DETERMINATION OF BIOCHEMICAL AND HEMATOLOGICAL PARAMETERS OF ALBINO *Clarias gariepinus* FINGERLINGS FED WITH FERMENTED *Parkia biglobosa*

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Abstract: This study was conducted to investigate the changes in hematological and biochemical parameters in albino *Clarias gariepinus* fed with fermented locust beans (*Parkia biglobosa*) seed. Albino *Clarias gariepinus*of mean weight of 1.01± 0.00 g and length of 1.00± 0.0 cm was used for the study. Four treatments of three replications were used in 12 experimental tanks stocking 20 fingerlings each. Four isonitrogenous diets containing varying replacement level of locust bean meal (FLBM) designated 0% FLBM, 25% FLBM, 50% FLBM and 75% FLBM, diets 1 to 4, respectively. The results obtained indicated significant differences ($p<0.05$) for the biochemical and hematological parameters examined. Diet with 75% FLBM gave appreciable levels of biochemical and hematological parameters which was closely followed by diet 1 (contain high fish meal as protein source); which were significantly different ($p<0.05$) to other diet without FLBM inclusion. The present study showed that, fermented *Parkia biglobosa* meal could serve as a source protein in constituting fish meal diet for Albino *Clarias gariepinus* fingerlings without any adverse effect. However, limited growth observed in this study could be attributed to complete absence of soya beans in the diets.

Keywords: Albino, *Clarias gariepinus Parkia biglobosa*, locust bean seed meal

Introduction

African aquaculture has been dominated by farming of *Clarias* fishes and among which the African sharp tooth catfish (Albino *Clarias gariepinus*) is the most popular and of great economic importance as source of food protein (Adewumi *et al.,* 2011). Albino African catfish are just like all other animal albinos that arise as a result of genetic polymorphism that causes the fish to lack pigment thereby appearing white (Sazima and Pombal, 1986). Albino *Clarias gariepinus* is typical air-breathing catfish with scaleless, bony elongated body with long dorsal and anal fins, and a helmet like head. Its color varies dorsally from bark to light brown and often mottled with shades of olive and grey, and the underside is a pale cream to white (Skelton, 2001). It attracts good prices in Nigerian markets (Oladosu *et al.,* 1993) due to its tasty flesh and devoid of sharp bones. It also exhibit great tolerance to high sinking density even in low oxygen waters, good growth rate , efficient feed conversion with excellent nutritional profile and medicinally valuable (Debnath, 2011).

Fish generally is very important to humans due to its very high quality protein as well as the essential amino acids required by the body for growth and maintenance of muscle tissue. Worldwide, fish protein provide up complete protein sources in many people's diets used to maintain an active metabolism (Ayoola, 2011). Proteins of low quality do not contain all essential amino acids required for use in protein synthesis and as such the protein must either be used as energy or converted to fat (Mahmoud *et al*., 2014). This is because fish are rich in omega-3 fatty acids. They play a very important role for normal growth particularly for the blood vessels and the nerves as well in keeping our skin and other tissues youthful (Ayoola, 2011).Fish protein improve nutrition because it has a high biological value in terms of high protein retention in the human body (Akande *et al.,* 1994).

Search for plant protein and vitamin substitutes and flavour, made the use of African locust beans very popular especially in the fermented form as dawadawa. It serves as an ingredient in the preparation of various stews, soups and sauces for the consumption of cereal and also proteinous to fish (Falaye, 1992) which led to increased crude protein and crude lipid content (Faila and Dakare, 2019).

Animal feed, today, is becoming costly due to the competition between man and animal for protein source (Adeparusi and Agbede, 2005). The source of fish feed is very expensive especially imported ones because of high rate of foreign exchange and economics of Covid-19 world economics. The use of commercial pelleted fish feed expensive as it accounts for about 60 – 80% of the recurrent cost of fish farming venture (Madu and Ufodike, 2003). The high cost of local feeds is accounted for by the high cost of fishmeal, the main protein source, and other conventional protein sources such as soya bean and groundnut. It became imperative to search for alternative ingredients of high nutritional value that are cheap, available and non-competitive for human, livestock or industrial uses when used for fishmeal.

