EFFECT OF SOAKED AND FERMENTED AFRICAN LOCUST BEAN (*Parkia biglobosa*) SEED MEAL ON GROWTH PERFORMANCE, HAEMATOLOGICAL PROFILE AND NUTRIENT DIGESTIBILITY OF BROILER CHICKENS[1]

[EFECTO DE LA SEMILLA DE LA HARINA DE SEMILLA DE ALGARROBO AFRICANO (*Parkia biglobosa*) REMOJADA Y FERMENTADA SOBRE CRECIMIENTO, PERFIL HEMATOLOGICO Y DIGESTIBILIDAD DE NUTRIENTES DE POLLOS DE ENGORDA]

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SUMMARY

African locust bean (*Parkia biglobosa*) seed is rich in protein and has recently found its way into the feed industry. This research was conducted to determine the growth performance, haematological profile and nutrient digestibility by broiler chickens fed diets containing soaked and fermented African locust bean **(***Parkia biglobosa***)** seed meal (SFALBSM). Five diets were formulated in which SFALSBM was included at graded levels of 0, 7.5, 15, 22.5 and 30% designated as T1, T2, T3, T4 and T5 respectively. Two hundred and twenty five (225) day old broiler chickens (Marshall Strain) were fed these diets in a completely randomized design and each treatment was replicated three times with 15 birds per replicate. The experiment lasted 8 weeks (4week starter phase and 4week finisher phase). The results of performance of broiler chicks at starter phase showed there were differences ($P<0.05$) in final body weight (734.25 - 937.81 g) and total weight gain of birds (679.13 -898.31 g). T3 had the highest body gain compared to other treatments. Similarly, final body weight of broilers at finisher revealed that birds fed T3 and T4 (2786.14 g and 2686.14 g) were higher ($P<0.05$) than those fed other diets. Birds fed T5 had the lowest value (2312.73g). There were differences ($P<0.05$) in the feed conversion ratio (3.26 - 4.55) and feed cost per kilogram gain (222.33 - 316.70 ₦/kg gain). The best feed conversion ratio was observed on birds fed T3 diet. The results of blood analysis showed that there were differences ($P < 0.05$) in the packed cell volume (23.33 - 27.67 %), total glucose (129.22 - 161.01 mmol/l), and red blood cell (3.30 - 4.29 $X10^6$/l). There were no effect ($P >0.05$) on digestibility of dry matter, crude protein and ash. The crude fibre, ether extract and nitrogen free extract digestibility were affected by treatments ($P<0.05$). Birds fed T3 had highest crude fibre digestibility value ($P<0.05$). It was concluded that soaked and fermented African locust bean seed meal can be included in broiler chickens diets up to 15% dietary level at the starter phase and 22.5% at the finisher phase without any adverse effect on performance, haematological profile and nutrient digestibility.

Key words: Broiler chickens; soaked and fermented; locust bean seed; performance; haematology; nutrient digestibility.

RESUMEN

La semilla de algarrobo africano (Parkia biglobosa) es rica en proteínas y recientemente ha sido reconocido por la industria de alimentos. Esta investigación se realizó para determinar el crecimiento, el perfil hematológico y la digestibilidad de nutrientes de pollos de engorde alimentados con dietas que contenían harina de semilla de algarroba africana (Parkia biglobosa) remojada y fermentada (SFALBSM). Se formularon cinco dietas en las que se incluyó SFALSBM en niveles de 0, 7,5, 15, 22,5 y 30% denominados T1, T2, T3, T4 y T5, respectivamente. Doscientos veinticinco (225) pollos (cepa de Marshall) de un día de edad fueron alimentados con estas dietas en un diseño

