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EFFECTS OF WHEAT BRAN ON GROWTH PARAMETERS, HAEMATOLOGY, HISTOLOGY AND CARCASS QUALITY OF *CLARIAS GARIEPINUS* (BURCHELL 1822) JUVENILES

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Abstract

The increasing cost of foodstuff due to competition between livestock and humans necessitates research into Low-Cost Unconventional Foodstuff (LCUF) for profitable fish farming. This research determines the effects of wheat bran meal, on growth parameters, Hematology, Histology, and Carcass Quality of *Clarias gariepinus* (Burchell) Juveniles. The study was conducted for Fifty-Six (56), under a completely randomized design day. The final body weight and the daily weight gain increased as the wheat bran meal inclusion increased among the individual treatments. The results of the feed conversion ratio were significantly ($p < 0.05$) different among the groups, such that T1 and T2had the best FCR followed by T5 and T6 which had similar values but T4 had the least value. The amino acid profile showed that the Glutamic Acid, Aspartic Acid, Valine, Threonine, Serine, Phenylalanine, Proline and Methionine increased in value while Lysine, Leucine, Arginine, Alanine, Isoleucine, Glycine, Histidine and Tryptophan reduced in value and there was no significant change in cysteine (%) all were significantly at ($P<0.05$). The hematological parameters of the catfish (*Clarias gariepinus)* juveniles fed graded levels of diets containing wheat bran meal were not significantly different ($P>0.05$). The histological analysis of wheat bran meal feed shows normal skin architecture with well-outlined epithelia cell (EC) moderate effect on the skin layer with moderate necrosis (N) of the muscular region with the epithelia lining and superficial spreading of melanoma (M) restricted to the epidermis The heart shows normal cardiac tissue with cardiac cell (CC), cardiac fiber (CF) cardiac muscles (CM) show moderate aggregate of myocardiac inflammation (AMI). The gill showed a section of gill with a ghost (G) appearance with a severe aggregate of inflammatory cells (AIC). The liver cells revealed severe effects on the hepatic tissue with severe intra-hepatic inflammation (IHI) and intra-hepatic hemorrhage (IHIH). The damage done to these organs as a result of the feeds correlates with the concentrations of the feeds in each experimental tank.

Keywords: Wheat Bran, Hematology, Histology, Carcass Quality, *Clarias gariepinus*
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1.0 Introduction

Nigeria's aquaculture industry is currently faced with the problem of inadequate supply and prohibitive cost of quality fish feeds (Omitoyin 2005). Fagbenro and Adeparusi (2003) reported increasing attempts to develop practical diets for farmed fish in Nigeria. However, most fish farmers particularly in rural areas still depend on agricultural wastes including poultry litter for feeding fish. Omitoyin (2005) and Aderemi *et al.* (2004) noted that Nigeria produces large quantities of agricultural and agro-industrial by-products, which serve as alternative feed sources to conventional feed ingredients. Nutritional deficiency signs are the visible signs of insufficient dietary nutrient provision in fish production. Malnutrition is one of the major factors that cause profound adverse changes in the immune response of all vertebrates (Adebayo, 2017). Deficiencies of protein, energy, vitamins, and certain minerals have all been shown to reduce the ability of animals to resist disease. Fish fed the diets low in pyridoxine did not exhibit clinical signs of deficiency, but were sub-clinically deficient, as judged from the results of serum alanine amino-transferase activity. Fish-fed high-protein diets require higher dietary levels of pyridoxine to resist disease compared to fish that are fed low-protein diets. A relationship between dietary ascorbic acid level and disease resistance has been demonstrated in catfish (Adebayo *et al.*,2017) and rainbow trout challenged with bacteria and a virus (Adebayo*et al.*, 2017). Dietary levels approximately 10 times higher than those required to prevent deficiency signs were required to provide maximum disease resistance. What these and other studies show is that fish suffering from subclinical deficiencies, which cannot be detected by observing the fish, are more likely to be lost from disease than those in optimal nutritional condition. Craig, (2009) has recently reviewed the subject of the relationship between nutrition and disease resistance in fish.

Non-conventional feed resources are end products of production and consumption that have not been used (Jimon *et al.*, 2014). They are mainly organic and can be in a solid, slurry, or liquid form. Their economic value is often very low. Fruit wastes such as banana rejects and pineapple pulp by comparison have sugars that are energetically very beneficial. The feed crops which generate valuable NCFR are excellent sources of fermentable carbohydrates e.g. Cassava and Sweet potato and this is an advantage to ruminants because of their ability to utilize inorganic nitrogen (Jimon *et al.*, 2014). Amadi-Ibiam (2024) reported that the utilization of non-conventional feedstuffs of plant origin had been limited as a result of the presence of alkaloids, glycosides, oxalic acids, phytates, protease inhibitors, haematoglutinin, saponegin, momosine, cyanoglycosides, linamarin to mention a few despite their nutrient values and low-cost implications. Concerning the feeds of crop origin, the majority are bulky poor-quality cellulosic roughages with high crude fibre and low nitrogen contents, suitable for feeding to ruminants. They have considerable potential as feed materials and their value can be increased if they are converted into some usable products. While feeding attention needs to be paid to the inclusion level of the resources as they vary with the crop one intends to use. The farmer should also know about the deleterious factors of the fodder and treatment regarding the same. The NCFR differs from region to region. All fodders cannot be found in all regions of India throughout the year (Sáenz, 2021)

Wheat is one of the most widely used raw materials worldwide. This product is used for human food (wheat flour) and animal feed (wheat bran). It is one of the three most-produced kinds of cereal in the world, together with corn and rice (Sáenz, 2021). Wheat belongs to the genus Triticum spp. of the Poaceae family also called Gramineae, which constitutes the most important group in the feeding sector. It is recommended that wheat have moisture values below 14% to avoid problems related to digestibility and contamination by mycotoxin-producing fungi. The amount of lipids in wheat is characterized by a low value compared to corn, which is reported as an advantage since it reduces rancidity. In addition, wheat bran is characterized by increasing the palatability of the feed which is added as a raw material (Sáenz, 2021). Wheat bran is considered an important source of minerals such as zinc, selenium, iodine, and potassium which are important elements in the diet as they participate in multiple physiological functions such as the immune system. On the other hand, wheat bran provides vitamins such as thiamine, B6, folate, vitamin E, and carotenoids (pigments) (Imani *et al*., 2017). Wheat presents high fiber values of 11%, higher compared to corn. This portion of fiber contains between 4-5% of pentosans and 0.5-1% of ß-glucans, which can have benefits if the diet is supplemented with multienzymatic products such as Alquerzim (Sáenz, 2021)

Wheat bran is a product intended for animal feed due to its high content of amino acids and a high percentage of protein superior to other existing cereals (Sáenz, 2021). This wheat bran (technically called pericarp) consists mainly of the external parts of the wheat grain after processing. Wheat **roughage** is considered an important source of minerals such as zinc, selenium, iodine, and potassium which are important elements in the diet as they participate in multiple physiological functions such as the immune system. On the other hand, wheat bran provides vitamins such as thiamine, B6, folate, vitamin E, and carotenoids (pigments).

African Sharptooth catfish *Clarias gariepinus* is one of the most important fish species cultured in Nigeria. The Juveniles of this fish are widely produced in Nigeria (FAO, 2003). The species has shown considerable potential for use in intensive aquaculture because of its omnivorous feeding habit which allows it to feed on a wide range of food materials, for example, general supplemental feeds are obtained from Agricultural by-products (e.g. oil cakes, brans, and others, industrial residues (e.g. brewers waste) animal by-products (e.g. blood meal, maggot meal and wastes (e.g. poultry droppings). Catfish culture has over time become the desire of most fish farmers due to its continuous increasing demand (Ganesh *et al.,* 2021). As the world's campaign for the consumption of less fatty food continues to intensify, people consider fish and its products as a reliable and affordable option for required protein (FAO 2021; Henchion *et al*., 2017). Food is a major requirement for all living organisms including fish for growth, reproduction, and body maintenance (WHO 2021). In fish culture systems, the importance of feed cannot be overemphasized, since feed is the most expensive input in terms of cost in fish production. The nutritional requirement of fish is necessary in order to formulate an economical and nutritionally balanced diet for the fish (Solomon *et al.* 2012). To sustain fish under culture, a supplementary diet must be provided to complement the natural feed supply Amadi-Ibiam (2024). Feedstuffs used in aquaculture to provide basic nutrients such as protein, carbohydrates, minerals, water, vitamins, and lipids are expensive because of their competitive uses by man and other animals (Jimon *et al.*, 2014). Mosses have been neglected as a study subject for a long time.