There is limited information on the use of *Parkia biglobosa* meal as protein source for fish. It is against this background, that the present study was undertaken and mainly focuses on the use of fermented locust bean meal as a replacement for fishmeal in the diets of Albino *Clarias gariepinus* fingerlings. It also determines the effect of varying inclusion levels of *Parkia biglobosa* meal on the growth and nutrient utilization of Albino *Clarias gariepinus* fingerlings.

Materials and Methods

Location of study area

The treatment of experimental animals (fish) was conducted at the Department of fisheries Adamawa State University Mubi. And proximate analysis of locust beans, biochemical and hematological analysis were conducted in the Department of Biochemistry Laboratory Adamawa State University, Mubi.

Sources of locust beans seed and processing

Raw African locust bean was sourced from local markets in Mubi, Adamawa State, Nigeria. The seeds were air- dried and sorted to remove unwanted particles. The method of fermentation as described by Omafuvbe *et al.* (2004) with little modification was used for seed processing. Two equal batches of the raw African locust bean seeds were separated

and boiled in water for 12 h. The seeds were further soaked in water and boiled for another 12 h. After soaking and boiling, excess water was drained off while the seeds were manually de-hulled by pressing using large wooden mortar. Further removal of the seed coat was carried out by rubbing the seeds between the palms of the hand and washing with water. The de-hulled seeds were then boiled for another 6 h. The first batch were dried in oven, bagged and labeled unfermented African locust bean (UALB).

The second batch of the cooked and de-hulled seeds were put in a local fermenter and allowed to undergo natural fermentation for 72 h. Thereafter, the resulting cotyledons were oven dried, bagged and labeled fermented African locust bean (FALB) (Table 1).

Table 1: Formulation of different experimental diets using African locust bean

Feedstuffs (%)	Fermented African locust bean replacements			
	1	2	3	4
Fishmeal	68.85	26.52	19.89	13.26
Fermented African locust bean (FALB)	0	13.26	19.89	26.56
Maize meal	26.18	55.00	55.00	55.00
Vegetable oil	2.00	2.00	2.00	2.00
Vitamin-mineral premix	3.00	3.00	3.00	3.00
	100.03	99.78	99.78	99.82

Sources of albino Clarias gariepinus fingerlings

The animal for the study were albino *Clarias gariepinus fingerlings* (1.01±0.00 g weight) was obtained from the Department of Fisheries and Aquaculture Adamawa State University, Mubi.

Albino Clarias gariepinus acclimatization

The Albino *Clarias gariepinus* fingerlings placed on a commercial pelleted diet was used for the study and was acclimatized for 7 days prior to the feeding trial. Twenty (20) fingerlings were allotted into each of the fifteen 25 liters' rectangular tanks containing 20 liters of water. Experimental diets; 0% FLBM, 25% FLBM, 50% FLBM and 75% FLBM, were assigned to the four (4) tanks with three replicates per treatment. Fish in each tank were fed with 5% formulation per day in two equal proportions between 9.00 –10.00 am and 5.00 – 6.00 pm for 3 months.

Proximate analysis of Parkia biglobosa

Analytical methods of AOAC (2004) was adopted to determine the crude protein, fibre, ash, ether extract and nitrogen free extract of the raw, unfermented and fermented African locust beans.

Experimental design and water quality assessment

Water quality parameters such as temperature, dissolved oxygen and pH of the experimental set up was monitored using standard methods (APHA, 1998; Boyd, 1979). While the proximate composition of poultry litter and control diets were carried out using the AOAC (1990).

