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GROWTH PERFORMANCE, PLASMA PROTEIN INDICES, SERUM ENZYMES AND LIVER HISTOLOGICAL CHANGES IN BROILER CHICKENS FED DIFFERENTLY PROCESSED *Parkia biglobosa* SEED MEAL DIETS

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ABSTRACT

The study determined the effects of feeding differently processed *Parkia biglobosa* seed meals (PBSM) in broiler diets on the growth performance, serum biochemical indices and liver histological changes of broiler chickens. *P. biglobosa* seeds were subjected to three processing methods namely; (1) lye treated, (2) cooked for 1 hour at 100ºC and (3) fermented for 5 days. Five experimental diets were formulated: diet T1 0% PBSM served as the control while diets in T2, T3, T4 and T5 contained 100% replacement of soybean for raw, cooked, lye treated and fermented PBSM, respectively. A total of 195 one-day-old Marshal broiler chicks were randomly distributed into 5 dietary treatments of 3 replicates with 39 birds per treatment in a completely randomized design. Data collected were subjected to one-way analysis of variance. The results showed that starter broilers fed fermented PBSM and those fed control diet had similar final body weight (FBW), average daily gain (ADG) and feed conversion ration FCR. Finisher broilers fed fermented and cooked PBSM diets had improved ($P<0.0001$) FBW, ADG and FCR ($P<0.0009$) relative to those fed raw and lye treated PBSM. Raw and lye treated PBSM caused serious adverse histological alterations in the liver. Broiler chickens fed raw PBSM diet had higher ($P<0.001$) serum uric acid concentration and elevated ($P<0.003$) serum alanine aminotransferase than those fed processed PBSM diets. In conclusion, feeding cooked and fermented PBSM enhanced broiler performance. However, mild histological alterations were observed in the liver of broilers fed cooked and fermented PBSM.

KEYWORDS

Broiler, Raw, Processed *Pakia biglobosa* seed, Liver, Histology and Organ.

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INTRODUCTION

Plants provide nearly two thirds of the world supply of food protein for human and animal in which 10-15% comes from legumes (Oso *et al*, 2011)[1]. Among the plant species, grain legumes are considered as the major source of dietary proteins. They are consumed world-wide, especially in developing and undeveloped countries where consumption of animal protein may be limited as a result of economic, social, cultural or religious factors (Esenwah and Ikenebomeh, 2008)[2]. Plant protein sources for poultry feed are expensive and they constitute about 30-35% of diet (Agbede and Aletor, 2004)[3]. The cost of poultry feed has been recognized as the major factor affecting the development and expansion of poultry enterprise in African countries (Eckman, 1995)[4]. Hence, the search for least cost formulation is currently exploring the replacement of expensive feed materials with cheaper alternatives in formulating poultry ration. Atteh *et al.* (1995)[5] suggested that the alternative plant protein should have comparative nutritive value to or preferably be cheaper than the conventional protein sources. Non-conventional feedstuffs offer cheaper and less competitive alternatives to poultry producers especially during period of scarcity of ingredients. *Parkia biglobosa* commonly known as African locust bean is a plant with an outstanding protein quality (Cook *et al.*, 2000)[6]. *P. biglobosa* seeds are harvested and processed into a fermented product locally known as 'Iru', 'Ogiri' and 'Dadawa' in Yoruba, Igbo and Hausa languages respectively in Nigeria (Odunfa, 1986)[7]. It also contribute significantly to the intake of protein, carbohydrate, calcium, phosphate, iron content and essential fatty acids, as well as vitamin B and vitamin A (Beaumont, 2002)[8]. *P. biglobosa* seed has a proximate composition of 30% crude protein, 15% fat, 4% crude fiber, 2% ash and 49% carbohydrate (Campbell-Platt, 1980)[9]. However, there is a limitation to the use of *P. biglobosa* seed as a non-conventional feedstuff ingredient due to the presence of anti-nutritional factors which includes tannins, phytic acid, oxalates and trypsin inhibitors (Alabi *et al*., 2005)[10].These anti-nutritional factors have serious implication on the performance and health status of animals when considerable amounts are ingested in feed. Processing by application of heat, fermentation, cooking, sprouting and enzymatic additions has been reported (Alabi *et al*., 2005)[10] to reduce the anti-nutritional factors in grain legumes. The physiological responses to dietary treatment on animals are best judged by chemical constituents of the feed, performance of the animal and the cellular changes in the organs (Akande *et al*, 2012)[11]. Serum biochemistry is one of the good *in vivo* assessors of feed quality and nutrient availability in both monogastric and ruminant animals. Blood is a very good medium of assessing the health status of animals (Taiwo and Anosa, 1995)[12]. Aletor (1989)[13] described the use of haematological parameters and indices of blood in assessing the differential resistance or otherwise of some animals to variation in diets composition and resultant health implications in our environment. This study was designed to evaluate the growth performance, serum enzymes, plasma protein indices, selected organs and liver histology of broiler chickens fed raw and processed *P. biglobosa* seed meal diets.