2.0 Materials and methods

2.1 Experimental site

State University, Abakaliki, in the Department of Fisheries and Aquaculture Research and Teaching Farm. The area is located in the South East of Nigeria and has a prevailing tropical climate with a mean annual rainfall of about 1500mm. The average range of ambient temperature of 240C to 380C with a yearly average of 340C. The average relative humidity ranges from 60 to 94 percent with a year average of about 83 percent. Abakaliki lies between latitudes 50 and 60 N and between longitudes 70 and 80 E at an elevation of 59m above sea level within the South Eastern Agricultural Zone of Nigeria

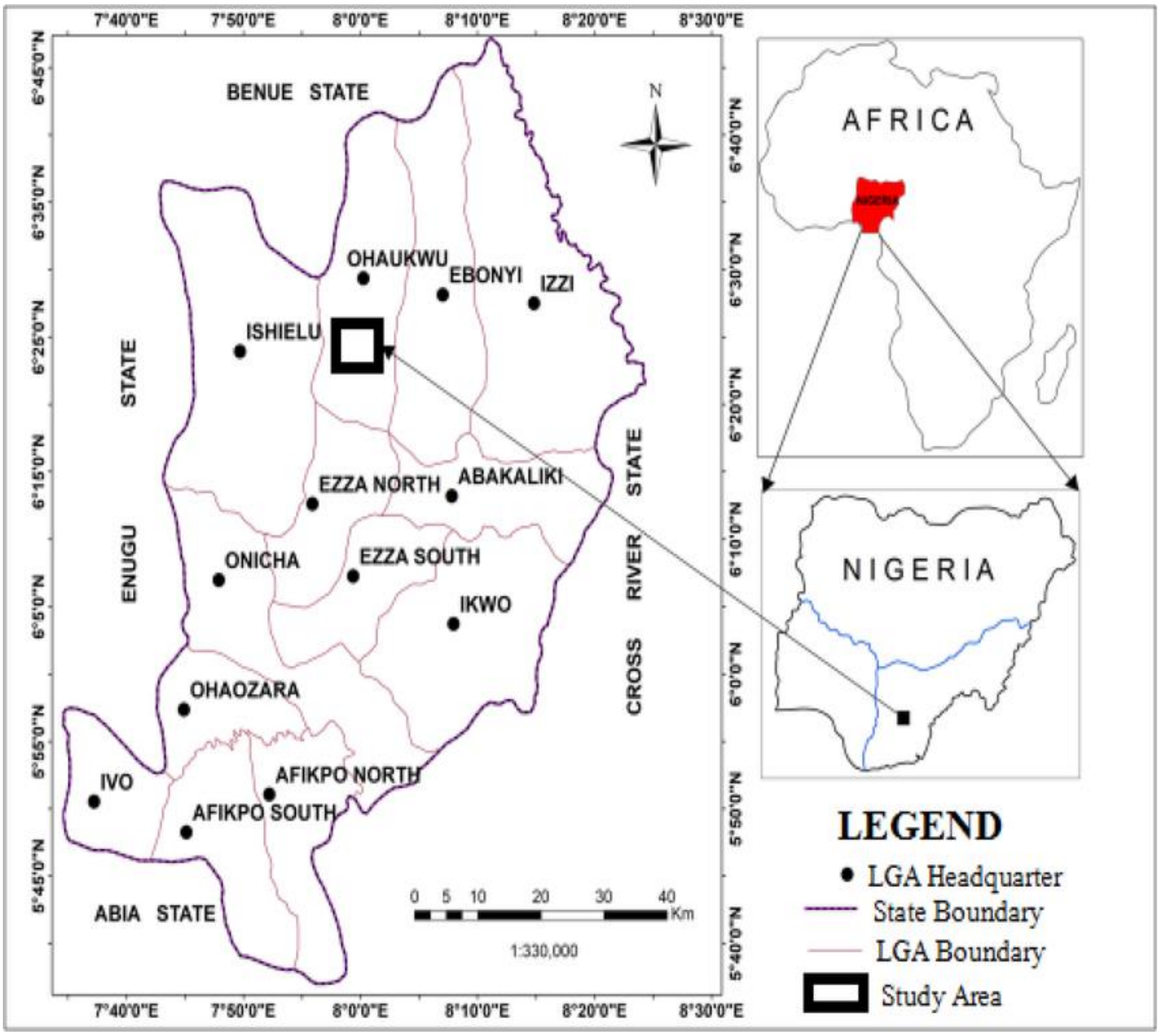


Figure 1: Map of Ebonyi state showing Abakaliki the study area

2.2 Experimental fish

One hundred and eighty (180) catfish (*Clarias gariepenus*) juveniles with average initial body-weight of Mean ± SD (g) and STD Length Mean ± SD (cm) were obtained from Amazons Farms hatcheries, Ugwuachara and divided into six treatments. Each treatment contained 30 fish. Each of the treatment groups were further subdivided into three replicates of 10 fish per replicate. All the fish for the study were homogenous in body weights and apparently healthy and were acclimated to farm conditions for 1 week prior to the commencement of the experiment.

2.3 Collection and preparation of Wheat Bran

The wheat bran was procured from the international market in Abakaliki, Ebonyi State. This was ground using a hammer grinding machine into powdered for fish feed preparation.

2.4 Preparation of Experimental Diets

The research was conducted in the Fisheries Research Unit of Ebonyi The dietary ingredients for the experiment include **Wheat bran** meal. Other ingredients include fishmeal, soybean meal, maize, vitamin Premix, mineral premix, salt, and vitamin E (antioxidant). Six different diets were compounded for experiment one each containing varying levels of the experimental diet except the control. The gross composition of the experimental diets is shown in Table 1. All the diets contain different proportions of test ingredients. The diets were all isonitrogenous (40%CP). In preparing the diet the two protein sources were included in the ratio of 2:1. Dry ingredients were ground to a powdery form to aid assimilation by fish using a gasoline-driven grinding machine in Abakaliki. The diets were thoroughly mixed with each experimental diet, Vitamin E antioxidant was added to the feed at 400ppm i.e. 400mg/kg. The dough was pelleted using a locally fabricated pelleting machine with a 2.0mm die. Diets were immediately sun-dried and later broken mechanically into small sizes.

Table 1. Percentage Compositions of Wheat bran in the diets (%)

Ingredients%	T_1	T_2	T_3	T_4	T_5	T_6
Fish meal	42.00	43.00	44.00	45.00	46.00	48.00
SBM	29.00	28.00	27.00	26.00	25.00	24.00
Wheat Roughage	-	2.00	4.00	6.00	8.00	10.00
Maize	25.00	23.00	21.00	19.00	17.00	14.00
Vitamin C	0.5	0.5	0.5	0.5	0.5	0.5
Lysine	0.5	0.5	0.5	0.5	0.5	0.5
Methionine	0.5	0.5	0.5	0.5	0.5	0.5
Fish Premix	0.5	0.5	0.5	0.5	0.5	0.5
Bone Meal	0.5	0.5	0.5	0.5	0.5	0.5

Salt	0.5	0.5	0.5	0.5	0.5	0.5
Oil (Palm oil)	0.5	0.5	0.5	0.5	0.5	0.5
Starch	0.5	0.5	0.5	0.5	0.5	0.5
Total	**100**	**100**	**100**	**100**	**100**	**100**

* Fish Premix (vital fish) manufactured by Animal Care Service Consult (Nig) Ltd. Lagos, Supplied the following per kg of premix: Vitamin A, 5000,00 IU;Vitamin D3 800,000 IU; Vitamin E, 12,000 mg; Vitamin K, 1,5000 mg; Vitamin B1, 1,000 mg; Vitamin B2, 2,000 mg, Vitamin B6, 1,500 mg; Niacin,12,000 mg; pantothenic acid, 20.00
10,000mg; iron;15,000 mg, zinc 800.00 mg; Copper 400.00 mg; Iodine 80.00 mg; cobalt 40 mg; selenium 8,00 mg. BBRCM= Bovine blood-rumen content mixture.

2.5 Diet Performance evaluation

Growth performance and nutrient utilization of fish were determined following the methods of Jimoh, and Aroyehun, (2011) in terms of Final Individual Weight, Survival (%), Specific Growth Rate (SGR %/ day), Feed Conversion Ratio, (FCR) and Protein Efficiency Ratio (PER), Net Protein Utilization (NPU) responses were calculated as

$$\textbf{Weight Gain (\%)} = \frac{\text{Final body weight} - \text{Initial body Weight}}{\text{Initial Weight}} \times \frac{100}{1}$$

$$\textbf{SGR (\%/day)} = \frac{\text{In (Final body weight} - \text{In (Initial body weight)}}{\text{Time (in days)}}$$

$$\text{Feed Conversion Ratio, (FCR)} = \frac{\text{Dry weight of feed fed}}{\text{Feed weight Gain}}$$

$$\text{Protein Efficiency Ratio (PER)} = \frac{\text{Fish weight of gain}}{\text{Protein Fed}}$$

$$\text{Protein Utilization (NPU)} = \frac{\text{Net Protein Carcass}}{\text{Protein Fed}}$$

2.6 Haematological analysis

Blood (1-2ml) was collected from the vertebral caudal blood vessel according to Schmit *et al*., (1999), using a disposable 2ml syringe and needle. The blood was emptied into the heparinized blood bottle treated with Ethyl DiamineTetracetic Acid (EDTA). A blood sample was centrifuged (1500 rpm for 7mins) to obtain the blood plasma. Plasma samples were stored at (-200C) for the electrochemical and biochemical analysis. A computerized method employing System KX-2INTM Automated Hematology Analyzer was used in blood analysis, the KX-2IN is an ideal hematology analyzer for a clinical satellite laboratory or research testing. Spectrophotometric method was used for biochemical analysis as **described by Svobodova *et al*.,** (2003). The plasma electrolytes were determined using a corning 400 flame photometer. Other metals were determined using (a back) Model 200A flame of the Atomic Absorption Spectrophotometer (AAS).

