# Journal of
# Fisheries and Aquatic Science

ISSN 1816-4927

Academic
Journals Inc.

www.academicjournals.com

Journal of Fisheries and Aquatic Science 9 (5): 407-412, 2014
ISSN 1816-4927 / DOI: 10.3923/jfas.2014.407.412


# Haematological Changes in the Blood of *Clarias gariepinus* Fed *Chrysophyllum albidum* Seedmeal Replacing Maize

[1]W.A. Jimoh, [1]F.O. Ajasin, [2]M.D. Adebayo, [1]O.T. Banjo, [1]A.O. Rifhat and [1]K.D. Olawepo
[1]Department of Fisheries Technology,
[2]Department of Animal Health, Federal College of Animal Health and Production Technology, Moor Plantation, PMB 5029, Ibadan, Nigeria

*Corresponding Author: W.A. Jimoh, Department of Fisheries Technology, Federal College of Animal Health and Production Technology, Moor Plantation, PMB 5029, Ibadan, Nigeria*

## ABSTRACT

This study was conducted to investigate haematological changes in the blood of *Clarias gariepinus* fed diets containing *Chrysophyllum albidum* seedmeal replacing maize. Five isonitrogenous diets containing maize, which was replaced by *Chrysophylum albidum* at a rate of 0, 25, 50, 75 and 100% were made. The diet without *Chrysophylum albidum* seedmeal served as the control. Experimental diets were assigned randomly to the tanks and each group of fish was fed 5% body weight in equal proportion per day. The fish fed diet 1 had the highest PCV while the fish fed diet 3 had the lowest PCV. There was significant difference ($p<0.05$) in the PCV of the fish fed various dietary treatments. However, there was no significant difference ($p>0.05$) in the PCV of the fish fed diet 2, 3, 4 and 5. A similar trend, as observed for PCV, was also observed for Hb, RBC, MCV, MCH and MCHC. There was no significant difference ($p>0.05$) in the WBC of the blood of the fish fed various dietary treatments so there were also neutrophyls and lymphocytes.

**Key words:** *Clarias gariepinus*, *Chrysophyllum albidum*, maize, dietary treatments

## INTRODUCTION

A review of the animal and aquafeed industries in Nigeria made by Fagbenro and Adebayo (2005) revealed that most catfish feeds are farm made, using locally available ingredients such as maize, soybean, fish meal, blood meal, rice bran and fish oil, etc. Olurin *et al.* (2006) reported that maize is the major source of metabolisable energy feed ingredient in most compounded diet for catfish spp. This is because, it is readily available and digestible. However, the increasing prohibitive cost of this commodity has necessitated the need to search for alternative ingredients that will serve as a replacement. More so, FAO reported insufficient quantities of maize that are produced in Nigeria were predominantly used for human consumption. Osuigwe *et al.* (2005) reported that high cost and scarcity of maize in formulated diet has led to the use of under utilised energy sources; such as cassava root meal, wheat bran and sorghum meal.

*Chrysophyllum albidum*, from the Sapoteacea family is commonly found in the Central Eastern and Western Africa (Amusa *et al.*, 2003). They are distributed in Nigeria, Uganda, Niger, Cameroun and Cote d'l voire. It is often called the white star apple are distributed throughout the southern part of Nigeria (Iwalewa *et al.*, 2006). Across Nigeria, it is known by several local names. In South-western Nigeria, the fruit is called "agbalumo" and known as "udara"in South eastern

Nigeria and is generally regarded as a plant with diverse ethno-medicinal uses (Amusa *et al.*, 2003). It has nutritional profile comparable to maize and other energy source feed ingridients.

Svobodova *et al.* (1991) opined that ichthyohaemotology would be useful in the assessment of suitability of feeds and feed mixture, evaluation of fish condition, determination of toxic effect of substances, as well as diagnosis of disease. The use of haematological values, as indices of diagnosing diseases and stress induced condition as well as for feed assessment, are well documented (Fagbenro *et al.*, 1993; Adeparusi and Ajayi, 2000; George *et al.*, 2007; Yue and Zhou, 2008; Akintayo *et al.*, 2008). This study, therefore, seeks to study the haematological response of *Clarias gariepinus* fed diet containing *Chrysopyllum albidum* seedmeal.