MATERIAL AND METHODS

Experimental site

The study was carried out at the Broiler Unit, Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria.

Processing of test ingredients

Dried *Parkia biglobosa* seeds used for the study were purchased from a local market in Ogbomoso, Oyo state. The seeds were separated from the dirt manually and divided into four portions for processing to minimize the anti-nutrients. Three different processing methods were used with one method per portion while the last portion was used in raw form.

Raw *Parkia biglobasa* seed meal (RPSM)

A portion of the raw seed was milled to obtain raw *Parkia biglobosa* seed meal (RPSM).

Cooked *Parkia biglobosa* seed meal (CPSM): a portion of raw seeds was cooked at 100^{o}C for 1 hour in a cooking pot, sundried to constant weight and milled to obtain CPSM

Lye treated *Parkia biglobosa* seed meal (LPSM)

lye water was prepared according to the method of Akande and Odunsi (2012)[14]. The pH of the lye water was determined using pH meter at 9.5. A portion of the *P. biglobosa* seed was then soaked in the lye water (1 part of the seed to 2 parts of lye water to completely submerge the seed) for 12 hours. The soaked *P. biglobosa* seed was removed, rinsed with fresh water and then sundried to constant weight and milled to obtain LSPM

Fermented *Parkia biglobosa* seed meal (FPSM)

The fermentation process was carried out according to the method of Obun (2007)[15]. Precisely, the seeds were cooked for 12hours at 100^0C and later the seed coat was separated from the seed. The seeds were traditionally fermented in polythene sack at room temperature for 5 days. The fermented seeds were removed, sundried to constant weight and milled to obtain FPSM.

Formulation of the experimental Diets

Five (5) experimental diets were formulated for this study namely: Diet 1 (T1) contained 0% *Parkia biglobosa* seed meal and served as the control; while diets 2 (T2), 3 (T3), 4 (T4) and 5 (T5) contained 33% inclusion level (100% replacement of soybean meal) of RPSM, CPSM, LPSM and FPSM respectively as presented in Table No.1 (starter diet) and Table No.2 (finisher diet).

Experiment Animal and Management

A total of 195 one-day-old Marshal broiler chicks purchased from a reputable farm were subdivided into five treatment groups of 39 birds per treatment. The birds were randomly assigned to the five diets in a completely randomized design with 3 replicates per treatment. Each replicate contained 13 birds. Feed and water were offered *ad libitum* to the birds. Routine management practices and vaccination were undertaken during the six weeks of the experiment.

Data collection

Growth performance characteristics

Initial body weights of the birds were taken on replicate basis at the beginning of the experiment and thereafter on weekly basis. Weekly feed intake was also recorded. The average daily gain, daily feed intake and feed conversion ratio were calculated from the data obtained at the end of the experiment.

Blood biochemical indices

On the 40^{th} day of the experiment, six blood samples per treatment were collected from the wing vein of birds. The blood samples from each group was collected into sample bottles containing ethylene diamine tetra acetic acid (EDTA) for plasma protein and albumin analysis at the Chemical Pathology laboratory of the LAUTECH Teaching Hospital, Ogbomoso. Six blood samples were also collected into bottles without anticoagulant for the assessment of serum enzymes and serum uric acid.