2.7 Histological examination of test organ

At the end of the experiment, one fish per treatment, that is, three fish per concentration were sampled after 96hours of exposure for histological analysis, the test organism was killed with a blow on the head, using a mallet, and was dissected to remove the vital organs (gill, liver, kidney and skin). The organs were fixed in 10% formalin for three days after which the tissue was dehydrated in periodic acid Schiff's reagent (PAS) following the method of Hughes and Perry, (1976), in graded levels of 50%, 70%, 90%, and 100% alcohol for 3 days, to allow paraffin wax to penetrate the tissue during embedding. The organs were embedded in melted wax. The tissue was sectioned into thin sections (5-7mm), by means of a rotatory microtome and was dehydrated and stained with Harris haematoxyllin-eosin (H&E) stain, Bancroft & Cook, (1994), using a microtone and each section were cleared by placing in warm water (38oC), where it was picked with clean slide and oven-dried at 58oC for 30 minutes to melt the wax. The slide containing sectioned materials/tissue was cleared using xylene and graded levels of 50%, 70%, 90%, 95%, and 100% alcohol for two minutes each. The section was stained in haematoxyline eosin for ten minutes. The stained slide was observed under a light microscope at varying X100 magnification, sections were examined and photographed using an Olympus BH2 microscope fitted with photographic attachment (Olympus C35 AD4), a camera (Olympus C40 AB-4) and an automatic light exposure unit (Olympus PM CS5P).

2.8 Biochemical composition (proximate) analysis

the biochemical composition of the carcass of the experimental fish was run to determine the Crude Protein (CP), crude Lipid (CL), Crude Fiber (CF), Moisture (M), Ash, and Nitrogen Free Extract (NFE), using standard methods (AOAC, 1990). Nitrogen was determined by the micro-kjedahl method (Pearson, 1976) and the crude protein was taken as N% x 6.25 (constant factor) where N is equal to Nitrogen content per 100g sample. Total carbohydrate was determined using the phenol-sulphuric acid method. The crude fiber was obtained by dry ashing of the sample at 550oC dissolved in 10% HCl (25ml) and 5% Lanthanum Chloride (2ml) boiled, filtered, and made up to standard volume with distilled water.

2.9 Water quality analysis

The water quality parameters were recorded for temperature, dissolved oxygen (Do) content, pH, and conductivity before and after the experiment. pH was determined using a digital pH meter (Mettler Toledo 320). DO and conductivity were measured using a digital dissolved oxygen meter (oxygen analyzer model JPB-607 portable) once a day at 8.00 am. The water quality was determined using the method of the America Public Health Association (APHA, 2000) Model Number, E-9909 (pH, TDS, Salinity, EC, Temp.)

2.10 Method of statistical analysis

The data was collated and analyzed using descriptive statistics, one-way analysis of variance, and Pearson's correlation. The differences in the means between both values were assessed with the Duncan multiple range test Using SPSS version 21 at $P<0.05$ significant level.

2.11 Results

The result of the final total length of the *Clarias gariepinus* fed diets containing wheat Bran presented in Table 2, showed that there were significant ($p<0.05$) differences in the final total length during the period of the study. However, the highest final total length was recorded among the T5, T3 and T1 respectively followed by T6 while T4 and T3 had similar records which were the least among the groups.

Table 2: Length and Weight relationship of Catfish *Clarias Gariepinus* Juveniles Used for the Experiments (Mean±SD).

Treatment	Control	1	2	3	4	5
Length (cm)	20.97±1.3^a	19.10±0.8^a	18.66±0.7^a	18.50±0.5^a	18.49±0.3^a	19.37±1.2^b
Weight (g)	69.20±0.2^b	62.63±6.2^a	59.50±1.9^a	59.03±3.5^a	59.97±5.7^a	67.73±4.5^b

Means with the same superscripts in the same column are not significantly different at P>0.05, while those with different superscripts in the same column are significantly different at same level.

2.12 Proximate analysis of Wheat Bran in the diets

The result of the proximate composition of the diets containing wheat bran used for feeding the *Clarias gariepinus* in the experiment is presented in table 3.

Table 3: Proximate analysis of Wheat bran in the diets

SAMPLE	%CP	%CFAT	%CFIBRE	%ASH	%M	%NFE	%DM
T1	38.72	5.45	2.22	7.81	9.02	36.78	90.98
T2	37.17	4.34	2.31	8.09	9.98	38.79	90.02
T3	37.29	4.82	2.29	7.41	9.31	38.88	90.69
T4	39.64	5.75	2.18	7.17	8.47	36.91	91.53
T5	38.92	5.63	2.24	7.27	8.61	37.33	91.61
T6	39.86	5.83	2.15	7.13	8.38	36.65	91.62

%NFE =100 – (%CP+%CFAT+%CFIBRE+%ASH+%M); %DM = 100 - %M

The proximate analysis of the fish diet containing wheat bran meal in the diets as presented in the Table 3 showed varying levels of nutrients in diets containing wheat bran for the experiment. The T_6 (39.86% CP) diet had the highest percentage level of crude protein followed by T_4 (39.64% CP) then T_5 (38.92% CP) and T_1 (38.72%), while T_3 and T_2 had the least crude protein. The crude fat was also highest in T_6 followed by T_4, T_5, T_1, T_3 and T_2 respectively. The crude fibre showed close similarities in the values such that they followed this trend; T_2, T_3, T_1, T_5, T_4 and T_6 respectively. The ash content, Moisture content Nitrogen Free Extract and Dry matter content equally showed little variations among the individual groups

2.13 Performance of *Clarias gariepinus* Fed diets containing Wheat Bran

The result of the productive performance of the *Clarias gariepinus* fed the diets containing wheat bran used for feeding the fish in the experiment is shown in table 4.

Table 4: Performance of *Clarias gariepinus* Fed diets containing Wheat Bran

Parameters	T_1	T_2	T_3	T_4	T_5	T_6	± SEM
Av. Initial Body Weight(g)/fish	21.1	22.7	21.5	24.3	24.9	22.6	0.45
Av. Final Body weight (g)/fish	1105	1238	1443	1534	1814	1265	0.34
Av. Daily Feed Intake (g)/fish	98	110	104	142	104	102	1.40
Av. Daily weight gain	19.35	21.70	25.38	26.96	31.95	22.19	1.23
Feed conversion Ratio	5.16	5.24	4.10	5.27	3.26	4.60	1.04
Av. Initial Total Length (cm)	35.1	36.3	35.5	35.0	34.4	34.30	0.31
Av. Final Total Length (cm)	54.8	59.0	64.3	63.6	66.04	58.9	1.01
Av. Survival rate (%)	90	90	80	85	90	80	1.20

The productive performance of the *Clarias gariepinus* Fed diets containing Wheat bran meal as indicated in Table 4 showed a close relationship in body weights of the fish with varying levels of wheat bran at the start of the experiment. The final body weight and the daily weight gain decreased as the wheat bran meal inclusion increased among the individual treatment, such that the T1 had highest final body weight and daily weight gain among those in the control group (T1) followed by T2 then T3, but T5 and T6 had similar values whereas T4 had the least weight gain, which the mean differences were statistically significant ($p<0.05$) among the individual treatments. Table 4 showed that there were no significant ($p>0.05$) differences in the daily feed intake and the total feed intake during the period of the study. Though, the highest feed intake was recorded among the T3 while others had similar records of feed intake among the groups. The results of the feed conversion ratio in Table 4 were significantly ($p <0.05$) different among the groups, such that T1 and T2 had the best FCR followed by T5 and T6 which had similar values but T4 had the lowest value.

The result of the final total length of the *Clariasgariepinus-fed* diets containing Wheat bran presented in Table 4 showed that there were significant ($p<0.05$) differences in the final total length during the period of the study. However, the highest final total length was recorded among the T5, T3 and T1 respectively followed by T6 while T4 and T3 had similar records which were the least among the groups. Table 4 showed that there were significant ($p<0.05$) differences in the survival rate during the period of the study such that T2 recorded the highest survival rate, followed by T3 and T6 while T4 and T5 had similar records and the least survival rate among the groups.

2.14 Water quality of the pond containing *Clarias gariepinus*-fed diet with wheat bran

The result of the water quality of the pond containing *clarias gariepinus* fed diet with wheat bran meal in the experiment is presented in Table 5.

