were examined and snapped and viewed under the computer aided sperm analysis microscopic system.

Milt count: Concentration of sperm was determined by counting the numbers of spermatozoa in sample dilute with distilled water (100×) in a Burker haemocytometer under 400× magnification immediately after addition of 20ul distilled water as an activating solution.

During spermatozoa activation, Immotile Sperm Cell (ISC) was counted, when the activation stopped, Whole Sperm Cell (WSC) was counted; motile sperm cell (MC) was calculated [4].

\[ \text{MC} = \frac{\text{WSC} - \text{ISC}}{\text{ISC}} \times 100 \]

Sperm morphology: The milt was analysed with the use of a computer aided sperm analysis system and the data were mathematically elaborated to obtain numerical indices expressing the state of the ejaculation.

Chemical analysis: Proximate composition of test ingredient (bitter kola), fish sample and experimental diets were determined according to the method of A.O.A.C [15].

Statistical analysis: All data collected during experimental period were subjected to one–way analysis of variance (ANOVA) using completely randomized design in accordance with SPSS (2000) and Duncan’s multiple range tests was employed to reveal significant differences among the treatment means.

Results

The proximate composition of Bitter Kola Seed Meal (BKSM) is presented in the Table 2. Bitter kola seed meal had a crude protein of 2.45%, crude fiber 6.50%, ether extract 2.50%, ash 6.10% and dry matter 93.46%.

| Parameters          | Percentage (%) |
|---------------------|----------------|
| Crude protein (CP)  | 2.45           |
| Crude Fiber (CF)    | 6.50           |
| Ether Extract (EE)  | 2.50           |
| Ash                 | 6.10           |
| Dry matter          | 93.46          |
| Moisture            | 6.54           |
| Nitrogen Free Extract | 75.91          |

The carcass composition of the experimental fish fed varying inclusion levels of bitter kola after the experiment is as shown in Table 3. There was a high significant different (p<0.05) between the crude protein of treatment T5 (61.60%) than treatment T1 (31.80%) having the lowest crude protein. Treatment T6 had the highest ash (13.10%), treatment T3 had the highest crude fiber, and treatment T2 had the highest ether extract (11.90%) and dry matter (89.80%).

The growth performance and nutrient utilisation of Africa catfish fed varying inclusion levels of Bitter Kola Seed Meal (BKSM) is presented in Table 4. All production performance measured were significantly influenced (p<0.05) by the increasing inclusion levels of bitter kola seed meal except the IMW which was not significantly influenced (p>0.5). The result obtained revealed that fish fed 50g/kg BKSM (T2) recorded highest values for the FMW, MWG, SGR, AFI and PER while
The least values of FMW, PWG, SGR, AFI, PI and PER were obtained by the fish fed 200g/kg BKSM (T6). Poor FCR were recorded at dietary treatment T2 while the best FCR was recorded at dietary treatment T6.

Haematology of African catfish fed varying inclusion levels of bitter kola seed meal (BKSM) is as shown in Table 5. There were no significant effects (p>0.05) on haematological parameters of African catfish fed with varying levels of bitter kola seed meal.

Sperm count, percentage motility, percentage immotile, sperm morphology, live and death percentage of African catfish fed varying inclusion levels of bitter kola seed meal as is shown in Table 6. There were significant difference (p<0.05) in all the treatments. The fish fed 150g/kg BKSM (T4) had greatest live percentage, motility percentage, sperm morphology and sperm count (88.68%, 84.40%, 87.27% and 88.40%) compared with fish fed other different inclusion levels of bitter kola seed meal. However, fish fed control diet had the least values of all the parameters measured.

**Discussion**

The use of bitter kola in the diet of African catfish in this study has revealed its ability to enhance sperm quality as well as improving growth better than the control diet with no inclusion level of bitter kola seed meal. Differential growth among the control diet and other diets with various inclusion levels of bitter kola seed meal (BKSM) as observed in the study is definitely not due to protein since isonitrogenous diet was used for the study however, variation in this study is strongly linked to the presence of bioflavonoid in *Garcinia kola* which stimulates growth in fish as previously reported by Braide [16]. Kocour, et al., [17], revealed that bioflavonoid is plant.