Selected organs and intestinal content measurement

On the 42^{nd} day of the study, 6 birds per treatment were selected and fasted for 18 hours but they had access to clean drinking water. These birds were decapitated and some of the organs were taken for measurement. The weights of the organs were expressed based on the final body weight of the individual birds. Some of the selected organs were liver, kidney, while the intestinal content were caeca, whole gastrointestinal content, right and left caecum.

Histology of the liver

At the expiration of feeding trial, samples of liver were taken from slaughtered birds for histological examination. The histological slide of the liver was prepared according to the method of Amao and Olaitan (2014)[16]. The slides were mounted on a microscope for histological examination.

Chemical analysis: Proximate composition

The proximate composition of diets containing differently processed *Parkia biglobosa* seed meals were determined using procedures of the AOAC (1999)[17].

Energy determination

The metabolizable energy contents of the diets containing differently processed *Parkia biglobosa* seed meals were calculated using Pauzenga equation (Pauzenga, 1985)[18] via proximate composition of the diets.

Blood biochemical indices

The blood biochemical constituents determined namely plasma total protein, albumin, and serum uric acid were as described by Tietz (1995)[19], Doumas *et al* (1971)[20] and Wybenga *et al.* (1971)[21] respectively. Globulin was estimated as a difference in total protein and albumin. Serum enzymes such as alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase were assayed by kinetic methods SPAN kits (Moss and Handerson, 1994)[22].

Statistical analysis: All data collected were subjected to one way Analysis of Variance

(ANOVA) using SAS (1999)[23] Software Package and Duncan's option of the same software was used to separate the means at probability of 5 percent (P<0.05).

PBSM = *P. biglobosa* seed meal *Fixed ingredients consist of 4.5% fishmeal (72%CP), 0.7% bone meal, 1.55% limestone, 0.1%methionine, 0.25% vitamin premix+, 0.3% salt. +Broiler vitamin premix supplied the following vitamins and trace elements per kg diet: 8000IU Vit .A; 16000IU Vit. D_3: 150IU Vit. E;20mg Vit.K; 30mg Vit.B_2; 0.5g Vit. C; 200mg Niacin; 60mg Panthothenic acid; 200mg Iron; 15mg Vit. B6; 100mg Vit. B_{12}; 5mg Folic acid; 4mg Biotin; 1500mg Choline chloride; 1mg Cobalt; 6mg Copper; 100mg Iodine; 900mg Manganese; 1mg selenium; 200mg Zinc and 13mg Antioxidant. ** Metabolizable energy of the raw and processed *P. biglobosa* seed meals were used to estimate that of the experimental diets (see Table No 1).

PBSM= *P. biglobosa* seed meal *Fixed ingredients consist of 3% fishmeal (72%CP), 0.7% bone meal, 1.55% limestone, 0.1% methionine, 0.25% vitamin premix+ and 0.3% salt.

+Broiler vitamin premix supplied the following vitamins and trace elements per kg diet: 8000IU Vit .A; 16000IU Vit. D_3: 150IU Vit. E; 20mg Vit.K; 30mg Vit. B_2; 0.5g Vit.C.; 200mg Niacin; 60mg Panthothenic acid; 200mg Iron; 15mg Vit B6; 100mg Vit B_{12}; 5mg folic acid; 4mg Biotin; 1500mg Choline chloride; 1mg Cobalt; 6mg Copper; 100mg Iodine; 900mg Manganese; 1mg selenium; 200mg Zinc and 13mg antioxidant. **Metabolizable energy of the raw and processed *P. biglobosa* seed meals were used to estimate that of the experimental diets (see Table No.2).