## MATERIALS AND METHODS

**Seed collection and processing:** Dried matured *Chrysophylum albidum* seeds were obtained from Bodija Market, Ibadan, Oyo State and they were processed by boiling in water (100°C) for 30 min. They were prepared by grinding the samples in a laboratory mill, then mechanically defatted by the use of locally made screw press and sieved with a 200 mm mesh size sieve before putting in polythene bags and stored at 4°C. The cakes, therefore, were analysed for their proximate composition (AOAC, 1990). Fish meal, soybean meal and other feedstuffs obtained from commercial sources in Nigeria were separately milled screened to fine particle size and triplicate samples were analyzed for their proximate composition (AOAC, 1990). Based on the nutrient composition of the protein feed stuff (Table 1), a control diet and four test diets were formulated. The control diet contained maize which was replaced by cooked *Chrysophylum albidum* seed meal. The rate of substitution was 0, 25, 50, 75 and 100% (Table 2).

Table 1: Proximate composition of the protein feed ingredients

| Parameters | Fish meal | Soybean meal | CSM | Corn meal |
|---|---|---|---|---|
| Moisture | 9.75 | 10.70 | 9.10 | 10.48 |
| Crude protein | 72.40 | 45.74 | 10.95 | 9.87 |
| Crude lipid | 10.45 | 9.68 | 2.94 | 4.28 |
| Crude fibre | - | 5.10 | 3.06 | 5.78 |
| Ash | 8.32 | 4.48 | 2.12 | 6.73 |
| NFE | - | 30.00 | 71.83 | 62.35 |

CSM: *Chrysophyllum albidum* seedmeal

Table 2: Gross composition of experimental diets (g/100 g) containing *Chrysophyllum albidum* seedmeal fed to *Clarias gariepinus*

| | Experimental diets | | | | |
|---|---|---|---|---|---|
| Parameters | $D_1$ | $D_2$ | $D_3$ | $D_4$ | $D_5$ |
| Fishmeal (72.4%) | 52.78 | 52.78 | 52.78 | 52.78 | 52.78 |
| Corn meal (10.48%) | 20.00 | 15.00 | 10.00 | 5.00 | - |
| CSM ( 10.95%) | - | 4.56 | 9.13 | 13.69 | 18.25 |
| *Vit/min premix | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Fish oil | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Starch | 17.22 | 17.66 | 18.09 | 18.53 | 18.97 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

CSM: *Chrysophyllum albidum* seedmeal. *Each killogram contains, Vitamin A: 4,000,000 IU, Vitamin B: 800,000 IU, Vitamin E: 16,000 mg, Vitamin $K_3$: 800 mg, Vitamin $B_1$: 600 mg, Vitamin $B_2$: 2,000 mg, Vitamin $B_6$: 1,600 mg, Vitamin $B_{12}$: 8 mg, Niacin: 16,000 mg, Caplan: 4,000 mg, Folic acid: 400 mg, Biotin: 40 mg, Antioxidant: 40,000 mg, Chlorine chloride: 120,000 mg, Manganese: 32,000 mg, Iron: 16,000 mg, Zinc: 24,000 mg, Copper: 32,000 mg, Iodine: 320 mg, Cobalt: 120 mg and Selenium: 800 mg manufactured by DSM Nutritional products Europe Limited, Basle, Switzerland

**Culture condition:** *Clarias gariepinus* fingerlings were acclimated to experimental condition for 7 days prior to the feeding trial. Groups of 15 catfish fingerlings were stocked into aquaria comprising 60 L capacity rectangular plastic tanks. Each diet was fed to the catfish in triplicate tanks twice daily (9 and 16 h) at 5% body weight for 56 days. Fish mortality was monitored daily, total fish weight in each tank was determined at two weeks intervals and the amount of diet was adjusted according to the new weight.

**Haematological studies:** The blood analyses were determined according to the method described by Svobodova *et al*. (1991). The following analyses were done:

- **Blood analysis:** The 5-10 mL blood samples were collected from cardiac puncture using 2 mL disposable heparinised syringe treated with EDTA as anti-coagulant
- **Blood cell count:** Haemocytometer was used in blood cell count. The blood diluting fluid was prepared as described by Svobodova *et al*. (1991). The blood cells were counted on the counting chamber of haemocytometer with the aid of compound microscope

RBC = No. of cells counted×3×10×200 ($10^6$ $mm^3$)
WBC = No. of cells counted×0×25×10×20 ($10^4$ $mm^3$)

- **Haemoglobin estimation:** Haemoblobinometer was used for haemoglobin estimation based on acid haematin method (SAHLI):

$$\text{Haemoglobin} = \frac{\text{Value obtained} \times 17.2 \text{ mg} / 100 \text{ mL}}{100}$$

The packed cell volume was measured after placing sealed microhaematocrit tube in a centrifuge at 10,500 rpm using microhaematocrit reader and expressed as percentage.