**Table 3:** Proximate carcass composition of African catfish (*Clarias gariepinus*) fed bitter kola seed meal.

| Parameters       | T1      | T2      | T3      | T4      | T5      | T6      | SEM  |
|------------------|---------|---------|---------|---------|---------|---------|------|
| %Crude protein   | 31.80±  | 37.63±  | 53.50±  | 52.85±  | 61.60±  | 45.00±  | 2.70 |
| %Ash             | 11.50   | 7.90    | 10.00   | 11.20   | 10.90   | 13.10   | 0.83 |
| %Crude fiber     | 3.80±   | 4.90±   | 4.20±   | 3.20±   | 3.60±   | 4.10±   | 0.23 |
| %Ether extract   | 10.70   | 11.90   | 10.40   | 8.35    | 8.80    | 8.20    | 0.72 |
| %Dry matter      | 85.80   | 89.80   | 83.75   | 87.30   | 88.50   | 81.90   | 1.90 |

Mean in the same row with the same superscript are not significantly different (P>0.05). BKSM- Bitter kola seed meal, T1- control, T2- (fish fed 50g kola/kg BKSM), T3- (fish fed 100g kola/kg BKSM), T4- (fish fed 150g kola/kg BKSM), T5- (fish fed 200g kola/kg BKSM), T6- (fish fed 250g kola/kg BKSM), SEM-standard error of means.

**Table 4:** Growth Performance and Nutrient Utilization of Juvenile African Catfish Fed Varying Inclusion Levels of Bitter Kola Seed Meal.

| PARAMETERS         | T1      | T2      | T3      | T4      | T5      | T6      | SEM  |
|--------------------|---------|---------|---------|---------|---------|---------|------|
| IMW (g)            | 232.40  | 235.20  | 228.80  | 227.85  | 230.80  | 234.80  | 1.00 |
| FMW (g)            | 403.94± | 431.07± | 410.20± | 401.92± | 350.23± | 260.64± | 4.08 |
| M WG (g)           | 171.50± | 196.10± | 181.40± | 174.30± | 119.40± | 25.80±  | 12.18|
| PWG (%)            | 73.80±  | 83.40±  | 79.30±  | 76.60±  | 51.70±  | 11.00±  | 5.32 |
| SGR (%/day)        | 0.79±   | 0.87±   | 0.84±   | 0.81±   | 0.60±   | 0.14±   | 0.06 |
| FCR                | 0.91±   | 0.72±   | 0.74±   | 0.86±   | 0.79±   | 1.01±   | 0.02 |
| AFI (g)            | 21.71±  | 22.03±  | 21.81±  | 24.55±  | 19.80±  | 15.02±  | 0.92 |
| PI                 | 1049.20±| 881.20± | 870.40± | 982.00± | 792.00± | 600.80± | 31.73|
| PER                | 0.16±   | 0.22±   | 0.21±   | 0.18±   | 0.19±   | 0.04±   | 0.01 |

Mean in the same row with the same superscript are not significantly different (P>0.05). BKSM- Bitter kola seed meal, T1- control, T2- (fish fed 50g kola/kg diet), T3- (fish fed 100g kola/kg BKSM), T4- (fish fed 150g kola/kg BKSM), T5- (fish fed 200g kola/kg BKSM), T6- (fish fed 250g kola/kg BKSM), SEM: Standard Error of Means; IMW: Initial Mean Weight; FMW: Final Mean Weight; M WG: Mean Weight Gain; PWG: Percentage Weight Gain; SGR: Specific Growth Rate; FCR: Feed Conversion Ratio; AFI: Average Feed Intake; PI: Protein Intake; PER: Protein Efficiency Ratio; SEM: Standard Error of Mean; T: Treatment.