RESULTS AND DISCUSSION

The proximate composition of raw and processed *Parkia biglobosa* seed meals is shown in Table No.3. Cooked and lye treated *P. biglobosa* seed meals had lower crude protein than the raw seed meal. However, fermentation of the seeds led to tremendous improvement in the crude protein (with about 91% increment) of the fermented bean meal. It also lowered the crude fibre content of the fermented *P. biglobosa* seed meal. It implied that fermentation is more of preferred processing method for improving the nutritional content of Parkia seeds. Odebunmi *et al*. (2010)[24] reported the nutritional components of fermented locust beans (except ash) were significantly higher than those of the raw beans. Alabi *et al.* (2005)[10] also suggested that cooking and fermentation were better methods of processing to eliminate the antinutritional factors in *P. biglobosa* seeds such as tannin, oxalate, phytate and hydrogen cyanide. The crude protein content of fermented *P. biglobosa* seed meal reported in the present study was higher than most of the findings of other authors (35.73%, 34.3% by Odebunmi *et al.*, 2010[24] and Obizoba 1998[25], respectively). Omafuvbe *et al.* (2004)[26] documented 31.7, 31.3 and 32.9% in *P biglobosa* seed fermented respectively for 24, 48 and 72 hours. The processing method adopted by Omafuvbe *et al.* (2004)[26] involved boiling the raw seeds for 12 hours, soaked in hot water for another 12 hours and finally the cotyledons were cooked for another 6 hours prior to 3-4 days fermentation. So it seems different techniques in the processing methods may account for the varied crude protein contents in reported studies. Moreover, the technique adopted for fermentation of *P. biglobosa* seed in the present study seems to improve the crude protein content in the bean meal better than previous reports.

The growth performance of broiler starters fed raw and processed *Parkia biglobosa* seed meal diets from day 1st to 21st day is shown in Table No.4. The results showed that there were significant differences (P<0.0002) in the final body weight FBW, average daily gain ADG and feed conversion ratio FCR (P<0.0001). Broiler starters fed control diet had the best FBW, ADG and FCR. Starter broilers fed fermented PBSM diet had similar FBW, ADG and FCR with those fed control diet. Furthermore, broiler starters fed raw *Parkia biglobosa* seed meal diet had the lowest FBW and ADG with very poor FCR. The observation on the starters fed fermented PBSM diet concurred with the finding of Obun (2007)[15] who reported improved growth performance and nutrient utilization in broiler finishers fed 100% replacement of fermented *P. biglobosa* seed meal for groundnut cake.

Control finishers had the heaviest FBW and ADG, meanwhile there were improvement in the FBW and ADG in broiler finishers fed cooked and fermented *P. biglobosa* seed meal diets over those fed raw and lye treated PBSM (Table No.5). This implied that cooking and fermentation were better processing methods for the seeds of *P. biglobosa* to reduce some of its anti-nutritional factors such as tannin, trypsin inhibitor. Bridget *et al*. (2004)[27] reported that fermentation of locust bean seed led to an enrichment of its amino acid content. The most important biochemical change that occurs during fermentation is extensive hydrolysis of proteins in African locust bean (Aworh, 2008)[28]. Other biochemical changes that occur during *P. biglobosa* fermentation include hydrolysis of indigestible oligosaccharides present in the bean, notably stachynose and raffinose to simple sugars by alpha and beta galactosidases, synthesis of B-vitamins (thiamine and riboflavin) and reduction of antinutritional factors (oxalate and phytate) and vitamin C (Eka 1980[29], Odunfa 1985[30], Aworh, 2008)[28]. It could also be suggested that the nutrient content in fermented *Parkia biglobosa* seed meal supported broilers growth although lower performance was observed when compared to control finishers fed corn-soybean meal diet.

The plasma protein indices and serum enzymes of broiler chickens fed raw and processed PBSM diets are shown in Table No.6. There were no significant differences in the total protein, albumin and globulin but there existed significant difference (P<0.001) in the uric acid concentrations. Broiler chickens fed raw *P. biglobosa* seed meal diets had the highest concentration of uric acid (0.82mmoI/L) while those fed cooked PBSM diets had lowest level uric acid (0.25mmol/L). This result agreed with the report of Akande and Odunsi (2012)[14] who observed increased in the uric acid and creatine level of broilers fed raw castor kernel meal. Urea is one of the waste products of protein metabolism that is excreted via the kidney and it is one of the most sensitive biochemical markers employed in the diagnosis of renal damage (Akande and Odunsi, 2012)[14]. So, in cellular damage, there will be retention of urea in the blood as noticed and this affirms an indication of functional damage to the kidney as reported by Dyer *et al*., (2000)[31]. Excess breakdown of blood protein and increase in tissue protein catabolism may also be responsible for the increment in the uric-acid concentration (Akande and Odunsi, 2012)[14]. The inclusion of raw PBSM in the broiler diets significantly (P<0.003) elevated the serum alanine aminotransferase of chickens fed PBSM diets. High serum uric acid concentration and elevated alanine aminotransferase in birds fed raw *P. biglobosa* seed meal revealed the need to process the seeds prior to use in feed formulation for broiler chickens so as to avoid cellular damage to the liver and kidney. Purines are found in all dietary sources with some foods having higher levels of purines than others (Kaneko *et al.*, 2014)[32]. Foods that are high in protein usually have high purine content. Legumes such as kidney beans, soya beans, chick peas and black grams are rich sources of purine. Uric acid is the end product of purine degradation so the avoidance of purine rich foods is commonly recommended to gout patients (Jordan *et al.*, 2007)[33]. It may be probably that high purine in *P. biglobosa* bean as in other legumes may have contributed to high uric acid concentration observed in broilers fed raw PBSM diet.