Table 5 Water Quality of the pond containing *Clarias gariepinus* fed diet with wheat bran

Parameters	T_1	T_2	T_3	T_4	T_5	T_6
O'C	29.00	29.10	29.10	29.00	29.05	29.10
Ph	7.12	7.12	7.13	7.15	7.00	7.05
EC	117.10	124.60	127.00	127.80	127.80	128.05
TDS	59.20	62.90	62.61	63.30	65.10	60.10
SAL	0.05	0.05	0.05	0.05	0.05	0.05
D.O	5.05	5.00	4.95	5.05	5.00	4.90
NH3mg/l	0.10	0.20	0.20	0.10	0.20	0.20
NO_2	3.00	3.00	3.00	5.10	3.05	3.15
NO_3	5.00	5.00	5.00	5.00	5.00	5.00

The result of the average water quality of the pond containing *Clarias gariepinus* fed diet with wheat bran meal in the experiment as presented in Table 5 indicated that there were similarities in the pH level of the water such that the T1, T2, T3, and T4 had similar pH followed by T6 whereas T5 had the least pH, which the mean differences were not statistically significant ($p>0.05$) among the individual treatments.

The Total Dissolved Solid (TDS) of the pond containing graded levels of wheat bran meal as indicated in Table 5 showed a close relationship in body weights of the fish with varying levels of wheat bran at the start of the experiment. There were no significant increases ($P>0.05$) in the Total Dissolved Solid (TDS) though T5 had the highest wheat bran inclusion increased up to 4% among the individual treatments, followed by T2, T3, and T4 which had similar values then T6 whereas T1 had the least Total Dissolved Solid (TDS) which the mean differences were not statistically significant (p>0.05) among the individual treatments.

The result of the water conductivity of the pond containing *Clarias gariepinus* fed diet with wheat bran in the experiment as presented in Table 5 indicated that there were significant differences (P<0.05) among the group such that T4 (4% inclusion of wheat bran meal) had the highest level of water conductivity followed by T1, T3T5 and T6 that had similar conductivity while T2(2% inclusion of wheat bran meal) had the least. The average water salinity of the pond containing graded levels of wheat bran meal as presented in Table 5 were similar in their individual salinity of the water at varying levels of wheat bran during the experiment. The average salinity is not significantly different (P>0.05) among the individual groups as the wheat bran inclusion increased. Though there were marginal increases such that T4, had increased salinity followed by T2, then T3 and T6 whereas T5 had the least value which the mean differences were statistically not significant (p>0.05) among the groups.

The result of the average ammonia content of the water in the pond containing *Clarias gariepinus* fed diet with wheat bran meal in the experiment is presented in Table 5. This indicated that there were significant differences (P<0.05) in the ammonia content of the water such that T4, had the highest ammonia concentration followed by T3 T5, and T6 which had the same ammonia concentration, while T1 and T2 had ammonia concentration. The average Temperature (OoC), Nitrite (NO3), Nitrate (NO2), and Dissolved oxygen (DO) of the pond containing graded levels of wheat bran meal as presented in Table 5 were similar in their individual water at varying levels of wheat bran inclusion during experiment their results indicated no significant differences among the groups.

2.15 Haematological parameters of Catfish Juveniles fed Wheat bran meal

The result of the average haematological parameters of catfish (*clarias gariepinus)* juveniles fed diets containing wheat bran is presented in Table 6.

Table 6: Effect of Wheat Branon haematological parameters of Catfish *Clarias Gariepinus* Juveniles (Mean±SD).

Trt	White blood cell (ul))	Red blood cell (ul)	Haemoglobin (g/dl)	PCV	Platelet (ul)	Mean cell volume (fl)	Mean cell Haemoglobin (pg)	Mean cell Haemoglobin concentration.
Control	$1.76x10^2$±7.8[b]	$1.39x10^7$ ±9.0[a]	9.53±0.7[a]	23.61±2.1[b]	$3.05x10^4$± 16.3[ab]	1.17±2.5[a]	48.00±2.2[ab]	41.07±2.5[a]
1	$1.73x10^2$±30.6[b]	$1.10x10^7$ ±1.2[a]	9.20±3.0[a]	20.43±12.8[ab]	$5.08x10^4$± 17.6[ab]	1.06±10.7[a]	43.83±1.7[b]	26.37±20.4[a]

2	1.61x10^{2}±24.7^{b}	1.19x10^{7}±6.7^{a}	8.70±4.1^{a}	13.83±8.0^{ab}	6.19x10^{4}±47.1^{b}	1.12±10.2^{ab}	56.13±16.9^{b}	36.43±32.5^{a}
3	1.56x10^{2}±22.2^{ab}	4.90x10^{7}±7.4^{a}	7.63±1.2^{a}	11.37±8.7^{a}	2.23x10^{4}±24.4^{a}	1.19±3.8^{b}	48.00±6.7^{ab}	38.70±5.4^{a}
4	1.34x10^{2}±10.9^{a}	1.50x10^{7}±1.5^{a}	7.03±0.9^{a}	18.87±1.6^{ab}	2.46x10^{4}±22.4^{a}	0.90±0.3^{b}	46.93±5.9^{ab}	39.60±5.0^{a}
5	1.73x10^{2}±9.4^{b}	1.4x10^{7}±9.4^{a}	9.17±1.2^{a}	1..53±11.1^{ab}	2.45x10^{4}±13.2^{a}	1.17±3.0^{b}	47.47±3.6^{ab}	39.90±3.2^{a}

Means with the same superscripts in the same column are not significantly different at P>0.05, while those with different superscripts in the same column are significantly different at same level.

The result of average haematological parameters of catfish (*clarias gariepinus)* juveniles fed diet containing wheat bran meal is presented in the Table 6. The study showed that the haematological parameters of the catfish (*clarias gariepinus)* juveniles fed graded levels of diets containing wheat bran were not significantly different (P>0.05). Though there were marginal variations among the individual group, there were still a lot of similarities among the values in each of the groups.

2.16 Biochemical characteristics of Catfish Juveniles fed Wheat bran meal

The result of the average biochemical characteristics of catfish (*clarias gariepinus)* juveniles fed diets containing wheat bran is presented in table 7.

Table 7: Effect of Wheat Branon biochemical characteristics of Catfish *Clarias Gariepinus* Juveniles (Mean±SD).

Trt	Protein	Ether Extract	Ash	NFE	Energy	Glucose
Control	26.93±0.5^{ab}	3.38±0.1^{bc}	0.92±0.0^{b}	0.51±0.2^{b}	1.37x10^{2}±5.7^{b}	5.73±0.9^{b}
1	26.36±1.0^{a}	3.48±0.5^{c}	0.52±0.4^{a}	0.51±0.1^{b}	99.71±65.9^{a}	6.70±0.6^{a}
2	27.12±0.3^{ab}	3.26±0.4^{abc}	0.89±0.0^{b}	0.57±0.3^{b}	1.37x10^{2}±4.0^{b}	6.53±1.0^{b}
3	26.98±0.5^{ab}	3.16±0.2^{abc}	0.91±0.1^{b}	0.29±0.1^{a}	1.38x10^{2}±3.2^{b}	6.97±0.3^{b}
4	26.72±0.5^{ab}	2.93±0.7^{ab}	0.79±0.1^{b}	0.42±0.1^{ab}	1.38x10^{2}±3.8^{b}	7.37±0.2^{b}
5	27.60±1.8^{b}	2.81±0.3^{a}	0.87±0.1^{b}	0.37±0.2^{ab}	1.34x10^{2}±4.4^{b}	7.27±0.3^{b}

Means with the same superscripts in the same column are not significantly different at P>0.05, while those with different superscripts in the same column are significantly different at same level.

The result of average biochemical characteristics of catfish (C*larias gariepinus)* juveniles fed diet containing wheat bran meal is presented in the Table 7. The study showed that the protein content of the catfish (C*larias gariepinus)* juveniles fed graded levels of diets containing wheat bran were significantly different (P<0.05). The catfish fed T_4 diet had the highest percentage level protein followed by T_2, andT_6 then T_1, while T_3 and T_5 had the least protein. The average ether extract was also highest in T_2 which were similar to those in T_4, and T_6, but were significantly different (P<0.05) to T_1 and T_3 which had the same protein level, whereas T_5 had the least. The ash content, Nitrogen Free Extract, energy and glucose showed close similarities in the values such that they showed marginal variations which were not significantly different (P>0.05) among the individual groups.

Table 8: Effect Wheat bran on electrochemical characteristics of Catfish *Clarias Gariepinus* Juveniles (Mean±SD).

Treatment	Control	1	2	3	4	5
Sodium	$79.00±23.1^a$	$73.60±21.3^a$	$73.60±21.3^a$	$99.17±77.2^a$	$72.23±16.9^a$	$82.80±5.5^a$
Potassium	$39.33±6.2^{ab}$	$39.43±5.2^a$	$28.27±6.9^a$	$32.57±12.4^{ab}$	$72.18±5.8^a$	$69.12±21.1^a$

Means with the same superscripts in the same column are not significantly different at P>0.05, while those with different superscripts in the same column are significantly different at same level.