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completamente al azar y cada tratamiento se replicó tres veces con 15 aves por repetición. El experimento duró 8 semanas (fase inicial de 4 semanas y fase de finalización de 4 semanas). Los resultados de crecimiento de los pollos de engorde en la fase de arranque mostraron diferencias (P <0.05) en el peso vivo final (734.25 – 937.81 g) y el aumento de peso total de las aves (679.13 a 898.31 g). T3 tuvo la mayor ganancia de peso vivo en comparación con otros tratamientos. Del mismo modo, el peso vivo final de los pollos de engorde reveló que las aves alimentadas con T3 y T4 (2786.14 g y 2686.14 g) fueron más altas (P <0.05) que aquellas alimentadas con otras dietas. Las aves alimentadas con T5 tuvieron el valor más bajo (2312.73 g). Hubo diferencias (P <0.05) en la conversión alimenticia (3.26 – 4.55) y en el costo de alimentación por kilogramo de ganancia (222.33 – 316.70 ₦ / kg de ganancia). La mejor conversión alimenticia se observó en aves alimentadas con dieta T3. Los resultados del análisis de sangre mostraron diferencias (P <0.05) en el hematocrito (23.33 – 27.67%), glucosa total (129.22 – 161.01 mmol/L) y glóbulos rojos (3.30 – 4.29 x 10^6/L). No hubo efecto (P> 0.05) sobre la digestibilidad de la materia seca, proteína cruda y ceniza. La digestibilidad de la fibra cruda, extracto etéreo y extracto libre de nitrógeno fueron (P <0.05) afectados por los tratamientos. Las aves alimentadas con T3 tuvieron un valor de digestibilidad de fibra cruda alto (P <0.05). Se concluyó que la harina de semilla de algarroba africana remojada y fermentada puede incluirse en dietas de pollos de engorde hasta un 15% en la fase de arranque y un 22.5% en la fase de acabado sin ningún efecto adverso en el comportamiento, el perfil hematológico y la digestibilidad de nutrientes.
Palabras clave: pollos de engorde; remojado y fermentado; Semilla de algarroba; comportamiento; hematología; digestibilidad de nutrientes.

INTRODUCTION

Nigeria like many developing countries of the world has protein deficiency gap, especially that of high quality animal protein. This low animal protein intake has very serious implications on the health status and well-being of the citizenry (Oyawoye, 1989). The shortage of animal protein intake among the ever increasing human population in the third world countries has long been recognized (Omoikhoje *et al*., 2008). Poultry production especially broiler chicken is one of the fastest way of achieving adequate animal protein supply for the Nigerian populace due to their short generation interval and rapid growth rate (Bamgbose *et al.*, 2004). This is due to their genetic makeup when adequately nourished and managed (Uzegbu *et al.*, 2007).

Feed is the most important input in a profitable poultry production. It accounts for 70-80% of total the cost of production (Ogundipe, 1987; Kehinde *et al.*, 2006). At present, the high cost of conventional feedstuffs has brought about the need to have alternative feedstuffs that can replace the expensive ones in order to reduce the cost of livestock production (Longe, 2006; Bamgbose *et al*., 2011). Non conventional feedstuffs offer the best alternatives in our environment for reducing feed cost and therefore a reduction in the cost of meat and animal products (Dafwang *et al*., 2001). The search for alternative sources of protein from legume crops in lieu of expensive ones has been advocated (Adebowale and Lawal, 2004; Ibe and Makinde, 2014). However, legume seeds contain anti-nutritional factors like enzymes inhibitors, phytate, oxalates, saponin and polyhenolic compounds, which limit their utilization (Vijayakumari *et al*., 1997). Fortunately, remarkable improvement in the nutritive value and quality of legume seeds has been achieved by the application of various processing methods through research efforts (Dike and Odunfa, 2003).

The African locust bean tree is a leguminous plant which produces seed grain that is often cheaper and readily available in northern Nigeria. It grows in the savannah region of Nigeria, to the southern edge of zone (Oyenuga, 1968; Campbell-Platt, 1980). African locust bean seed is rich in protein and is used as a flavor intensifier for soups and stew (Dike and Odunfa, 2003). The protein content of seed varies between 25 and 30% and has the potential to be utilized in livestock feeding (Olomu, 2011). This research was aimed at investigating the nutritive value of soaked and fermented African locust bean (*Parkia biglobosa*) seed meal as a source of feed ingredient for broiler chickens.