The histology of liver of birds fed differently processed *P. biglobosa* seed meals is presented in figures No1-No5. There was no histological alterations observed in livers of the birds on control diet (Figure No.1), there was normal arrangement of hepatocytes, with blood vessels neatly arranged. The histological changes observed in the liver of birds fed raw *P. biglobosa* seed meal diets (Figure No.2) were necrosis of the hepatocytes, erosion of portal vein and fatty congestion of the hepatic portal vein. Mild infiltration of the hepatocytes, erosion of portal vein and necrosis of the cells were notable in the broilers fed cooked PBSM diets (Figure No.3). There was congestion of the portal vein and necrosis of the hepatocytes in broilers fed lye *P. biglobosa* seed meal diets (Figure No.4) while congestion of the hepatocytes erosion in to the portal vein and leucocytes infiltration of the hepatic portal vein was observed on the liver of birds fed fermented *P. biglobosa* seed meal (Figure No.5). The histological changes observed in the liver of broilers fed raw, cooked, lye and fermented *P. biglobosa* seed meal diets were in consonance with the observation of Akande *et al.* (2012)[11] who fed raw and processed castor bean cake to broiler chickens and reported infiltration and degeneration of the hepatocytes. Animals with cellular infiltration, congestion of the portal vein, erosion of the portal vein and necrosis had their cells badly altered. It may be suggested that the severity of the histological observation was dependent on the level of residual antinutritional factors present in the raw and differently processed PBSM diets as indicated in the figures. According to Emiola *et al.* (2007)[34], the absence of histological lesions in broilers fed toasted and aqueous heated kidney bean meal could be attributed to the low concentrations of residual anti-nutritional factors. Akanji *et al.* (2015)[35] reported severe histopathological lesions in liver of cockerels fed 50% raw jack beans which could be attributed to the combined effects of canavanine, haemagglutinin and trypsin inhibitor activities.

Table No.1: Gross Composition of Experimental Diets for the Broiler Starters

S.No	**Ingredients (%)**	**T1 (Control)**	**T2 (Raw)**	**T3 (Cooked)**	**T 4 (Lye)**	**T5 (Fermented)**
1	Maize	57.20	57.20	57.20	57.20	57.20
2	Palm kernel meal	2.40	2.40	2.40	2.40	2.40
3	Soy bean meal	33.00	0.00	0.00	0.00	0.00
4	PBSM	0.00	33.00	33.00	33.00	33.00
5	Fixed ingredients*	7.40	7.40	7.40	7.40	7.40
6	Total	100.00	100.00	100.00	100.00	100.00
7	*Determined Analysis*					
8	Crude Protein (%)	21.75	23.50	22.25	24.09	23.50
9	Ash (%)	3.00	4.00	4.00	4.00	5.00
10	Ether Extract (%)	7.20	7.50	7.80	8.00	8.30
11	Crude Fibre (%)	6.10	5.10	7.00	8.00	8.30
12	Nitrogen Free Extract (%)	61.95	59.90	58.95	58.89	57.90
13	Dry Matter (%)	91.35	91.80	90.95	91.27	90.60
14	Metabolizable					
14	Energy (kcal/kg)**	3556.92	3574.25	3519.08	3601.28	3569.13