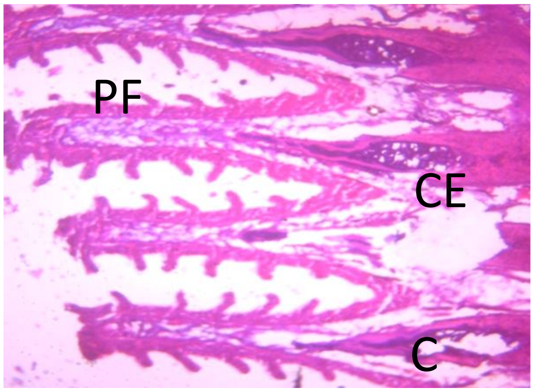
The result of the effect of Wheat bran on Amino Acid Profile of Catfish *Clarias gariepinus* Juveniles fed diet containing Wheat bran is presented in the Table 9. The study showed that the Glutamic Acid, Aspartic Acid, Valine, Threonine, Serine, Phenylalanine, Proline and Methionine increased in value while Lysine, Leucine, Arginine, Alanine, Isoleucine, Glycine, Histidine and Tryptophan reduced in value and there was no significant change in cysteine (%) all were significantly at (P<0.05).

Table 9: Effect of Wheat Bran on Amino Acid profile of Catfish *Clarias Gariepinus* Juveniles (Mean ±SD).

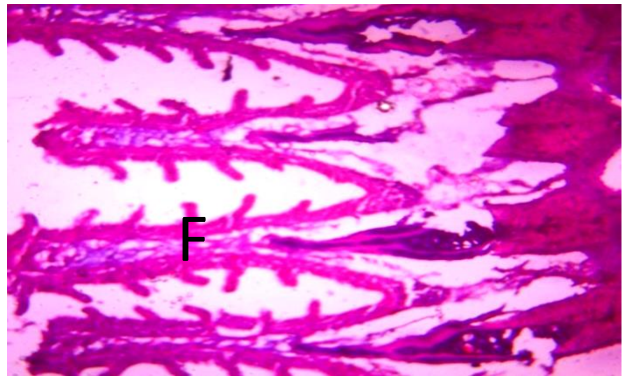
Trt	Glutamic Acid (%)	Aspartic Acid (%)	Lysine (%)	Leucine (%)	Arginine (%)	Alanine (%)	Valine (%)	Isoleucine (%)	Glycine (%)	Threonine (%)	Serine (%)	Phenylalanine (%)	Proline (%)	Methionine (%)	Histidine (%)	Cysteine (%)	Tryptophan (%)
Control	3.70±2.1[a]	6.26±4.0[a]	4.49±4.8[a]	4.61±3.2[ab]	6.25±3.9[a]	2.73±1.3[a]	3.08±1.6[a]	3.65±1.1[a]	2.63±1.6[a]	3.25±1.7[a]	2.97±1.6[a]	2.88±1.4[a]	2.31±1.1[a]	2.82±1.4[a]	3.56 ±3.5[b]	0.99±0.1[ab]	2.57±3.8[a]
1	5.22±0.6[c]	6.37±4.0[a]	4.66±6.5[a]	1.72±4.0[a]	6.37±4.0[a]	2.96±1.5[a]	3.47±1.8[a]	2.61±0.1[a]	2.95±1.7[a]	5.32±2.3[a]	3.25±1.8[a]	5.29±4.6[a]	2.82±1.5[a]	3.52±1.8[a]	6.78±4.8[ab]	1.05±0.2[bc]	2.22±3.5[a]
2	1.65±0.3[ac]	6.4.1 ±3.5[a]	4.17±0.4[a]	5.36±3.3[b]	6.41±3.5[a]	2.68±1.2[a]	3.58±0.6[a]	3.35±2.1[a]	2.76±1.2[a]	3.02±0.5[a]	2.62±1.9[a]	2.84±1.5[a]	2.14±0.9[a]	2.72±1.0[a]	2.96±0.5[ab]	1.03±0.1[a]	2.38±3.4[a]
3	5.04±0.4[c]	7.45±3.1[a]	6.82±7.0[a]	1.84±0.4[a]	5.04±2.0[a]	3.44±1.1[a]	4.06±1.5[a]	3.53±0.2[a]	3.51±1.4[a]	6.05±1.8[a]	2.82±1.4[a]	5.72±4.3[a]	3.30±1.1[a]	4.01±1.5[a]	8.38±3.8[b]	1.09±0.2[c]	2.63±3.4[a]
4	4.04±1.7[c]	7.56±3.1[a]	5.56±3.7[a]	3.85±2.8[ab]	5.50±2.0[a]	3.30±1.1[a]	3.80±1.4[a]	3.51±1.2[a]	3.34±1.4[a]	4.68±4.3[a]	3.66±1.3[a]	3.30±1.1[a]	2.93±1.1[a]	3.67±1.4[a]	4.26±4.3[b]	1.09±0.2[abc]	3.86±1.8[a]
5	2,24±1.3[ab]	7.60±1.7[a]	3.62±5.0[a]	5.57±3.1[b]	5.29±2.0[a]	3.14±1.0[a]	3.83±0.6[a]	3.64±1.7[a]	3.38±1.0[a]	3.45±1.6[a]	3.32±1.6[a]	3.31±1.2[a]	2.61±0.9[a]	3.26±1.0[a]	4.23±2.3[ab]	1.05±0.2[ab]	2.99±3.7[a]

Means with the same superscripts in the same column are not significantly different at P>0.05, while those with different superscripts in the same column are significantly different at same level.

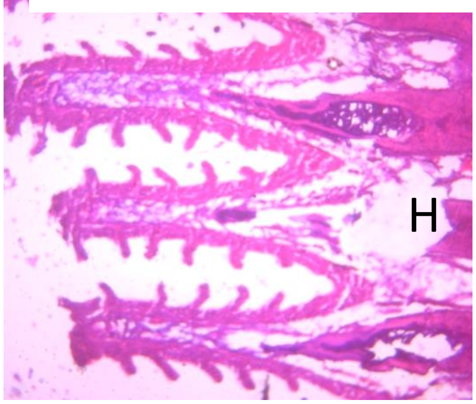
Plate A: (Fig 1-6) Histological change observed in the gill of Juvenile Catfish *Clarias gariepinus* fed with different level Wheat Bran in the diets.



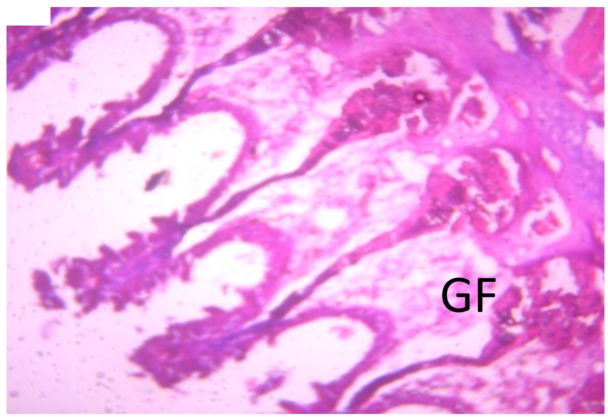
Photomicrograph of T0 control section of gill (X150)(H/E) shows normal gill architecture with well projected filament (PF) , gill epithelium (GE) and cartilages (C).



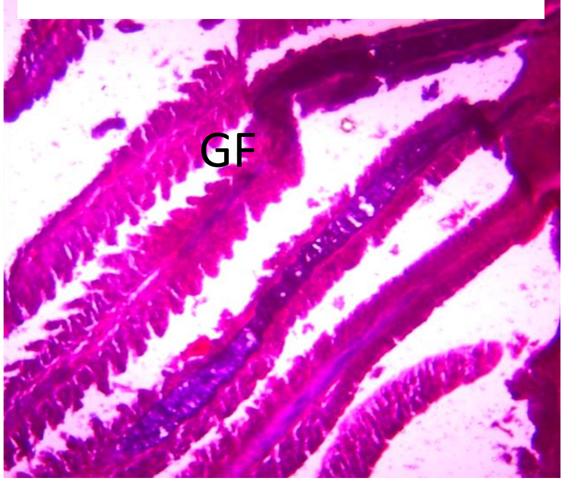
Photomicrograph of T1 section of gill (X150)(H/E) shows section of gill with necrotic filaments (F) in R2