**Table 5:** Haematology Of African Catfish Fed Varying Inclusion Levels Of Bitter Kola Seed Meal.

| PARAMETERS        | T1      | T2      | T3      | T4      | T5      | T6      | SEM  |
|-------------------|---------|---------|---------|---------|---------|---------|------|
| RBC(10³/μl)       | 3.71±   | 2.63±   | 3.32±   | 3.18±   | 3.44±   | 3.30±   | 0.16 |
| WBC               | 17.10   | 14.80   | 15.50   | 15.00   | 16.40   | 11.75   | 1.04 |
| HB (g/dl)         | 9.20±   | 9.80±   | 10.00   | 10.20   | 10.51   | 8.70±   | 0.66 |
| LYM               | 65.25   | 61.00   | 62.00   | 62.00   | 60.00   | 64.00   | 3.85 |
| PCV (%)           | 27.00   | 31.00   | 33.00   | 35.00   | 37.00   | 29.00   | 1.94 |
| ALB               | 1.50±   | 2.09±   | 1.94±   | 1.50±   | 1.64±   | 1.42±   | 0.16 |
| MCV (f/l)         | 72.47±  | 119.23± | 100.00± | 109.38± | 108.82± | 86.13±  | 8.94 |
| MCH (pg)          | 24.80   | 37.36±  | 30.12±  | 32.08±  | 30.52±  | 26.13±  | 2.25 |
| MCHC (g/dl)       | 35.93±  | 31.61±  | 30.30±  | 29.14±  | 28.38±  | 30.00±  | 1.88 |

Mean in the same row with the same superscript are not significantly different (P>0.05). BKSM- Bitter kola seed meal, T1- control, T2- (fish fed 50g kola/kg BKSM), T3- (fish fed 100g kola/kg BKSM), T4- (fish fed 150g kola/kg BKSM), T5- (fish fed 200g kola/kg BKSM), T6- (fish fed 250g kola/kg BKSM), RBC: Red Blood Cell; WBC: White Blood Cell; HB: Haemoglobin; LYM: Lymphocyte; PCV: Packed Cell Volume; ALB: Albumen; MCV: Mean Corpuscular Volume; MCH: Mean Corpuscular Haemoglobin; MCHC: Mean Corpuscular Haemoglobin Concentration; SEM: Standard Error of Mean.

Citation: Olaniyi CO, Akimotoju O, Sokunbi AE, Olayiwola O.O (2020) Nutrition and reproductive performance of African catfish fed bitter kola (*Garcinia kola*). Int J Aquac Fish Sci 6(1): 001-007. DOI: https://dx.doi.org/10.17352/2455-8400.000049
Table 6: Effect of Bitter kola on sperm motility of African catfish (Clarias gariepinus).

| Parameters          | T1            | T2            | T3            | T4            | T5            | T6            | SEM  |
|---------------------|---------------|---------------|---------------|---------------|---------------|---------------|------|
| Sperm Count         | 85.40 ±       | 83.80 ±       | 86.40 ±       | 88.40 ±       | 83.20 ±       | 87.60 ±       | 2.05 |
| % Motility          | 82.42 ±       | 83.13 ±       | 82.00 ±       | 84.40 ±       | 82.11 ±       | 82.86 ±       | 1.84 |
| % Immotile          | 17.58 ±       | 16.87 ±       | 18.00 ±       | 15.60 ±       | 17.89 ±       | 17.14 ±       | 1.56 |
| % Sperm morphology  | 85.87 ±       | 85.71 ±       | 85.15 ±       | 87.27 ±       | 84.38 ±       | 84.91 ±       | 2.34 |
| Live %              | 88.17 ±       | 88.24 ±       | 87.26 ±       | 88.68 ±       | 86.48 ±       | 88.57 ±       | 2.67 |
| Death %             | 11.83 ±       | 11.76 ±       | 12.75 ±       | 11.32 ±       | 13.54 ±       | 11.43 ±       | 0.78 |

Mean in the same row with the same superscript are not significantly different (P>0.05). BKSM - Bitter kola seed meal, T- Treatment: T1- control, T2- (fish fed 50g kola/kg BKSM), T3- (fish fed 100g kola/kg BKSM), T4- (fish fed 150g kola/kg BKSM), T5- (fish fed 200g kola/kg BKSM), T6- (fish fed 250g kola/kg BKSM), SEM – standard error of means.

A retarded growth effect was reported by Akpantah, et al., [19], on rat treated with Garcinia kola seed extract for six weeks. However, the results observed shows that there was significant differences (p<0.05) in the mean weight of fish fed with Garcinia kola seed meal. The weight of the fish was depressed progressively in all the treatments subjected to Garcinia kola at the inclusion level from 50–250g/kg BKSM despite the drying process of bitter kola which would have reduce the effectiveness of tannins, the higher the inclusion level of bitter kola seed meal in the feed, the lower the weight. This is attributed to the inhibition of protein metabolism by tannins in Garcinia kola may be responsible for weight depression in African catfish fed on Garcinia kola seed meal in this study. Anti-atherogenic and anti-adipogenic effect of kolaviron present in Garcinia kola seed which inhibits the accumulation of lipid droplets in fat cells when other extracts are low [20].