Four plastic tanks, T0, T1, T2, T3, and T4, each measuring 1 x 1 x 1 m were used for the study. Each of the tanks were filled with water to 2/3 of its volume and stocked with 20 fingerlings. The mean weight gains and length of the fingerlings in each of the experiment tanks were recorded at the end of every week.

Blood sample collection

The Albino *Clarias gariepinus* fish were removed from the different tanks for blood collection. The fish were labeled T0, T1, T2, T3, and T4 according to the treatment provided. Each fish was held firmly andblood sample was taken from the ventral region near the anal opening using sterile syringe and immediately transferred into ethylenediaminetetracetic acid (EDTA) bottle to prevent clotting. The blood samples were carried to the laboratory immediately for hematological and biochemical analysis.

The blood samples collected were dispensed into tubes containing EDTA to obtain plasma for biochemical analysis; while hematological values were determined according to standard methods described by Joshi *et al*. (2002).

Evaluation of plasma biochemical parameters

Blood samples of the Albino *Clarias gariepinus* fingerling at the beginning of feeding trial and after twelve weeks of feeding and control diet were collected from un-anaesthetized fish by cardiac puncture with a 1.4 x 50 mm non-heparinized injection needle as described by Morgan and Iwama (1997) and Lawrence *et al*. (2009).

Estimation of alanine aminotransferase (ALT) activity

The method described by IFCC (1980)using Randox kits (Randox lab, UK). Approximately, 50 µl of the sample and 500 µl of the ALT reagent were mixed in a test tube, and the initial absorbance at 340 nm was read after 1, 2, and 3 minutes. ALT activity (nm/min) were read = 1746 × ΔA 340 nm/min; where ΔA 340 nm/min is change in absorbance per minute for the homogenate sample, 1746 = Extinction coefficient. About 1 ml of reagent (LDH 1.25 U/ml NADH 0.18 mmol/ml 2-oxoglutarate 15 mmol/l L-alanine 0.5 mmol/l Tris buffer 100 mmol/l) pH 7.5 was pipetted into 2 disposable cuvettes containing the samples.

Estimation of alkaline phosphotase (ALP) and aspartate aminotransferase (AST)

Assay of Alkaline phosphatase (ALP) and aspartate aminotransferase (AST) were conducted according to method described by Bassey *et al.* (1946) as modified by Wright *et al*. (1972) using Randox kits. Into a cuvette, 10 µl of sample was mixed with 500 µl of the reagent. The initial absorbance was read at 405 nm, and subsequently over 3 min. The mean absorbance per minute was used in the calculation: ALP activity (IU/l) = 2742 × ΔA 405 nm/min (where: 2742 = Extinction coefficient; ΔA 405 nm/min = change in absorbance per minute for the homogenate sample).

Determination of serum electrolytes

The Trimetric Method of Schales (1971) was used to determine the level of electrolyte in the serum by using sodium and potassium ion reagent. Three test tubes were labeled Test, Standard and Blank respectively. Into the test tube labeled "Test" only, 0.10 ml of deionized water was added, to the test tube labeled "Blank" only, few (0.10) ml of deionized water were added. To the test tube labeled "Test" only, 0.10 ml of Serum were added; to the test tube labeled "standard", 0.10 ml of working standard were added. The concentrations were read in flame photometer using sodium and potassium light filters.

Determination of chloride ion

Chloride ion was determined by titration using Mercuric Nitrate Method of Schales (1941). To 1.80 ml of distilled water, 0.20 ml of serum and 3 drops of biphenyl carbazone indicator were added. It was properly mixed and titrated from a second pipette (graduated in 0.01 ml) with $HgNO_3$. A violet color denotes the end point.

Evaluation of hematologicalparameters

The blood analysis was conducted as described by Svobodova *et al.* (1991). *Packed Cell Volume (PCV***)** Non-clotted blood will be drawn by capillary action into micro hematocrit tubes; one end of the tube was sealed with synthetic sealant. The sealed tube was centrifuged in a micro hematocrit centrifuge. Centrifugation lasted for 5 min at 10500 rpm. The packed cell volume was measured using microhematocritreader and expressed as percentage.