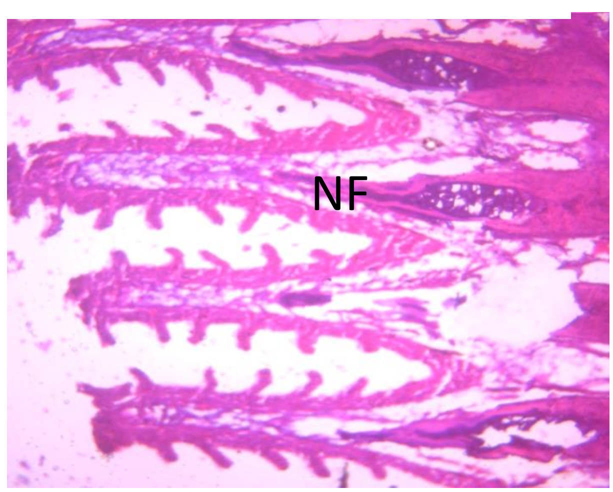
Photomicrograph of T2 section of gill (X150)(H/E) shows section of gill with moderate hypertrophy (H) of the filament in both section



Photomicrograph of T3 section of gill (X150)(H/E) shows section of gill with moderate hypertrophy of the filament in both section and ghost filament (GF)

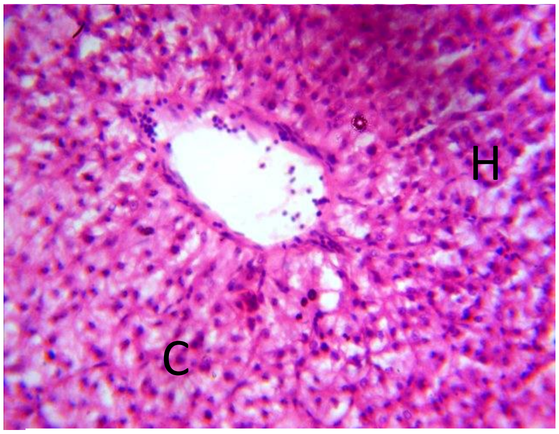


Photomicrograph of T4 section of gill (X150)(H/E) shows section of gill with severe hypertrophy of the filament in both section and ghost filament (GF)

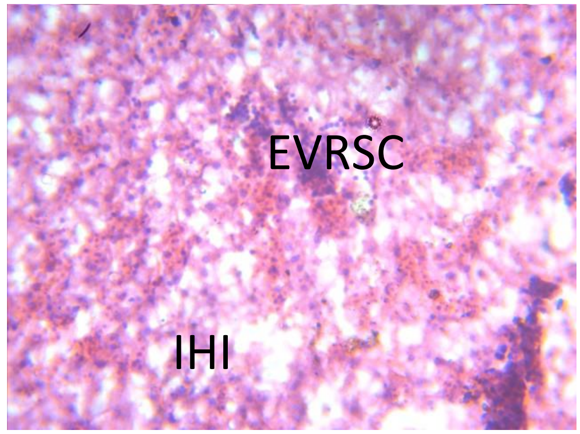


Photomicrograph of T5 section of gill (X150)(H/E) shows section of gill with severe hypertrophy of the filament in both section and necrotic filament (NF)

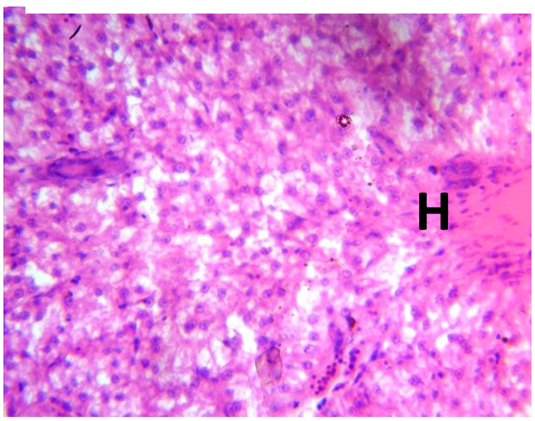
Plate B: (Fig 7-12) Histological change observed in the liver of Juvenile Catfish *Clarias gariepinus* fed with different level Wheat Bran in the diets.



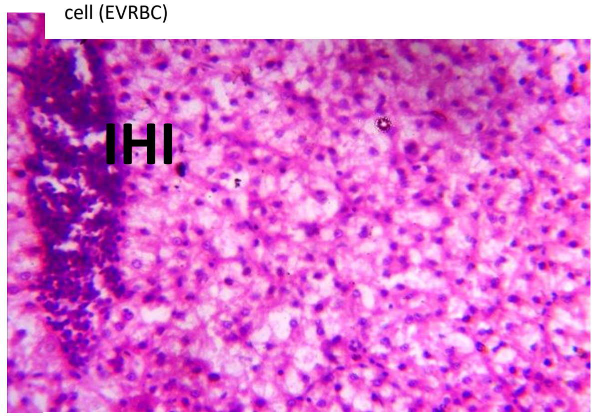
Photomicrograph of TO control section of liver (X100)(H/E) shows normal hepatic architecture with normal hepatocyte (H) and central vain (C).



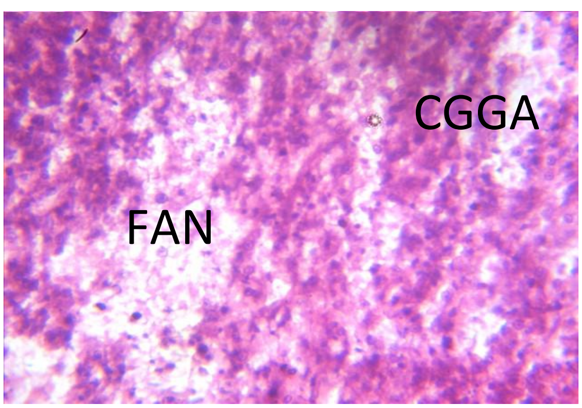
Photomicrograph of T1 section of liver (X100)(H/E) shows severe degeneration with severe intra hepatic inflammation (IHI) and moderate extrvassated red blood cell (EVRBC)



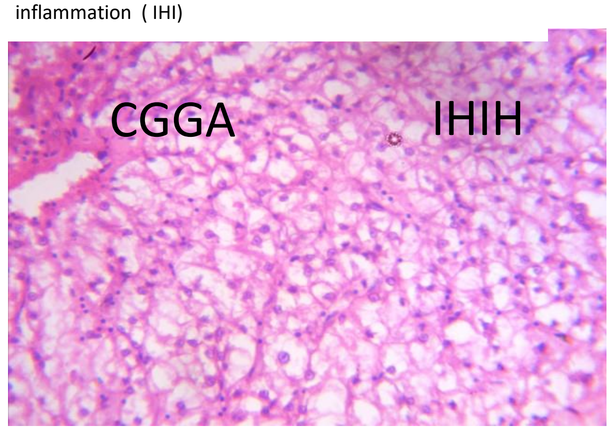
Photomicrograph of T2 section of liver (X100)(H/E) shows moderate degeneration with severe intra hepatic (H)



Photomicrograph of T3 section of liver (X100)(H/E) shows moderate degeneration with moderate intra hepatic inflammation (IHI)

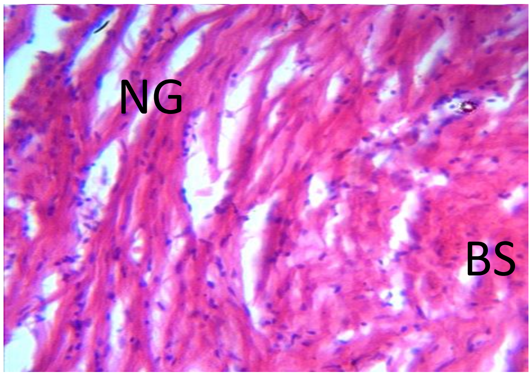


Photomicrograph of T4 section of liver (X100)(H/E) shows moderate degeneration with moderate focal area of necrosis (FAN) and cytoplasmic groundglass apperance (CGGA)

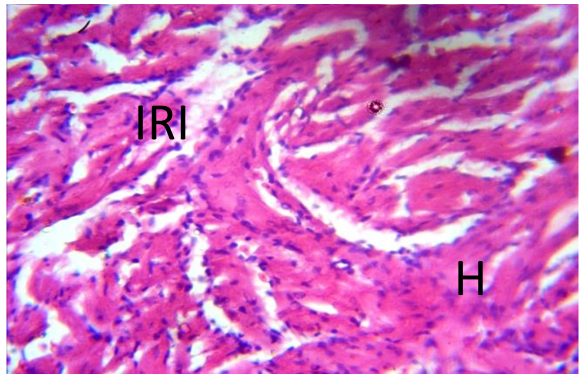


Photomicrograph of section of live T5 (X100)(H/E) administered with shows severe degeneration with severe intravassated red blood aggregate of inflammatory cell (AIC) and severe intra hepatic hemorrhage (IHH) and cytoplasmic groundglass apperance (CGGA) in R1

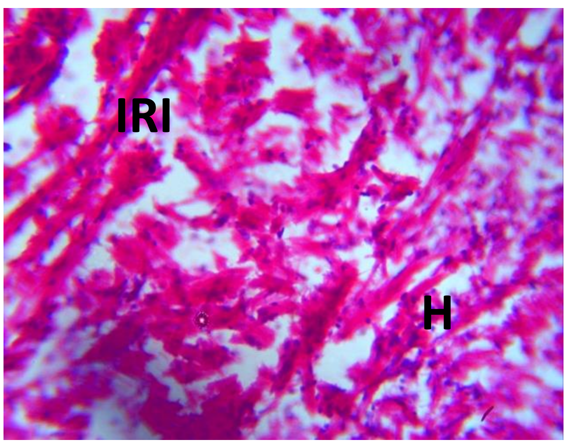
Plate C: (Fig 13-18) Histological change observed in the kidney of Juvenile Catfish *Clarias gariepinus* fed with different level Wheat Bran in the diets.