Table No.2: Gross Composition of Experimental Diets for the Broiler Finishers

S.No	Ingredients (%)	T 1 (Control)	T 2 (Raw)	T 3 (Cooked)	T 4 (Lye)	T 5 (Fermented)
1	Maize	38.00	38.00	38.00	38.00	38.00
2	Corn-bran	26.10	26.10	26.10	26.10	26.10
3	Soya bean meal	30.00	0.00	0.00	0.00	0.00
4	PBSM	0.00	30.00	30.00	30.00	30.00
5	Fixed ingredients*	5.90	5.90	5.90	5.90	5.90
6	Total	100.00	100.00	100.00	100.00	100.00
7	Determined Analysis					
8	Crude Protein (%)	19.80	20.50	20.90	20.50	18.95
9	Ash (%)	14.70	18.40	20.10	13.20	20.40
10	Ether Extract (%)	5.50	6.30	5.98	5.20	5.80
11	Crude Fibre (%)	5.70	5.50	5.30	5.40	5.47
12	Nitrogen Free Extract (%)	54.30	49.30	47.72	55.70	49.38
13	Dry Matter (%)	92.28	91.94	92.32	91.85	91.85
14	Calculated Metabolizable					
15	Energy (Kcal/ kg)	3144.03	2994.93	2928.48	3129.72	2899.83

Table No.3: Proximate composition of differently processed Parkia biglobosa seed meals (%)

S.No	Parameters	Raw	Cooked	Lye treated	Fermented
1	Crude protein	28.00	24.50	26.25	53.50
2	Ash	3.00	4.00	3.00	2.00
3	Ether extract	15.00	14.30	15.70	5.00
4	Crude fibre	10.00	11.10	10.50	4.27
5	Nitrogen free extract	44.00	46.10	44.55	35.23
6	Dry matter	85.98	87.01	86.11	89.86
7	Metabolizable energy (Kcal/kg)*	3825.00	3729.15	3812.50	3639.17

*Metabolizable energy of the raw and processed *P. biglobosa* seed meals was estimated from the proximate composition of the meals using Pauzenga equation (Pauzenga, 1985).

Table No.4: Growth performance of broiler starters fed raw and processed *P. biglobosa* seed meal diets (g/bird)

S.No	Parameters	T1 (Control)	T2 (Raw)	T3 (Cooked)	T4 (Lye)	T5 (Fermented)	P-value	SEM
1	Initial body weight	38.68	38.65	39.04	38.73	40.02	0.505	0.61
2	Final body weight	519.93[a]	346.26[b]	410.72[b]	353.02[b]	511.16[a]	0.0002	20.72
3	Daily gain (g/b/d)	21.92[a]	14.65[b]	17.70[b]	14.97[b]	22.44[a]	0.0002	0.98
4	Feed intake (g/b/d)	41.35	45.53	48.59	44.78	47.70	0.179	2.03
5	Feed Conversion	1.80[b]	3.12[a]	2.74[a]	3.01[a]	2.13[b]	0.0001	0.13

[a,b,c,d]Means along the same row with different superscripts are significantly different \(P<0.05).

Table No.5: Growth performance of broiler finishers fed raw and processed *P. biglobosa* seed meal diets (g/bird)

S.No	Parameters	T1 (Control)	T2 (Raw)	T3 (Cooked)	T4 (Lye)	T5 (Fermented)	P-value	SEM
1	Initial body weight	519.93^{a}	346.26^{b}	410.72^{b}	353.02^{b}	511.16^{a}	0.0002	20.72
2	Final body weight	1460.91^{a}	771.68^{d}	986.54^{c}	807·77^{d}	1072.30^{b}	<0.0001	25.08
3	Daily gain (g/b/d)	44.81^{a}	20.26^{c}	27.42^{b}	21.65^{bc}	26.72^{b}	<0.0001	1.84
4	Feed intake (g/b/d)	148.03	131.14	138.52	138.03	133.62	0.075	3.75
5	Feed Conversion	3.33^{c}	6.50^{a}	5.06^{b}	6.47^{a}	5.07^{b}	0.0009	0.38

^{a,b,c,d}Means along the same row with different superscripts are significantly different \(P<0.05).