The value of the mean corpuscular volume was calculated from the haematocrit value (PCV) (%) and the Red Blood Count (RBC) ($10^6/mm^2$) according to the following formula

$$MCV = \frac{PCV}{RBC} \times 100 \text{ (fl)}$$

And Mean Corpuscular Hemoglobin (MCH) expressed as the concentration of hemoglobin in unit volume of erythrocyte, calculated from the hemoglobin value (Hb) and from the red blood cells according to the following formulae:

$$MCH = \frac{Hb}{RBC}$$

Blood cell count: red blood cell (RBC) and white blood cell (WBC)

Hemocytometer was used in blood cell counts with the blood diluting fluid prepared as described by (Svobodova *et al*., 1991). The blood cells were counted on the counting chamber of hemocytometer with the aid of compound microscope.

RBC = Number of cells counted x 3 x 10 x 200 (10^6 mm^3)

WBC = number of cells counted x 0.25 x 10 x 20 x 20 (10^3 mm^3)

Data analysis

Data obtained from the experiment were expressed in mean ±SD and subjected to one-way Analysis of Variance (ANOVA) using SPSS 16.0 version at ($p<0.05$) significant difference. Duncan multiple range test was used to compare differences among individual treatments mean.

Results and Discussion

Proximate composition of fermented and unfermented locust bean seed flour

Proximate analysis result is presented in Table 2. It showed that fermentation had significant effect on the proximate composition of the fermented locust bean. The moisture contents of the fermented African locust beans increased significantly from 14.52 to 15.83%. The percentage fat of African locust beans increased during fermentation from 20.19 to 22.46%. The percentage of protein of African locust beans as well increased slightly during fermentation from 30.27 to 32.46%. However, there were significant reduction in percentage content of ash and crude fiber of the fermented samples. The increase in the moisture content of the fermented samples may be due to the addition of water during cooking and washing of the cotyledon which leaks into the solvent. It may also be due to the proteolytic activity of the fermenting organisms on the substrate. The higher percentage of protein in the fermented samples may be due to increase of carbohydrate content of the fermented samples. The decrease in ash content of the seeds with fermentation observed may be due to lost in ash because of leaching of the solute inorganic salt into the processing water during the boiling of the samples.

The increase in fat content of the fermented samples from 20.19 to 22.46, may be attributed to the increase in activities of lipolytic enzymes, which hydrolyze fat to glycerol and fatty acid. From the results of this study, the seeds of *P. biglobosa* had higher protein, carbohydrate and fat content.

Table 2: Proximate composition of unfermented and fermented locust beans

Samples (%)	Protein	Fat	Fibre	Ash	Moisture	Carbohy.
Unferm.	30.27	20.19	23.28	5.21	14.52	6.08
Ferm.	32.46	22.46	9.46	4.52	15.83	15.26

Unferm. = Unfermented; **Ferm.** = Fermented; **Carbohy.** = Carbohydrates

Hematological parameters of albino Clarias gariepinus fed with different dietary level of locust beans seed

The hematological changes in Albino *Clarias gariepinus* fed with different dietary level of locust beans seed is presented in Table 3. The result showed significant differences ($P<0.05$) in the hematological parameters among the diets fed albino *Clarias gariepinus* fingerlings. Diet 1 with 0% fermented locust bean meal (FLBM) and diet 4 with 75% FLBM recorded highest WBC of 10.12 and 10.01 respectively. However, diets 2 and 3 gave low WBC (9.25 and 8.83%, respectively) showed no significant differences ($P>0.05$) among the two treatments.