Haematological parameters are routinely used for the evaluation of physiological environment and husbandry stressors in fishes [21]. In recent year good management practices have been advocated as effective’s ways of reducing stress in fish culture [22]. Many researchers have proved that change in blood characteristics of African catfish is due to stress, exposure to the environmental pollutant or by pathogen [22–24]. Also, haematological component of blood are valuable in the monitoring of feed toxicity especially with feed constituents that affects the formation of blood in culture fisheries [25]. Packed cell volume (PCV) range of 27.00 to 37.00% observed in this study is within range of 20 to 50% reported by Piestse, et al., [26]. And rarely do values above 50% being reported [27,28]. Reduction in the concentration of the PCV in the blood usually suggests the presence of toxic factor example of which is haemagglutinin which has adverse effect on blood formation [25]. White blood cells (WBC) and lymphocytes result recorded in this study showed a decrease as the level of bitter kola seed meal increases in the diet. The highest value 17.10×10³/µ for WBC was recorded in the control diets as well as that of lymphocyte 65.25%. WBC and LYM are the defense cells of the body. Douglas and Jane [29], demonstrated that the amount has implication in immune response and the ability to fight infection. High WBC is usually associated with microbial infection or the circulating system [25]. The value recorded in this study (11.75–17.10) is also within the range recommended value of (16.13×10³ to 16.39×10³/mm) as reported by Sotolu and Faturoti [30]. The range of Red Blood Cell (RBC) recorded in this study is (2.63–3.71×10⁶/µ) which is fairly comparable to (1.70×10⁶ to 4.00×10⁶/mm³) recommended by Bhasker and Rao [31] and more than that (2.24×10⁶ to 2.49×10⁶ mm⁻³) by Sotolu and Faturoti [2009][30].

Sperm quality can be quantified by evaluation of sperm motility and fertilization rate but the former is a faster approach than the latter [31]. The dietary inclusion level of Garcinia kola seed meal affected some parameters of sperm quality in Clarias gariepinus such as sperm count, percentage motility, and live percentage. The treatments were significantly different (p<0.05). Researchers observed that spermatozoa of Clarias gariepinus were active or motile for only 30 sec. Motility of the spermatozoa is the most commonly used indicator for sperm quality since high motility is a prerequisite for fertilization and correlates strongly with fertilization process [33,34]. Moreover, reproductive capacity is the most conclusive way of testing sperm motility [5].

In this study, the sperm count, sperm motility, sperm morphology and live percentage were higher in treatment 4 (88.40%, 84.40%, 87.27%, 88.68%) respectively than treatment T1. Treatment T5 was observed to have the lowest percentage motility (82.11%), sperm morphology (84.38) and live percentage (86.48%). It was reported by Uko, et al., [7], that rats fed Garcinia kola seed extract exhibited increased libido (sexual instinct) for the male rats justifying the use of Garcinia kola by native as an aphrodisiac, but did not improve pregnancy rates in female rats as a measure of the male fertility index. The findings of Adeparusi, et al., [6], also agrees that male Clarias gariepinus fed Kigelia africana had significantly higher sperm count than the control.

Conclusion

In conclusion, this study showed that:

- **Garcinia kola** at all inclusion levels was insignificant on the haematological parameters of Clarias gariepinus meaning that the fish can tolerate higher inclusion of Garcinia kola without any adverse effect.

- Inclusion of Bitter kola seed meal at the rate of 150g/kg (T4) in the diet of African catfish enhances sperm

Citation: Olaniyi CO, Akimouo O, Sokunbi AE, Olayiwola O.O (2020) Nutrition and reproductive performance of African catfish fed bitter kola (Garcinia kola). Int J Aquac Fish Sci 6(1): 001-007. DOI: https://dx.doi.org/10.17352/2455-8400.000049
quality (highest sperm count, sperm motility, sperm morphology and live percentage)

- Higher level of Bitter kola seed meal inclusion in the diet of African cat fish reduced the growth performance.