- **Mean Corpuscular Volume (MCV):** It was calculated from the haematocrit value (PCV (%) and the Erythrocyte count (Er $mm^3$)):

$$\text{MCV}\left(\mu^3\right) = \frac{\text{PCV}}{\text{Er}} \times 10$$

- **Mean Corpuscular Haemoglobin Concentration (MCHC):** This was obtained using the following equation:

$$\text{MCHC}\left(\%\right) = \frac{\text{Hb}}{\text{PCV}} \times 100$$

- **Mean Corpuscular Haemoglobin (MCH):** This was expressed in picogrammes (ρg) as follows:

$$\text{MCH}\left(\text{pg}\right) = \frac{\text{Hb}}{\text{Er}} \times 100$$

**Statistical analysis:** Data obtained from the experiment was expressed in Mean±SD and it was subjected to one way Analysis of Variance (ANOVA) using SPSS 16.0 version. Where, the ANOVA reveals significant difference ($p<0.05$), Duncan multiple range test was used to compare differences among individual treatment means.

## RESULTS

**Proximate composition of the experimental diets:** Table 3 shows the proximate composition of the experimental diets. It reveals the diets to be isonitrogenous and isolipidic as there was no significant difference ($p>0.05$) in the crude protein and crude lipid content of the diet. The protein and lipid requirement of *Clarias gariepinus* was met by the 40 and 12% provided in the experimental diets. All the fish responded well to the dietary treatment given to them.

**Haematological profile:** Table 4 shows the haematological profile of *Clarias gariepinus* fed diet containing *Chrysophyllum albidum* seedmeal. The fish fed diet 1 had the highest PCV while the fish fed at diet 3 had the lowest PCV. There was significant different ($p<0.05$) in the PCV of the fish fed various dietary treatments. However, there was no significant difference ($p>0.05$) in the PCV of the fish fed diet 2, 3, 4 and 5. Similar trends, as observed for PCV, were also observed for Hb, RBC, MCV, MCH and MCHC. These was no significant difference in the WBC of the blood of the fish fed various dietary treatment so also were neutrophyl and lymphocyte.

Table 3: Proximate composition of experimental diets containing *Chrysophyllum albidum* seed meal fed to *Clarias gariepinus*

| | Experimental diets | | | | |
|---|---|---|---|---|---|
| Parameters | $D_1$ | $D_2$ | $D_3$ | $D_4$ | $D_5$ |
| Moisture | 9.24±0.11 | 9.20±0.03 | 9.16±0.13 | 9.12±0.10 | 9.23±0.06 |
| Crude protein | 40.23±0.05 | 40.20±0.08 | 40.25±0.15 | 40.23±0.06 | 40.20±0.12 |
| Crude lipid | 12.17±0.09 | 12.20±0.05 | 12.15±0.12 | 12.16±0.08 | 12.20±0.13 |
| Crude fibre | 4.59±0.45 | 4.15±0.11 | 4.16±0.10 | 4.16±0.05 | 4.13±0.05 |
| Ash | 4.48±0.06 | 4.60±0.45 | 4.50±0.32 | 4.33±0.40 | 4.37±0.31 |
| NFE | 29.29±0.31 | 29.71±0.51 | 29.80±0.50 | 29.10±0.40 | 29.93±0.30 |

Mean in row without superscript are not significantly different ($p>0.05$) from one another

Table 4: Haematological profile of *Clarias gariepinus* fed diet containing *Chrysophyllum albidum* seedmeal

| | Experimental diets | | | | |
|---|---|---|---|---|---|
| Parameters | $D_1$ | $D_2$ | $D_3$ | $D_4$ | $D_5$ |
| PCV | 25.67±3.21$^a$ | 12.00±1.00$^b$ | 11.67±0.58$^b$ | 12.67±3.06$^b$ | 12.00±1.00$^b$ |
| HB | 8.60±1.13$^a$ | 4.00±0.20$^b$ | 3.93±0.12$^b$ | 4.23±0.97$^b$ | 4.00±0.20$^b$ |
| RBC | 2.25±0.28$^a$ | 1.05±0.09$^b$ | 1.04±0.05$^b$ | 1.11±0.27$^b$ | 1.06±0.11$^b$ |
| WBC | 142.93±6.22 | 140.57±8.26 | 177.00±61.82 | 190.23±78.30 | 133.83±12.91 |
| Neutrophyl | 64.33±4.04 | 60.00±5.00 | 65.67±11.60 | 70.33±10.50 | 31.70±2.90 |
| Lymphocyte | 35.67±4.07 | 40.00±5.00 | 34.33±11.59 | 29.67±10.50 | 31.67±2.89 |
| MCV | 99.10±12.44$^a$ | 46.33±3.85$^b$ | 45.03±2.19$^b$ | 48.90±11.82$^b$ | 46.33±3.85$^b$ |
| MCH | 30.77±4.05$^a$ | 14.30±0.70$^b$ | 13.97±0.35$^b$ | 15.17±3.48$^b$ | 14.30±0.70 |
| MCHC | 23.133±2.84$^a$ | 10.80±0.90$^b$ | 10.70±0.46$^b$ | 11.40±2.72$^b$ | 10.73±1.06$^b$ |