The RBC of D1 showed highest value of 0.09 with no significant difference ($p>0.05$) while diets 2, 3 and 4 were significantly different from each other ($p<0.05$) as well as other diets. Diet 1 with 0% FLBM exhibited the highest MCV followed by diets 3 and 4 which show no significant difference ($p>0.05$). Diet2 had the lowest MCV (28.00 fl) and significantly different from other treatments ($p<0.05$). The HGB of all diets showed significant difference ($p>0.05$) among each other. Diet 1 with 0% FLBM showed the highest GRA of 0.60 followed by diets 2, 3, and 4 with GRA of 0.52,0.42 and 0.30 /L, respectively which differed insignificantly ($p<0.05$) from each other while diet 4 recorded lowest GRA (0.30 /L). While the RWDC diets 1 and 2 showed no significant differences ($P>0.05$) in their RWDC values but diet 4 showed significant differences ($P<0.05$) from other diets. Diets 1 and 3 with 0% FLBM, 25% fish meal FLBM, 0% fishmeal recorded highest LYM value of 8.84 and 7.86 followed by diets 2 and 3(with 4.82 and 5.85 %, respectively) which differed significantly ($P>0.05$), while diet 2 contained 75% FLBM fish meal had lowest LYM (4.82%). Diet 1 recorded highest HCT value (0.59%) for all the diets significantly different ($p<0.05$) from other treatments. Diet 1 had the highest value P-LCR (13.66%) while the FLBM is reduce the value of P-LCR decrease.

Table 3: Hematology parameters of albino *Clarias gariepinus* feed with different dietary level of locust beans seed.

Hematology parameter	Treatment (Level of locust beans seed inclusion)				
	D1(0%)	D2(25%)	D3(50%)	D4 (75%)	LSD
WBC ($+10^{9/l}$)	10.12 ± 00^{a}	9.25 ± 0.00^{C}	8.83 ± 0.00^{d}	10.01 ± 0.33^{b}	0.44
RBC($-10^{12/l}$)	0.09 ± 0.00^{c}	0.34 ± 0.00^{a}	0.30 ± 0.00^{b}	0.06 ± 0.00^{d}	0.58
$HGB^{(-g/l)}$	82.00 ± 0.00^{b}	78.67 ± 0.00^{C}	88.00 ± 0.00^{a}	72.00 ± 0.00^{d}	4.71
MCV(fl)	40.00 ± 0.00^{a}	28.00 ± 0.00^{d}	29.00 ± 0.00^{c}	35.00 ± 0.00^{b}	4.66
RDWC(%)	10.1 ± 0.30^{a}	10.13 ± 0.0^{a}	9.29 ± 0.00^{b}	8.82 ± 0.00^{c}	1.96
GRA($-10^{9/l}$)	0.60 ± 0.60^{a}	0.30 ± 0.00^{d}	0.42 ± 0.00^{C}	0.52 ± 0.00^{b}	0.97
LYM(%)	8.84 ± 0.00^{a}	$4.82\pm0.00d^{d}$	5.85 ± 0.00^{C}	7.86 ± 0.00^{b}	0.04
HCT(%)	0.59 ± 0.00^{a}	0.38 ± 0.70^{d}	0.41 ± 0.00^{C}	0.55 ± 0.00^{b}	0.06
P-LCR(%)	13.66 ± 0.00^{a}	10.20 ± 0.00^{c}	10.19 ± 0.00^{C}	12.28 ± 0.00^{b}	0.05

Mean in the same column having the same superscript do not differ significantly ($p<0.05$). HGB = Hemoglobin; RBC = Red blood cells; WBC = White blood cells; MCV = Mean corpuscular volume; MCH = Mean corpuscularhemoglobin; MCHC = Mean corpuscular hemoglobin concentration; HCT =Hematocrit; RDWC =Red blood cell (erythrocyte) distribution width coefficient of variation; LYM = Lymphocytes

Table 4: Biochemical parameters of albino *Clarias gariepinus* feed with different dietary level of locust seed beans