**Recommendation**

It is therefore suggested that:

- Bitter kola (*Garcinia kola*) seed meal at 150g/kg inclusion level can be used by fish farmers to enhance sperm quality and thereby increasing the production rate of African catfish (*Clarias gariepinus*).

- The use of Bitter kola (*Garcinia kola*) seed meal for improving sperm fertility is not exorbitant in price (with respect to the quantity required by the farmers) therefore it is of high economic value because it reduces the cost of production compared to hormonal drugs that are very expensive.

**References**

1. Adedeji OS, Farami GO, Ameen SA, Olayeni JB (2006) Effect of Bitter kola (Garcinia kola) as growth promoters in broiler chicks from day to four weeks old. Journal of Advanced Veterinary Sci 5: 191-193. [Link](http://bit.ly/2GVDhA)

2. Adeparusi EO, Dada AA, Alale OV (2010) Effect of medicinal plant (*Kigelia africana*) on sperm quality of African catfish *Clarias gariepinus* (Burchell, 1822) broodstock. J Agric Sci 2. [Link](http://bit.ly/2twuxaa)

3. Akoachere JF, Ndip RN, Chenwi EB, Ndip LM, Njock TE, et al. (2002) Anti-pathogenic and anti-inflammatory activity of garlic, ginger and black seeds against *Giardia lamblia* and *Bacillus subtilis*. African Journal of Medical and Biological Sciences 8: 171-175.

4. Akpantah AO, Oremosun AA, Ajala MO, Moronha CC, Okanlawon AO (2003) The effect of crude extract of *Garcinia kola* seed on the histology and hormonal milieu of male Sprague-Dawley rats' reproductive organs. Nigerian Journal of Biomedical Sci 2: 40-46. [Link](http://bit.ly/31ff2DG)

5. AOAC (2000) (Association of Official Analytical Chemists). In: Cunniff PA (Ed.). Official Methods of Analysis of AOAC International 16th Edition. Arlington.

6. Bhaskar BR, Rao SK (1990) Use of haematological parameters as diagnostic tools in determine the health of milk fish (*Chanos chanos* forskall) in Brackish water culture. Aquaculture and Fisheries management 21: 125-129. [Link](http://bit.ly/2GY2FPr)

7. Billard RJ, Cosson LW, CrimandSuquet M (1995) Sperm Physiology and quality. In Brood stock Management, Egg and larval quality, (Edited: Bromage, N. and J. Roberts), Blackwell Science limited. Osney mead Oxford 25-52. [Link](http://bit.ly/20yNlf)

8. Braide VP (1991) Antihyperlipidemic biochemical effects of kolaviron of *Garcinia kola* leaves. Phytotherapy Resources 5: 35-37.

9. Canyurt MA, Akhan S (2008) Effect of ascobic acid supplementation on sperm quality of rainbow trout (*Oncorhynchusmykiss*). Turkey. Journal of Fisheries Aquatic Science 8: 171-175. [Link](http://bit.ly/2v7pMtv)

10. Clark S, Whitmore DH, McMahon RF (1979) Consideration of blood parameters of largemouth bass. Microperuromysiluides. J Fish Biol 14: 147-158. [Link](http://bit.ly/2ucQyfO)

11. Douglas JW, Jane KW (2010) In Schalm's Veterinary Haematology. John Wiley and Sons. Blackwell publishing Ltd 1232.

12. Duncan DB (1955) Multiple range and multiple F. tests biometrics. Wiley Publishers, New york 11:1-42. [Link](http://bit.ly/2GVo0Ae)

13. Eltun L, Lebo PE, King RP (1999) The dynamics of an exploited population of Silurid Catfish (*Silbhinlermedius*Ruppell, 1832) in the Cross River, Nigeria. Fish Res 40: 295-307. [Link](http://bit.ly/37lHkGA)

14. Ezeri GNO (2001) Haematological responses of *Clariasgariepinus* to bacterial infection and prophylactic treatment with antibiotics. J Aqua Sci 16: 22-24. [Link](http://bit.ly/2ou5hN)

15. FAO (2005) Review of the state of world marine fishery resources. Fisheries technical paper. [Link](http://bit.ly/23XbHv)