Mean in rows with the same superscript are not significantly different from each other ($p<0.05$)

## DISCUSSION

The result of the proximate analysis of the diets to be isonitrogenous and isolipidic. The protein and lipid requirement of *Clarias gariepinus* was met by the quantity provided in the diets. Uys and Hecht (1985) reported that the best growth rate and feed conversion efficiency in juvenile and sub-adult *Clarias gariepinus* are achieved with diets containing 38-42% crude protein and optimum liquid content of 10-11%.

The observed reduction in haematological parameters in *Clarias gariepinus* fed *Chrysophyllum albidum* meal, in this study, conform to the report of Tacon (1992) and Jimoh (2012) of nutritionally deficient diets can cause decrease in haemoglobin content, reduced PCV and red blood cell count. The decrease in haematological parameters with increasing level of incorporation of *Chrysophyllum albidum* meal agreed with other observation (Blom *et al*., 2001; Dabrowski *et al*., 2001; Rinchard *et al*., 2003; Fagbenro *et al*., 2010). However, the values recorded for RBC of the fish fed the dietary treatments were all within the range of normal haematology of a healthy fish (Fagbenro *et al*., 1993; Rastogi, 2007). Erythrocyte count greater than $1\times10^{6}$ $mm^{-3}$ is considered high and is indicative of high oxygen carrying capacity of the blood which is characteristic of fishes capable of aerial respiration and with high activity. The PCV values recorded in this study fall within the normal range of 20-38% for fish as reported by Clark *et al*. (1979) and Erondu *et al*. (1993).

Increase in white blood cell, as observed in the fish fed *Chrysophyllum albidum* diets, is attributed to increase in the production of leucocyte in the haemotopoietic tissue of the kidney and perhaps the spleen. Akinwande *et al*. (2004) reported that a measurable increase in WBC of fish is a function of immunity response to vulnerable illness and disease. Thus, it can be concluded that not much stress is placed on the health of *Clarias gariepinus* fed *Chrysophyllum albidum* seed meal replacing maize.

## REFERENCES

AOAC., 1990. Official Method of Analysis. In: Association of Official Analytical Chemists, Helrich, K. (Ed.). 15th Edn., Arlington, Virginia, USA.

Adeparusi, E.O. and A.D. Ajayi, 2000. Haematological characteristics of Nile Tilapia *Oreochromis niloticus* fed differently processed Lima bean (*Phaseolus lunatus* L.) diets. J. Agric. Technol., 2: 48-57.

Akintayo, I.A., S.O. Obasa, W.O. Alegbeleye and A.M. Bangbose, 2008. Evaluation of toasted sunflower (*Helianthus annus*) seed meal in the diets of African catfish (*Clarias gariepinus*) fingerlings. Livestock Res. Rural Dev., Vol. 20.

Akinwande, A.A., F.O. Moody, O.A. Sogbesan, A.A.A. Ugwumba and S.O. Ovie, 2004. Haematological response of *Heterobranchus longifilis* fed varying dietary protein levels. Proceedings of the 19th Annual Conference of the Fisheries Society of Nigeria, November 29-December 3, 2004, Ilorin, Nigeria, pp: 715-718.

Amusa, N.A., O.A. Ashaye and M.O. Oladapo, 2003. Biodeterioration of the African star apple (*Chrysophylum albidum*) in storage and the effect on its food value. Afr. J. Biotech., 2: 56-59.

Blom, J.H., K.J. Lee, J. Rinchard, K. Dabrowski and J. Ottobre, 2001. Reproductive efficiency and maternal-offspring transfer of gossypol in rainbow trout (*Oncorhynchus mykiss*) fed diets containing cottonseed meal. J. Anim. Sci., 79: 1533-1539.