MATERIALS AND METHODS

Experimental Site

This experiment was conducted at the Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture and Agricultural Technology, Kano University of Science and Technology, Wudil. Wudil local Government is located in the Sudan savannah region of Nigeria and the farm is located on latitude 11^0 37'N and longitude 8^0 58'E at an altitude of 403m above sea level (Olofin *et al.*, 2008).

Sources of African Locust Bean Seeds

African Locust bean seeds were purchased from Dawakin-kudu weekly market. The market is located in the Southern part of Kano state. The predominant variety of African locust bean tree available in Kano State is *Parkia biglobosa*, which is widely distributed in the area.

Processing of locust bean seeds Soaking and fermentation

Two hundred and fifty grams (250g) sample of locust bean seeds were cleaned, washed and poured into a container containing 2 litres of portable water. It was allowed to soak for 24 hours, excess water removed and the sample were allowed to ferment for 3 days in an air tight polythene bag. Fermented seeds were removed after 3 days and spread in aluminium metal trays to sun dry for 3 days.

Proximate Analysis and Determination of anti-nutritional factors

The proximate composition of the raw and soaked and fermented ALBSM samples was carried out according the method of A.O.A.C (1990)**.** The analysis was conducted at Animal Science Biochemistry laboratory of the Faculty of Agriculture, A.B.U. Zaria (Table 1). The anti-nutritional factors in the raw and processed African locust bean seeds were also determined and percent of reduction was also calculated and compared (Table 2).

Experimental Diets

Five diets were formulated such that soaked and fermented African locust bean seed meal (ALBSM) were included at dietary levels of 0, 7.5, 15, 22.5 and 30% designated as Treatment 1, 2, 3, 4 and 5 respectively. Both starter and finisher diets were formulated for the experiment as shown in Table 3 and 4 respectively.

Table 1: Proximate composition of raw and soaked and fermented African Locust Seed Meal (SKFALSM).

Parameter	Raw (%)	SKFALSM (%)
Dry matter	96.36	93.78
Crude Protein	24.31	28.56
Crude fibre	13.55	10.27
Ether extract	4.97	3.24
Ash	4.85	9.53
Nitrogen Free Extract	52.75	48.69

*SFALBSM= Soaked and fermented African Locust bean Seed meal

Table 2: Anti-nutritional factors (ANF) content (mg/100g) and percentage reduction by soaking and fermentation of African Locust bean seed (SFALBS).

Anti-nutritional factors	Raw seed	Soaked and Fermented Seed	Reduction of ANFs in SFALBS (%)
Tannin	1.08	0.11	89.89
Phytate	0.71	0.17	76.05
Saponin	2.08	0.45	78.36
Oxalate	1.78	0.43	75.84
Typsin inhibitor	0.90	0.15	83.33

Experimental Animals and Design

Two hundred and twenty five (225) day old broiler chicks (Marshall strain) were used for the experiment. After taking the initial weights, the birds were allocated to the five experimental diets in a completely randomized design (CRD). There were 45 chicks per treatment. Each treatment was replicated 3 times with 15 birds per replicate. The birds were raised on deep litter house partitioned into pens measuring 2.10m in length, 2.10 m wide and 1.25m in height. The birds were vaccinated against Gumboro disease and Newcastle diseases at two (2) and four (4) weeks respectively. Feeds and water were offered *ad libitum.* The birds were weighed weekly using 10 kg weighing balance. Feed conversion ratio was calculated as ratio of daily feed intake to daily weight gain per bird. Mortality was recorded as it occurred. The starter phase of the experiment lasted 4 weeks.

Data collection

Performance parameters

The birds were initially weighed at the beginning of the study and reweighed on weekly basis to determine the weight gain of the birds fed with different diets. A known quantity of feed was offered daily and the feed consumed by birds was determined by subtracting the leftover from the quantity of feed allocated to chicks every day. Birds were placed into an empty bucket and weighed with 10kg weighing scale on weekly basis to determine the daily weight gain. The feed conversion ratio was calculated as ratio of daily feed consumed to daily weight gain. At the end final body weights of birds were also taken and the initial body weight was subtracted for determination of total weight gain of birds.