Table No.6: Plasma protein indices, serum uric acid and serum enzymes of broiler chickens fed differently processed *Parkia biglobosa* seed meal diets

S.No	Parameters	T1 (Control)	T2 (Raw)	T3 (Cooked)	T4 (Lye)	T5 (Fermented)	P-value	SEM
1	Total Protein (g/L)	27.50	36.83	26.50	32.50	30.00	0.704	5.63
2	Albumin (g/L)	12.17	14.50	9.67	16.17	12.33	0.316	2,21
3	Globulin (g/L)	15.33	22.33	17.17	16.33	19.33	0.887	5.25
4	Uric acid (mmol/L)	0.38 ^{b}	0.82^{a}	0.25^{b}	0.33^{b}	0.28^{b}	0.001	0.09
5	ALT (IU/L)	7.83^{b}	32.00^{a}	6.17^{b}	6.83^{b}	6.50^{b}	0.003	5.29
6	AST (IU/L)	6.17	6.67	3.83	2.33	3.83	0.273	1.54
7	ALP (IU/L)	59.67	58.50	58.00	66.17	56.67	0.812	5.94

^{ab}Means along the same row with different superscripts are significantly different (P<0.050). SEM = Standar Error of Mean.

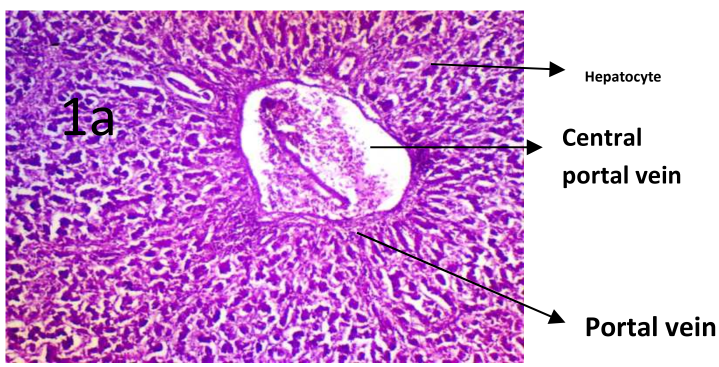

Figure No.1: Micrograph of the Liver of a bird on control diet (T1) showing Normal integrity of the Hepatocyte and blood vessels.Mag. X 100

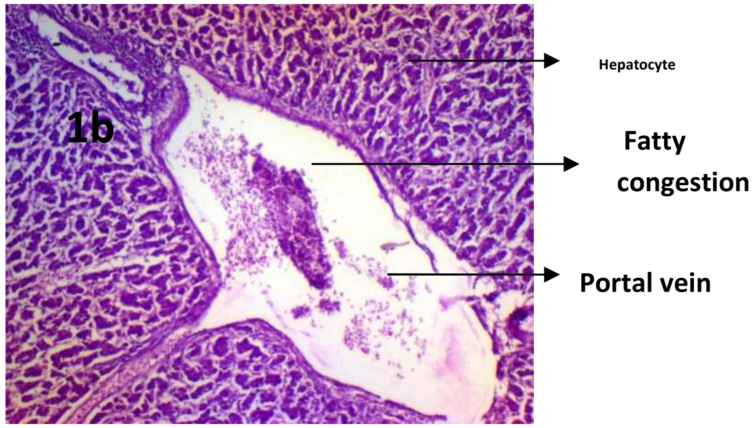

Figure No.2: Micrograph of the Liver of a bird on RPSM deit (T2) showing necrosis of the hepatocytes, erosion of portal vein and fatty congestion of the hepatic portal vein. Mag. X 100