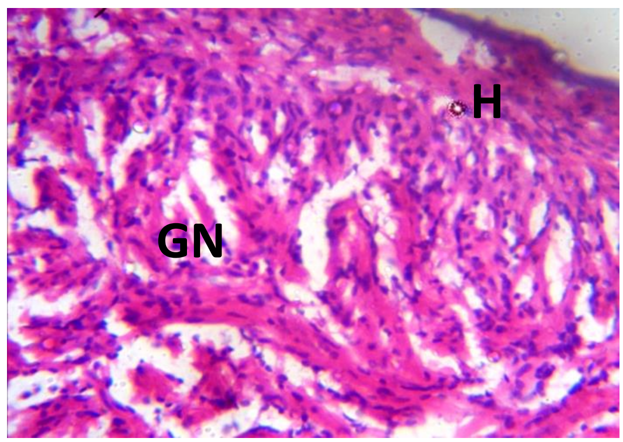
Photomicrograph T0 control section of kidney (X150)(H/E) shows normal renal architecture with normal glomeruli (NG),bowman space (BS) and



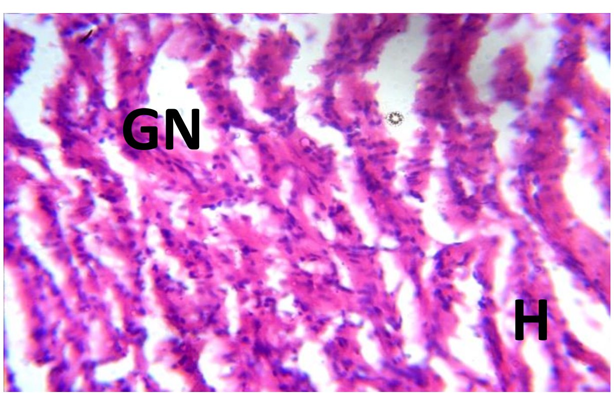
Photomicrograph T1 section of kidney administered with (X150)(H/E) shows mild effect on the renal tissue with mild focal area of mild focal area of intra renal inflammation*(IRI) and area of hemorrhage (H)*



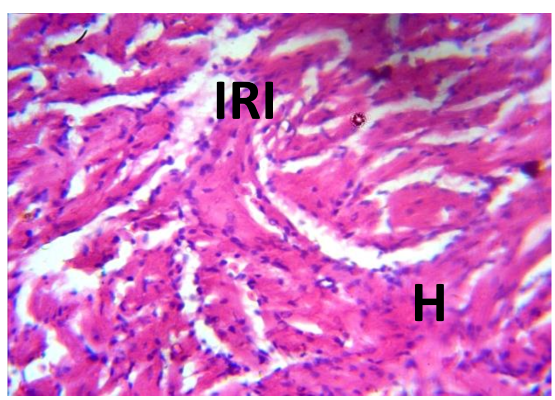
Photomicrograph T2 section of kidney administered with (X150)(H/E) shows moderate effect on the renal tissue with moderate intra renal inflammation*(IRI) and focal area of hemorrhage (H)*



Photomicrograph T3 section of kidney administered with (X150)(H/E) shows moderate effect on the renal tissue with moderate *focal area of hemorrhage (H) and glomerular necrosis (GN)*



Photomicrograph T4 section of kidney administered with (X150)(H/E) shows moderate effect on the renal tissue with moderate *focal area of hemorrhage (H) and glomerular necrosis (GN)*



Photomicrograph T5 section of kidney administered with (X150)(H/E) shows moderate effect on the renal tissue with moderate *focal area of hemorrhage (H) and intra renal inflammation (IRI)*

Plate A-C (figures 1-18) presents the results of tissue analysis of fish from the respective treatment. Histological examinations of the test fish showed some pathological changes. The wheat Bran) feed shows normal skin architecture with well-outlined epithelia cell (EC) moderate effect on the skin layer with moderate necrosis (N) of the muscular region with the epithelia lining and superficial spreading of melanoma (M) restricted to the epidermis The heart shows normal cardiac tissue with cardiac cell (CC), cardiac fiber (CF) cardiac muscles (CM) shows the moderate aggregate of myocardiac inflammation (AMI). The gill showed a section of gill with ghost (G) appearance with a severe aggregate of inflammatory cells (AIC). The liver cells revealed a section of the liver (X100) (H/E) that shows severe effects on the hepatic tissue with severe intrahepatic inflammation (IHI) and intrahepatic hemorrhage (IHIH). The damage done to these organs as a result of the feeds correlates with the concentrations of the feeds in each experimental tank.

3.0 Discussion

The costs of feed ingredients in the aquaculture sector are one of the main problems impacting the success or failure of a business. The study indicated that there is no significant difference in length and weight of Catfish *Clarias Gariepinus* Juveniles fed with Wheat bran, which is in line with Omodu and Solomon (2017) who observed that the analysis of the length-weight relationship showed that the growth of the fish is allometric. This means that the fish does not grow symmetrically. Amisah (2009), the use of wheat bran does not conflict with human food security issues and this study has demonstrated that wheat bran has the potential to partly replace conventional feed materials as they considerably reduce expenditure on fish feed, without compromising the growth performances of the African catfish When alternative food.

The result of the proximate composition of the diets containing wheat bran used for feeding the *Clarias gariepinus* in the experiment is presented in Table 23. The proximate analysis of the fish diet containing wheat bran meal in the diets as presented in Table 21 showed varying levels of nutrients in diets containing wheat bran for the experiment. The T6 (39.86% CP) diet had the highest percentage level of crude protein followed by T4 (39.64% CP) then T5 (38.92% CP) and T1(38.72%), while T3and T2 had the least crude protein. The crude fat was also highest in T6 followed by T4, T5, T1, T3, and T2 respectively. The crude fiber showed close similarities in the values such that they followed this trend; T2, T3, T1, T5, T4, and T6 respectively. The ash content, Moisture content Nitrogen Free Extract and Dry matter content equally showed little variations among the individual groups.

The result of the productive performance of the *Clarias gariepinus* fed the diets containing wheat bran used for feeding the fish in the experiment is shown in Table 24, The productive performance of the *Clarias gariepinus* Fed diets containing Wheat bran meal as indicated in Table 24 showed a close relationship in body weights of the fish varying levels of wheat bran at the start of the experiment. The final body weight and the daily weight gain decreased as the wheat bran meal inclusion increased among the individual treatments, such that the T1 had highest final body weight and daily weight gain among those in the control group (T1) followed by T2 then T3, but T5 andT6 had similar values whereas T4 had the least weight gain, which the mean differences were statistically significant (p<0.05) among the individual treatments.

Table 24 showed that there were no significant (p>0.05) differences in the daily feed intake and the total feed intake during the period of the study. Though, the highest feed intake was recorded among the T3 while others had similar records of feed intake among the groups. The results of the feed conversion ratio in Table 24 were significantly (p <0.05) different among the groups, such that T1 and T2 had the best FCR followed by T5 and T6 which had similar values but T4 had the lowest value. The result of the final total length of the *Clarias gariepinus-fed* diets containing Wheat bran presented in Table 24 showed that there were significant (p<0.05) differences in the final total length during the period of the study. However, the highest final total length was recorded among the T5, T3, and T1 respectively followed by T6 while T4 and T3 had similar records which were the least among the groups. Table 24 showed that there were significant (p<0.05) differences in the survival rate during the period of the study such that T2 recorded the highest survival rate, followed by T3 and T6 while T4 and T5 had similar records and the least survival rate among the groups.

The result of the average water quality of the pond containing *Clarias gariepinus* fed diet with wheat bran meal in the experiment as presented in table 25 indicated that there were similarities in the pH level of the water such that the T3, T4T5and T6 had the same marginally higher pH followed by T2whereas T1 had the least pH, which the mean differences were statistically not significant (p>0.05) among the individual treatments. The Total Dissolved Solid (TDS) of the pond containing graded levels of wheat bran meal as indicated in Table 25 showed a close relationship in body weights of the fish with varying levels of wheat bran at the start of the experiment. The Total Dissolved Solid (TDS) significantly increased (P<0.05) at T4 as the wheat bran inclusion increased up to 4% among the individual treatments, followed by T1, T3, T5, and T6 which had similar values whereas T2 had the least Total Dissolved Solid (TDS) which the mean differences were statistically significant (p<0.05) among the individual treatments.