Table 3: Composition of experimental diets for broiler starter containing graded levels of soaked and fermented of African Locust bean Seed

	% levels of inclusion of SFALBSM				
Ingredients (%)	T1 (0%)	T2 (7.5%)	T3 (15%)	T4 (22.5%)	T5 (30%)
Maize	53.00	48.50	45.00	42.60	39.00
Groundnut cake	25.00	22.00	18.00	13.50	9.00
SFALBSM	0.00	7.50	15.00	22.50	30.00
Soya bean Full-fat	10.00	10.00	10.00	10.00	10.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Wheat offal	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.30	0.30	0.30	0.30	0.30
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.25	0.25	0.25	0.25	0.25
*Vitamin-mineral premix	0.25	0.25	0.25	0.25	0.25
	100	100	100	100	100
Calculated analysis (%)					
Crude protein	23.00	23.00	23.00	23.00	23.00
M. E (Kcal/kg)	2944	2945	2954	2987	2980
Crude fibre	3.34	3.59	3.82	4.04	4.25
Ether extract	5.85	5.74	5.60	5.48	5.30
Ash	3.36	3.85	4.30	4.73	5.15
Calcium	1.36	1.37	1.38	1.39	1.40
Phosphorus	0.95	0.95	0.93	0.92	0.91
Lysine	1.21	1.26	1.30	1.34	1.37
Methionine+ cystine	0.58	0.62	0.65	0.69	0.72
Feed cost ₦/Kg	76.30	74.46	74.44	73.68	72.86

*Biomix premix supplied the following per kg of diet: Vit. A,10000 I.U., Vit. D, 2000 i.u;Vit k,2mg Vit.B1(Thiamine), 1.8mg; Vit B2 (Riboflavin), 5.5mg; Vit B6 (Pyridoxine), 0.3mg; Vit B12, 0.015mg; Pantothenic acid, 7.5mg; Folic acid, 0.75mg; Niacin, 27.5mg; Biotin, 0.6mg; Choline chloride, 3000mg; Cobalt, 0.2mg; copper, 3mg; Iodine, 1mg; Iron, 20mg; manganese, 40mg; Selenium, 0.2mg; Zinc, 30mg; Antioxidant, 1.25mg. M.E = Metabolisable Energy, SFALBSM= Soaked and Fermented African Locust Bean Seed Meal.

Determination of haematological and serum parameters

Blood samples were collected at seven weeks of age via the wing vein to determine the effects of diets on blood compositions. Sample bottles containing anticoagulant, ethylene diamine tetra acetic acid (EDTA) were used for blood collection. The blood samples were put in an ice pack and transported to the Faculty of Veterinary Medicine, Haematology laboratory of the Ahmadu Bello University, Zaria for the determination of packed cell volume (PCV), red blood cells (RBC), white blood cells (WBC) and its differential components, haemoglobin (Hb), blood glucose (BG) and total blood protein (TBP).

Nutrient digestibility

A digestibility trial was carried out at the end of finisher phase with four birds per replicate. Each treatment was replicated 3 times. A known quantity of feed was offered to birds daily and the leftover were weighed to determine the amount consumed by birds. The sample of diets and droppings from birds were conveyed and analyzed in the laboratory for proximate composition as described by A.O.A.C. (1990). Apparent nutrient digestibility of dry matter, crude protein, ether extract, crude fibre, ash and nitrogen free extract were determined.

Data Analysis

Data generated were subjected to Analysis of variance (ANOVA) using the general linear model of statistical analysis system (SAS, 2002). Statistical model used was: $Y_{ij} = \mu + Pi + eij$

Where:
Y_{ij} = the j^{th} observation of the i^{th} processing methods of Locust bean seeds
μ = the overall estimate of the population mean
P_i = the effect of the i^{th} processed seeds by inclusion in diets (T1, T2, T3, T4 and T5)
E_{ij} = the random error

Table 4: Composition of experimental diets for broiler finisher containing graded levels of Soaked and fermented ALBSM