Biochemical parameter	Treatment (Level of locust beans seed inclusion)				LSD
	D1(0%)	D2 (25%)	D3(50%)	D4 (75%)	
ALT(IU/L)	12.30±0.00^{b}	11.80±0.00^{c}	28.10±0.00^{a}	11.70±0.00^{c}	15.52
ALP(IU/L)	63.60±0.00^{a}	19.80±0.00^{d}	35.50±0.00^{c}	43.10±0.00^{b}	28.28
AST(IU/L)	93.40±0.00^{a}	43.30±0.00^{d}	60.40±0.00^{c}	83.10±0.00^{b}	10.48
K^{+}(mmol/L)	20.30±0.00^{a}	13.40±0.00^{d}	16.30±0.00^{c}	19.40±0.00^{b}	6.71
Na^{+}(mmol/L)	120.30±0.00^{b}	105.40±0.00^{c}	115.30±0.00^{a}	125.40±0.00^{d}	29.34
CL^{-}(mmol/L)	175.30±0.00^{a}	70.30±0.00^{d}	80.30±0.00^{c}	134.40±0.00^{b}	54.66

Mean in the same row having the same superscript do not differ significantly ($p<0.05$); AST = Aspartate aminotransferase; ALT = Alanine aminotransferase; ALP = Alkaline phosphatase; K = potassium ion; Na = Sodium ion; Cl = chloride ion

Biochemical parameters of albino Clarias gariepinus feed with different dietary level of locust seed beans

The biochemical changes in the blood of *Albino Clarias gariepinus* fed diets containing *Parkia biglobosa* seed meal is presented in Table 4. The result showed significant differences ($P<0.05$) in the biochemical parameters among the diets fed albino *Clarias gariepinus* fingerlings. The value of the AST varied between 43.30 to 93.40 IU/L, Diet 1 with 0% fermented locust bean meal (FLBM) recorded highest AST value (93.40 IU/L), while Diet 2 with 25% fermented locust bean meal (FLBM) had the lowest value (43.30 IU/L). As the level of fermented locust bean meal (FLBM) is reduced, the level of AST decreases.

Diet 1 with 0% fermented locust bean meal (FLBM)had the highest value of ALT (28.10I U/L), while Diet 1 had the value (12.30 IU/L), diet 2 and 4 had (11.70 and 11.80 IU/L), respectively. The value of ALP varied with from 19.80-63.60, diet 3 with 50% fermented locust bean meal (FLBM) had the highest value (63.60 IU/L)while diet 3 and 4 had the values of 35.50 and 43.10 IU/L, respectively. Diet 1 with 0% fermented locust bean meal (FLBM) had the lowest value of 19.80.

The electrolyte in the serum varied with each treatment. The value of potassium in diet 3 with 50% of fermented locust bean meal (FLBM) had the highest value (20.30 mmol/L), while diet 1 and 4 had the value of 19.40 and 16.30 mmol/L, respectively. Diet 2 had the lowest value (13.40 mmol/L). The result showed that the value of sodium varied depending on treatment provided for the fish. Diet 3 with 50% fermented locust bean meal (FLBM) had the highest value of 408.30 mmol/L, and diet 1 and 4 had the value of 400.30 and 378.40 mmol/L, respectively. Diet 2 had the lowest value of sodium ion (370.40 mmol/L). The range of the chloride varied with each diet formulation. Diet1 with 0% fermented locust bean meal (FLBM) had the highest of chloride (175.30 mmol/L and diet 4 had the lowest the value (70.30 mmol/L) of chloride ion.