Clark, S., D.H. Whitmore Jr. and R.F. McMahon, 1979. Considerations of blood parameters of largemouth bass, *Micropterus salmoides*. J. Fish Biol., 14: 147-158.

Dabrowski, K., K.J. Lee, J. Rinchard, A. Ciereszko, J.H. Blom and J.S. Ottobre, 2001. Gossypol Isomers bind specifically to blood plasma proteins and spermatozoa of rainbow trout fed diets containing cottonseed meal. Biochimica Biophysica Acta (BBA)-Gen. Subj., 1525: 37-42.

Erondu, E.S., C. Nnubia and F.O. Nwadukwe, 1993. Haematological studies on four catfish species raised in freshwater ponds in Nigeria. J. Applied Ichthyol., 9: 250-256.

Fagbenro, O.A. and O.T. Adebayo, 2005. A Review of the Animal and Aquafeed Industries in Nigeria. In: A Synthesis of the Formulated Animal and Aquafeed Industry in Sub-Saharan Africa, Moehl, J. and M. Halwart (Eds.). Food and Agriculture Organization of the United Nations, Rome, Italy, pp: 25-36.

Fagbenro, O.A., C.O. Adedire, E.A. Owoseeni and E.O. Ayotunde, 1993. Studies on the biology and aquaculture potential of feral catfish *Heterobranchus bidorsalis* (Geoffroy St. Hilaire 1809) (Clariidae). Trop. Zool., 6: 67-79.

Fagbenro, O.A., E.O. Adeparusi and W.A. Jimoh, 2010. Apparent nutrientdigestibility of sunflower andsesame seed meal in *Clarias gariepinus* (Burchell, 1822) fingerlings. Proceedingof the 25th Annual Conference of Fisheries Society of Nigeria, October 25-29, 2010, Badagry, Nigeria.

George, F.O.A., S.O. Obasa and S.O. Otubusin, 2007. Growth response and carcass quality of African Catfish, *Clarias gariepinus* (Burchell, 1822) fed multi-enzyme-supplemented soybean meal diets. J. Applied Trop. Agric., 12: 51-59.

Iwalewa, E.O., T.O. Idowu, M.A. Aderogba, B.A. Akinpelu and A.O. Ogundaini, 2006. Biochemical and behavioural effects of eleagnine from *Chrysophyllum albidum*. J. Biol. Sci., 6: 1029-1034.

Jimoh, W.A., 2012. Nutritive value of sesame (*Sesamum indicum*) or sunflower (*Helianthus annuus*) seed meals as dietary protein sources for African catfish. Ph.D. Thesis, Federal University of Technology, Akure.

Olurin, K.B., E.A.A. Olojo and O.A. Olukoya, 2006. Growth of African catfish *Clarias gariepinus* fingerlings, fed different levels of cassava. World J. Zool., 1: 54-56.

Osuigwe, D.I., A.I. Obiekezie and G.C. Onuoha, 2005. Some haematological changes in hybrid catfish (*Heterobranchus longifilis* x *Clarias gariepinus*) fed different dietary levels of raw and boiled jackbean (*Canavalia ensiformis*) seed meal. Afr. J. Biotechnol., 4: 1017-1021.

Rastogi, S.C., 2007. Essentials of Animal Physiology. New Age International, New Delhi, ISBN-13: 9788122420142, Pages: 578.

Rinchard, J., K.J. Lee, S. Czesny, A. Ciereszko and K. Dabrowski, 2003. Effect of feeding cottonseed meal-containing diets to broodstock rainbow trout and their impact on the growth of their progenies. Aquaculture, 227: 77-87.

Svobodova, Z., D. Pravda and J. Palackova, 1991. Unified Methods of Haematological Examination of Fish. Research Institute of Fish Culture and Hydrobiology, Vodnany, Czechoslovakia, Pages: 31.

Tacon, A.G.J., 1992. Nutritional fish pathology. Morphological signs of nutrient deficiency and toxicity in farmed fish. FAO Fish Technical Paper No. 330, Rome, pp: 75.

Uys, W. and T. Hecht, 1985. Evaluation and preparation of a suitable dry feed and optimal feeding frequency for primary nursing of *Clarias gariepinus* larvae (Pisces: Clariidae). Aquaculture, 47: 173-183.

Yue, Y.R. and Q.C. Zhou, 2008. Effect of replacing soybean meal with cottonseed meal on growth, feed utilization and hematological indexes for juvenile hybrid tilapia, *Oreochromis niloticus* x *O. aureus*. Aquaculture, 284: 185-189.