	% Inclusion levels of SFALBSM				
Ingredients (%)	T1 (0%)	T2 (7.5%)	T3 (15%)	T4 (22.5%)	T5 (30%)
Maize	61.00	57.50	54.00	50.50	46.00
Groundnut cake	18.00	14.00	10.00	6.00	3.00
SFALBSM	0.00	7.50	15.00	22.50	30.00
Soya bean Full-fat	10.00	10.00	10.00	10.00	10.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Wheat offal	4.00	4.00	4.00	4.00	4.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.30	0.30	0.30	0.30	0.30
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.25	0.25	0.25	0.25	0.25
Vitamin-mineral premix	0.25	0.25	0.25	0.25	0.25
	100	100	100	100	100
Calculated analysis (%)					
Crude protein	21.00	21.00	21.00	21.00	21.00
M. Energy Kcal/kg	3002	3011	3019	3019	3029
Crude fibre	3.31	3.51	3.44	3.80	4.05
Ether extract	5.71	5.58	5.44	5.30	5.18
Ash	3.06	3.51	3.96	4.41	4.90
Calcium	1.35	1.36	1.37	1.39	1.40
Phosphorus	0.93	0.92	0.91	0.90	0.90
Lysine	1.11	1.15	1.19	1.23	1.29
Methionine+ cystine	0.56	0.60	0.63	0.67	0.71
Feed cost ₦/Kg	74.66	73.67	73.06	72.26	71.06

*Biomix premix supplied the following per kg of diet: Vit A, 10000 I.U; Vit D3 2000 i.u.; Vit E, 23mg; Vit K,2mg; Vit K2mg; B1 (thiamine) 1.8mg; Vit B2 (Riboflavin), 5.5mg; Vit B6 (Pyridoxine),3.0mg; Vit. B12, 0.015mg; Pantothenic acid, 7.5mg; Folic acid, 0.75mg; Biotin, 0.06mg; Choline chloride, 300mg; Cobalt, 0.2mg; copper, 3mg; Iodine, 1mg; Iron 20mg; manganese, 40mg; Selenium 0.2mg; Zinc, 30mg; Antioxidant, 1.25mg. M.E = Metabolisable Energy, SFALBSM= Soaked and Fermented African Locust Bean Seed Meal.

RESULTS AND DISCUSSION

The proximate composition of raw African locust bean seed and anti-nutritional factors with percent reduction are presented in Table 1 and 2 respectively. There were some reduction of the level of anti-nutrients after soaking and fermentation. Soaking and fermentation have been reported to reduce effectively the level of toxic compounds in the legume seeds (Ologhobo *et al.,* 1993). Walter *et al.* (1984) also reported that fermentation improved palatability besides upgrading the nutrient composition of the fermented materials.

The result of performance of broiler chicks at starter phase fed soaked and fermented ALBSM diets is presented in Table 5. There were significant differences ($P<0.05$) in the final body weight and total weight gain of broiler chicks. Final body weight was highest for birds fed 15% SFALBSM diet (937.81g) and lowest among birds fed 30% soaked and fermented African locust bean seed meal diet (734.25g). Birds fed 15% SFALBSM had significantly ($P<0.05$) higher weight gain (898.31g) compared to those fed 22.5% and 30% SFALBSM diets. Reduced weight gain observed in other treatments may be attributed to residual anti-nutritional factors in ALBSM. Effects of residual anti-nutritional factors were reported after feeding soaked mango seed in the diet of broilers (Idris, 2012). The feed intake decreased with increase in the level of soaked and fermented ALBSM in the diets. The best feed conversion ratio was observed among birds fed 15% SFALBSM (1.87) while those fed 30% SFALBSM (2.31) had the highest value. Feed conversion ratio of birds and feed cost per kilogram gain (₦/kg gain) were better for birds fed 15% ALBSM diets compared to other. This may be due to microbial fermentation. Walter *et al.* (1984) had earlier reported that fermentation improved palatability besides upgrading the nutrient composition of the fermented material.