The enormous benefits attached to African locust beans cannot be over-stressed. The significant reduction in percentage content of ash, carbohydrates and crude fibre shown in this study is an indication of the impacts of fermentation on the nutritional quality of African locust beans. This is in tandem with the report on the effect of fermentation on the nutritional quality of African locust beans by Omodara and Olowomofe (2015). Also, the decrease in ash content of the seeds with fermentation may be due to loss in ash because of leaching of the solute inorganic salt into the processing water during the boiling of the samples. The reduction in crude fibre of the seeds with fermentation may be as a result of boiling and de-hulling during the processing of the locust bean (Osman, 2007). Higher levels of crude protein obtained in this study for the seeds (32.46%) were in agreement with the work of Alabi *et al*. (2004). African locust bean has been known to be rich in protein and may thus be used to add protein to a protein-deficient diet. The result of chemical composition of experimental diets revealed that the treatment diet had relatively high dry matter content; this could probably be due to the fact that they were prepared from dried ingredients which were characteristically high in dry matter. The marked difference between the values reported in this study and that reported in some literatures might have been caused by difference in composition of the diets.

The crude protein (CP) content was higher in unfermented locust bean than in fermented diet. They are generally on high side for both diets. The result of Na^{+} level obtained in this study ranged between 370.40 to 408.30 mmol/L), compared to the values (129.00 mmol/L) reported by Bhat *et al*. (2011), Chloride level from the present trial recorded significantly ($P<0.05$) difference among the treatments with diet 1 having the highest value (175.30 mmol/L) and diet 3 recorded the lowest value (70.30 mmol/L); these values were similar to those reported by Jackson and Cockcroft (2002).

The AST, ALT and ALP in this study did not significantly ($p>0.05$) affect the treatments; which showed that diet 3 has the highest AST value (93.40 IU/L) and diet 1 recorded the lowest value (43.30 IU/L). ALT recorded the highest value in diet 3 (28.10.00 IU/L) and lowest in diet 2(11.70 IU/L) while the highest value of ALP was observed in diet 3(63.60 IU/L) and the lowest in diet 1 (19.80 IU/L). The values for AST, ALT and ALP is in agreement with the findings of Bhat *et al.* (2011) who reported AST (43 to 123 IU/L), ALT (7 to 24 IU/L) and ALP (7 to 30 IU/L), respectively. Serum aspartate aminotransferase had been found in practically every tissue of the body including red blood cell and highly concentrated in cardiac muscle and liver, intermediate in skeletal muscle and kidney and in much lower concentrations in other tissues. The determination of AST levels could help in the diagnosis and monitoring cases of myocardial infarction, hepatocellular disease and skeletal muscle disorders. Similarly, it is used in monitoring trauma or in disease affecting skeletal muscle, after a renal infarction and in various hemolytic condition (Alex and Laverne, 1983). The concentration of serum ALT in tissue is not nearly as great as for serum ALT. If the serum Aspartate Aminotransferase is elevated while the serum ALT remains with normal limits in case of suspected myocardial infection, the result are comparable with myocardial infarction (Alex and Laverne, 1983).

The biochemical and hematological parameters of the fishes used in present study differed insignificantly ($p>0.05$) from each other. All the four feeds performed well but diet 2 performed better than all other diets. This implies that diets 2 containing 75% locust bean meal as good as the control diet that contained 100% fish meal. The performance was an indication of positive contribution to growth of the fish.

Conclusion

It conclusion the present study indicated 75% fermented locust bean meal inclusion level in the diet of Albino *Clarias gariepinus* was utilized efficiently for its growth. The fermented locust bean seed meal could therefore replace fishmeal up to 75% in the fish feed composition. This level of inclusion would be significant replacement for the expensive fishmeal in the feed manufacturing since locust bean meal is an agricultural product with no direct competition with man. The flours possess good functional properties which can be

incorporated into human diets not only as protein supplements but also as in processed foods such as weaning, baked and soup products. Food processing technologies for exploiting the utilization of locust bean flours should be promoted. It is also recommended that fermentation should always be conducted on locust bean before consumption. Additionally, African locust bean processing techniques for dawadawa production (including packaging) should be modernized for efficient production and improved shelf life.

Conflict of Interest

Authors have declared that there is no conflict of interest reported in this work.

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