The result of the water conductivity of the pond containing *Clarias gariepinus* fed diet with wheat bran in the experiment as presented in Table 25 indicated that there were significant differences (P<0.05) among the group such that T4 (4% inclusion of wheat bran meal) had the highest level of water conductivity followed by T1, T3T5and T6 that had similar conductivity while T2 (2% inclusion of wheat bran meal) had the least. The average water salinity of the pond containing graded levels of wheat bran meal as presented in Table 25 were similar in their individual salinity of the water at varying levels of wheat bran during the experiment. The average salinity is not significantly different (P>0.05) among the individual groups as the wheat bran inclusion increased. Though there were marginal increases such that T4, had increased salinity followed by T2, then T3 and T6 whereas T5 had the least value which the mean differences were statistically not significant (p>0.05) among the groups.

The result of the average ammonia content of the water in the pond containing *Clarias gariepinus* fed diet with wheat bran meal in the experiment is presented in Table 23. This indicated that there were significant differences (P<0.05) in the ammonia content of the water such that T4, had the highest ammonia concentration followed by T3T5 and T6 which had the same ammonia concentration, while T1 and T2had ammonia concentration. The average Temperature (OoC), Nitrite (NO3), Nitrate (NO2), and Dissolved oxygen (DO) of the pond containing graded levels of wheat bran meal as presented in Table 25 were similar in their individual water at varying levels of wheat bran inclusion during experiment their results indicated no significant differences among the groups.

The result of average haematological parameters of catfish (*Clarias gariepinus)* juveniles fed a diet containing wheat bran meal is presented in Table 26. The study showed that the haematological parameters of the catfish (*clarias gariepinus)* juveniles fed graded levels of diets containing wheat bran were not significantly different (P>0.05). Though there were marginal variations among the individual groups, there were still a lot of similarities among the values in each of the groups, this work is similar to the work of Nindum *et al.,* (2022) reported that Red Blood cell count, Packed Cell volume and Haemoglobin concentration were highest (p<0.05) in fish fed with "Le" feed while Mean Cell Haemoglobin Concentration, Mean Cell Haemoglobin, Mean Cell Volume, White Blood Cells Count, Lymphocytes, Monocytes, Granulocytes, and Platelets showed no significant difference (p>0.05) among the dietary treatments. while serum biochemistry, Total Cholesterol, and Glucose were highest (p<0.05) in fish fed with commercial feed while Total Protein, Alanine Transaminase, Aspartate Transaminase, and Alkaline Phosphatase were significantly higher (p<0.05) in fish fed "Lpe" and "Lex" feeds. Conclusively, variation of dietary treatments was not detrimental to the health status of *C. gariepinus* reared in plastic IBC tanks.

The result of the average biochemical characteristics of catfish (*Clarias gariepinus)* juveniles fed diets containing wheat bran is presented in Table 27. The result of average biochemical characteristics of catfish (*Clarias gariepinus)* juveniles fed a diet containing wheat bran meal is presented in Table 27. The study showed that the protein content of the catfish (*Clarias gariepinus)* juveniles fed graded levels of diets containing wheat bran were significantly different (P<0.05). The catfish fed T4diet had the highest percentage level of protein followed by T2, and T6 then T1, while T3 and T5 had the least protein. The average ether extract was also the highest which was similar to those in T4, and T6, but were significantly different (P<0.05) to T1 and which had the same protein level, whereas T5 had the least. The ash content, nitrogen-free extract, energy, and glucose showed close similarities in the values such that they showed marginal variations that were not significantly different (P>0.05) among the individual groups.

In the present research, the result of the effect of wheat Bran on Amino Acid Profile of Catfish *Clarias gariepinus* Juveniles fed a diet containing wheat Bran is presented in Table 35. The study showed that the Glutamic Acid, Aspartic Acid, Valine, Threonine, Serine, Phenylalanine, Proline, and Methionine reduced in value while Lysine, Leucine, Arginine, Alanine, Isoleucine, Glycine, Histidine and Tryptophan increased in value and there was no significant change in cysteine (%) all were significantly at (P<0.05). This work is similar to the work of Mohammed *et al.*, (2024) reported that there were no significant differences regarding growth performances and body composition among the groups, except that the feed conversion ratio was improved in D4. The different diet types did not affect hematologic parameters and blood indices. Serum growth hormone and amylase levels also revealed no significant (p = 0.09 and 0.55, respectively) differences among the groups, while serum lipase levels decreased significantly (p = 0.000) due to partial (D2) or complete (D4) substitution of fishmeal with plant protein. The replacement of fishmeal had no effects on liver (p = 0.51) and kidney functions (p = 0.34). However, D4 showed the best profit and economic efficiency compared to the other groups.

Altogether, we concluded that the substitution of fishmeal with plant protein sources is economically beneficial and maybe without any adverse effects on growth parameters, body composition, or hematologic and biochemical parameters, but with the addition of synthetic amino acids in their work to determine Growth, Hemato-Biochemical Parameters, Body Composition, and Myostatin Gene Expression of *Clarias gariepinus* Fed by Replacing Fishmeal with Plant Protein. (Fagbenro*et al*., (2000), recorded seventeen amino acids (isoleucine, leucine, lysine, methionine, cysteine, phenylalmine, tyrosine, threonine, valine, alanine, arginine, aspartic acid, glutamic acid, glycine, histidine, proline, and serine), their amino acid composition compares favorably with that of WHO/FAO protein standard indicating favorable nutritional balance except for lysine and methionine which appear marginal. The nutritional values of the phytochemicals were also assessed with a view to establishing and understanding their nutritional uses. The functional properties of the three vegetables were similar. Comparing the nutrient and chemical constituents with recommended dietary allowance (RDA) values, the results reveal that the leaves contain an appreciable amount of nutrients, minerals, vitamins, amino acids and phytochemicals and low levels of toxicants Essential or indispensable amino acids (EAAs) cannot be synthesized by fish and often remain inadequate but are needed for growth and tissue development (Fagbenro *et al*., (2000), Wilson, (1989).

Plate 1-12 (Fig 39-59) presents the results of tissue analysis of fish from the respective treatment. Histological examinations of the test fish showed some pathological changes. The wheat Bran) feed shows normal gill architecture with well-projected filament (PF), gill epithelium (GE), and cartilages (C) The liver shows normal hepatic architecture with normal hepatocyte (H) and central vein (C) and severe degeneration with severe intravassated red blood aggregate of inflammatory cell (AIC) and severe intra hepatic hemorrhage (IHH) and cytoplasmic ground glass appearance (CGGA) in R1. The heart shows normal renal architecture with normal glomeruli (NG), bowman space (BS) and) shows moderate effect on the renal tissue with moderate *focal area of hemorrhage (H) and intra renal inflammation (IRI).* The damage done to these organs as a result of the feeds correlates with the concentrations of the feeds in each experimental tank. “Several reports have indicated that gill lesions do not only indicate possibilities of impaired respiratory functions but impaired osmo-regulatory functions" (Au, 2004.). Even slight structural damage can render a fish vulnerable to osmo-regulatory as well as respiratory difficulties (Hughes and Morgan, 1973) thereby affecting the overall metabolism and survival of the fish. The histopathological alteration observed in the brain, gill, liver, intestine, and muscle/flesh is an indication of the toxic effect of *P. zeylanica* extracts to fish. This agreed with Fafioye 2001, 2004 observation when *Clarias gariepinus* and *O. niloticus* were exposed to lethal and sublethal concentrations of *Parkia biglobosa* and *Raphia vinifera* respectively.

4.0 Conclusion

The study was conducted to determine the effects of unconventional feed stuff (Wheat Bran) on growth parameters, haematology, histology, and carcass quality of *Clarias gariepinus* (burchell) (1822) juvenile. The study showed that the protein content of the catfish (*Clarias gariepinus)* juveniles fed graded levels of diets containing wheat bran were significantly different ($P<0.05$). The catfish fed T4diet had the highest percentage level of protein followed by T2, and andT6 then T1, while T3 and T5 had the least protein. The average ether extract was also the highest which was similar to those in T4, and T6, but was significantly different ($P<0.05$) to T1 and had the same protein level, whereas T5 had the least. The ash content, nitrogen-free extract, energy, and glucose showed close similarities in the values such that they showed marginal variations that were not significantly different ($P>0.05$) among the individual groups.

The study showed that the haematological parameters of the catfish (*Clarias gariepinus)* juveniles fed graded levels of diets containing wheat bran were not significantly different ($P>0.05$). The wheat Bran) feed shows normal gill architecture with well projected filament (PF), gill epithelium (GE) and cartilages (C) The liver shows normal hepatic architecture with normal hepatocyte (H) and central vein (C), and severe degeneration with severe intravasated red blood aggregate of inflammatory cell (AIC) and severe intra hepatic hemorrhage (IHH) and cytoplasmic ground glass appearance (CGGA) in R1. The heart shows normal renal architecture with normal glomeruli (NG), bowman space (BS) and) shows moderate effect on the renal tissue with moderate *focal area of hemorrhage (H) and intra renal inflammation (IRI)*

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