Table 5: Performance of broiler chickens fed soaked and fermented African locust bean seed meal diets during starter phase (0-4weeks)

Parameters	Level of Soaked and fermented African locust bean seed meal in Diets						
	T1 (0%)	T2 (7.5%)	T3 (15.00%)	T4 (22.5%)	T5 (30%)	SEM	P-value
Initial body weight (g)	39.50	39.50	39.50	39.50	39.50	0.00	1.01
Final body weight (g)	919.89^{a}	881.87^{b}	937.81^{a}	895.89^{b}	734.25^{c}	19.96	0.02
Total weight gain (g)	880.39^{a}	842.37^{a}	898.31^{a}	723.81^{b}	679.13^{b}	23.98	0.03
Total feed intake (g)	1708.56^{a}	1696.99^{a}	1672.72^{b}	1625.40^{c}	1572.39^{c}	6.24	0.01
Feed conversion ratio	1.94^{b}	2.02^{b}	1.87^{a}	2.23^{c}	2.31^{c}	0.06	0.03
Feed cost ₦/kg gain	148.19^{b}	152.20^{b}	137.51^{c}	163.44^{a}	168.71^{a}	4.72	0.02
Mortality rate (%)	2.22	4.00	4.33	4.44	0.00	3.08	0.82

abc= mean with different superscripts on the same row are significantly different (P<0.05), SEM= Standard error of means, P = probability. 1USD = ₦100 as at the time of the study

The result growth performance of broiler chickens at finisher phase fed SFALBSM diets is presented in Table 6. There were significant (P<0.05) differences in final body weight and total weight gain of birds. Final body weight of broilers was highest for birds fed 15% SFALBSM (2786.14g) and the values were similar to that of birds fed diets T2 (2743.41g) and T4 (2686.14g). However, birds fed diet T5 recorded the lowest value (2312.73g) of weight compared to others. This may be attributed to effective utilization of nutrients in the diets. Soaking and fermentation have been proved to reduce effectively the level of toxic compounds in the legume seeds (Ologhobo *et al.* 1993). There were significant differences (P<0.05) in the feed conversion ratio and feed cost per kilogram gain (₦/kg gain). The best feed conversion ratio was observed among birds 7.5%, 15% and 22.55% SFALBSM diets. Better feed conversion ratio recorded among these treatments may be attributed to the reduction of anti-nutritional factors and microbial fermentation that have been reported to improved the legume grain (Odunfa, 1985). Ologhobo *et al.* (1993) reported that soaking and fermentation reduced the level of toxic compound in legume seeds and also improved the nutrients availability. Feed cost per kilogram gain (₦/kg) was significantly (P<0.05) highest for diet T5 (₦316.70) and lowest for diet T3 (₦222.33).

The result of blood analysis is presented in Table 7. There were significant differences (P < 0.05) in the packed cell volume (PCV), total glucose (TG), and red blood cell (RBC). The higher values of PCV were recorded in 7.5 and 15% SFALBSM diets (25.34 and 27.67% respectively) while other treatments had lower values (24.33, 24.01 and 23.33% for T1, T3 and T4 respectively). The packed cell volume was significantly (P<0.05) better in birds fed 15% SFALBSM diet than the control diet. The PCV, TG and RBC values are within the normal range of chickens reported by Sunchint *et al*. (2004). The total glucose and red blood cells were higher for birds fed 15% and 22.5% SFALBSM diets compared to those fed the control and the 30% ALBSM diets.

Table 6: Performance of broiler chickens fed soaked and fermented African locust bean seed meal diets during finisher phase (5-8weeks)

Parameters	Level of Soaked and fermented African locust bean seed meal in Diets						
	T1 (0%)	T2 (7.5%)	T3 (15.00%)	T4 (22.5%)	T5 (30%)	SEM	P-value
Initial body weight (g)	1350.02	1350.03	1350.02	1350.03	1350.02	0.01	0.73
Final body weight (g)	2627.06^{b}	2743.41^{a}	2786.14^{a}	2686.14^{ab}	2312.73^{c}	35.06	0.01
Total weight gain (g)	1277.04^{b}	1424.73^{a}	1438.76^{a}	1336.16^{ab}	962.72^{c}	32.85	0.02
Total feed intake (g)	4430.35^{a}	4430.91^{a}	4373.88^{a}	4377.33^{a}	4287.73^{b}	26.46	0.02
Feed conversion ratio	3.47^{b}	3.18^{ab}	3.05^{a}	3.26^{ab}	4.55^{c}	0.09	0.03
Feed cost ₦/kg gain	259.31^{b}	235.05^{c}	222.33^{c}	237.63^{bc}	316.70^{a}	6.99	0.04
Mortality rate (%)	2.22	4.00	4.33	4.44	0.00	1.24	0.45

abc= mean with different superscripts on the same row are significantly different (P<0.05), SEM= Standard error of means, P = probability. 1USD = ₦100 as at the time of the study.