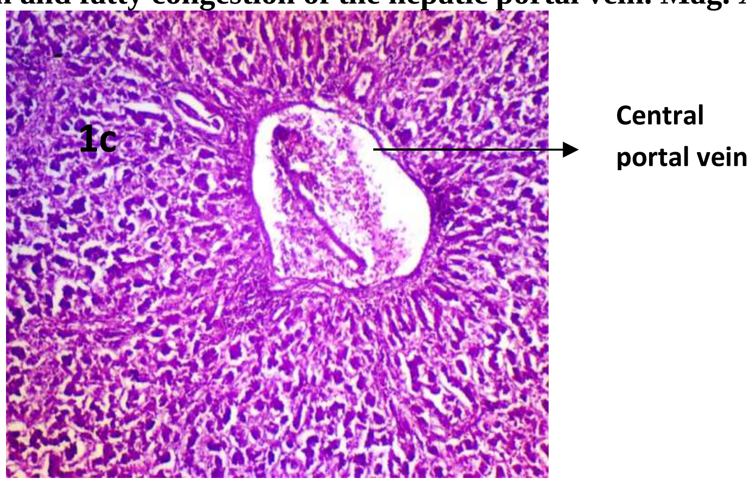

Figure No.3: Micrograph of the Liver of a bird on CPSM diet (T3) showing Mild infiltration of the hepatocytes, erosion of portal vein and necrosis of the cells. Mag. X 100

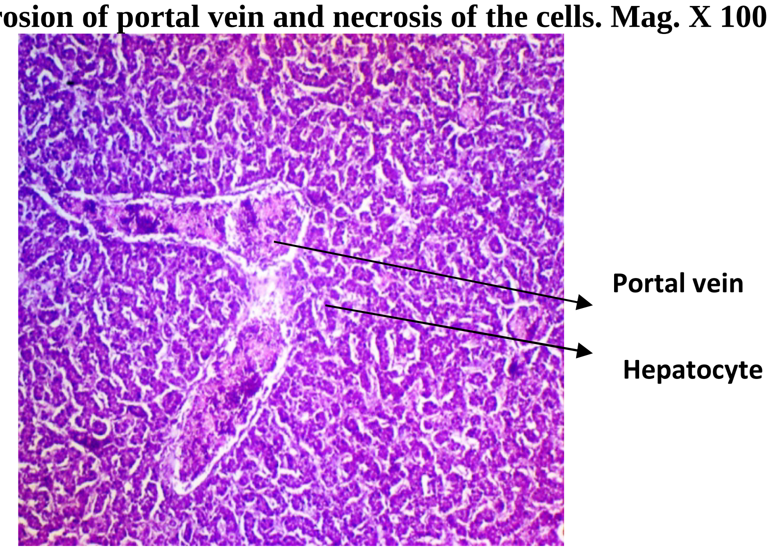

Figure No.4: Micrograph of the Liver of a bird on LPSM deit (T4) showing congestion of the portal vein and necrosis of the hepatocytes in broilers fed. Mag. X 100.

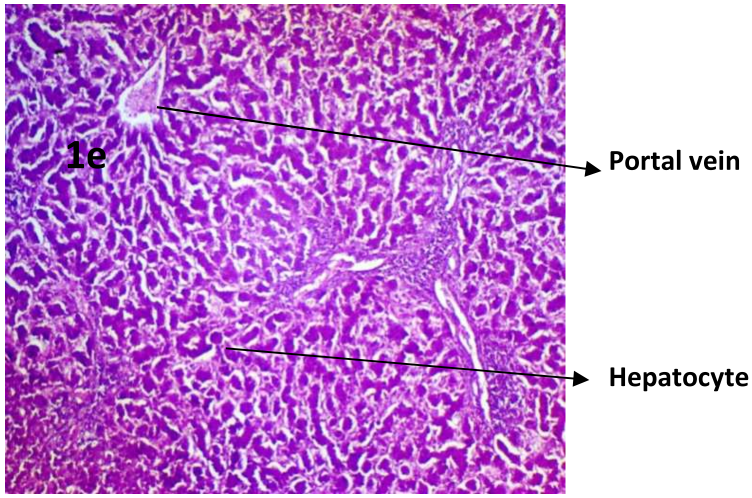

Figure No.5: Micrograph of the Liver of a bird on FPSM diet (T5) showing congestion of the hepatocytes, erosion in to the portal vein and leucocytes infiltration of the hepatic portal vein.Mag.X100.
Micrographs of livers of broiler chickens fed differently processed Parkia biglobosa seed meal diets

CONCLUSION AND RECOMMENDATION

This study demonstrated that cooked and fermented *Parkia biglobosa* seed meals supported the growth performance of broiler chickens. However, it is recommended that cooked and fermented *P. biglobosa* seed meals could used to replace soybean meal as a protein source in diet of broiler chickens particularly at period of soybean meal scarcity.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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