16. Farombi EO, Adepoju BF, Ola-Davies OE, Emerole GO (2005) Chemoprevention of aflatoxin B1-induced genotoxicity and hepatic oxidative in rats by kolaviron, a natural bioflavonoid of *Garcinia* kola seeds. Europe. Eur J Cancer Prev 14: 207-214. [Link](http://bit.ly/25nQBA)

17. Fauvel C, suquet M, Cosson J (2010) Evaluation of fish sperm quality. J Appl Ichthyol 26: 636-643. [Link](http://bit.ly/31zsmTZ)

18. Fruits P, Hervas G, Giraldez FJ, Mantecon AR (2004) Tannins and ruminant Nutrition. Spanish J Agricu Res 2: 191-202. [Link](http://bit.ly/37FPdSK)

19. Gabriel UU, Akinrotimi OA, Bekibele DO, Rodina M (2007) Locally produced fish feed, potentials for aquaculture development in Sub-Saharan. Afr J Agric Res 2: 287-295. [Link](http://bit.ly/37zEJYp)

20. Iwu MM, Igboke O (1982) Flavonoids of *Garcinia kola* seeds J Nat Prod 45: 650-651. [Link](http://bit.ly/39taeh)

21. Kocour M, Lynhard O, Gela D, Rodina M (2005) Growth performance of all female and mixed sex common carp, cyprinids capro population in central European climatic conditions. Journals of the world Aquaculture society 36: 103-113. [Link](http://bit.ly/25qGcFl)

22. Meyer DJ, Coles EH, Rich LJ (1992) Veterinary laboratory medicine. Interpretation and Diagnosis. WB. Saunders Company 12-26.

23. Nwokoye CO, Nwuba LA, Eyo J (2007) Induced propagation of African clariid *Clariasgariepinus*broodstock. J Aquarium Aquatic Sci 2000. Responsible aquaculture in the new millennium. Nice France.

24. Onusiriku BC, Ufodike EBC (2000) Effects of sublethal concentrations of colchicine on the growth and survival of juvenile fish (*Clariasgariepinus*) in low oxygen concentration of an aquaria. J Fish Biol 14: 147-158. [Link](http://bit.ly/31zAp6n)

25. Ochokwu L, Onyia L, Ajikok A (2014) Effect of Azanzagarckeana (Goron Tula) Pulp Meal Inclusion on Growth Performance of *Clariasgariepinus*Broodstock. International Journal of Aquaculture and Fisheries Management 21: 125-129.

26. Ochokwu L, Onyia L, Ajikok A (2014) Effect of Azanzagarckeana (Goron Tula) Pulp Meal Inclusion on Growth Performance of *Clariasgariepinus*Broodstock. International Journal of Aquaculture and Fisheries Management 21: 125-129.

27. Olayiwola O.O (2020) Nutrition and reproductive performance of African catfish fed bitter kola (*Garcinia kola*). Int J Aquac Fish Sci 6(1): 001-007. DOI: [https://dx.doi.org/10.17352/2455-8400.000049](https://dx.doi.org/10.17352/2455-8400.000049)
reproductive season using GnRHa implants. Aquaculture 19: 873-890. Link: http://bit.ly/39nyxJ

31. Roberts RJ (1978) Fish pathology. Balliere Tindall London 318. Link: http://bit.ly/37a3F4J

32. Rurangwa E, Kime DE, Ollevier F, Nash JP (2004) The measurement of sperm motility and factors affecting sperm quality in cultured fish. Aquaculture 234: 1-28. Link: http://bit.ly/20wq6dU

33. Sotolu AO, Faturoti EO (2009) Growth performance and haematology of Clarias gariepinus fed varying inclusions of Leucaena leucocephala leaf meal. Revista UDO Agricola 9: 979-985. Link: http://bit.ly/2vPpVnz

34. Uko OJ, Usman A, Ataja AM (2001) Some biological activities of Garcinia kola in growing rats. Vet Arhiv 71: 287-297. Link: http://bit.ly/3bfXC28

Copyright: © 2020 Olaniyi CO, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Citation: Olaniyi CO, Akimoju O, Sokunbi AE, Olayiwola O.O (2020) Nutrition and reproductive performance of African catfish fed bitter kola (Garcinia kola). Int J Aquac Fish Sci 6(1): 001-007. DOI: https://dx.doi.org/10.17352/2455-8400.000049