Table 7: Haematological and serum parameters of broiler chickens fed soaked and fermented ALBSM diet during finisher phase (5-9weeks)

	Level of Soaked and fermented African locust bean seed meal in Diets						
Parameters	T1 (0%)	T2 (7.5%)	T3 (15.00%)	T4 (22.5%)	T5 (30%)	SEM	P-value
Pack cell volume (%)	24.33 ^{b}	25.34^{a}	27.67^{a}	24.01^{b}	23.33^{b}	1.23	0.03
Haemoglobin (g/dl)	8.17	8.40	8.30	7.97	8.20	0.39	0.52
Total protein (g/dl)	3.60	3.93	4.00	3.26	3.93	0.25	0.41
Total glucose (mmol/l)	135.49^{b}	151.17^{b}	161.01^{a}	151.83^{ab}	129.22^{c}	5.73	0.02
Red blood cell (X10^{6}/l)	2.85^{c}	3.41^{b}	4.29^{a}	3.30^{b}	3.50^{ab}	0.32	0.03
White blood cell (X10^{3}/mm)	3.21	2.90	3.86	3.83	3.04	1.31	0.08
Neutrophils **(%)**	33.74^{b}	34.62^{b}	31.69 ^{b}	45.52^{a}	42.63^{a}	1.73	0.01
Lymphocytes **(%)**	54.24^{b}	54.23^{b}	62.55 ^{a}	48.17^{bc}	44.17 ^{c}	2.58	0.03
Monocytes **(%)**	3.78^{a}	2.94^{ab}	3.40^{b}	3.31^{b}	2.21^{c}	0.35	0.02
Eosinophils **(%)**	1.38^{b}	1.72^{ab}	2.12^{a}	2.14^{a}	1.08^{c}	0.28	0.03

abc= mean with different superscripts on the same row are significantly different (P<0.05), SEM= Standard error of means, P = Probability value

The result on nutrient digestibility by broiler chickens fed SFALBSM diets is presented in Table 8. There were no significant differences (P>0.05) in the dry matter and crude protein digestibility. Crude fibre digestibility for the control and 15% SFALBSM diets were similar and significantly (P<0.05) better than other treatments. Birds fed 15% SFALBSM had the highest crude fibre digestibility value of 64.94% while birds fed 30% SFALBSM had the lowest value of 54.37%. Ether extract digestibility of birds fed 7.5%, 15% and 22.5% SFALBSM diets were similar and significantly higher than birds fed the control and 30% SFALBSM diets. Odunfa (1985) and Ready and Pierson (1999) had earlier reported that soaking and fermentation improved digestibility, nutritive value and flavors of the raw ALBS. Fermentation also facilitates microbial and enzymes action on certain anti-nutritional factor in grain legumes (Simovic *et al*., 1972). According to Bressani and Eliase (1979), low protein digestibility in grain legumes such as lablab is often associated with the presence of trypsin inhibitors, haemagglutinin and tannin. Trypsin inhibitor may overwork the pancreas in an attempt to increase trypsin production, thereby resulting to its enlargement.

CONCLUSION

Considering the results obtained from this study, it was concluded that soaked and fermented African locust bean seed meal can be included in broiler chickens diets up to 15% level at starter phase and 22.5% at the finisher phase without any adverse effect on performance, haematological parameters and nutrient digestibility.

Table 8: Apparent digestibility of nutrients by broiler chickens fed finisher diets containing soaked and fermented ALBSM

	Level of Soaked and fermented African locust bean seed meal in Diets						
Parameters	T1 (0%)	T2 (7.5%)	T3 (15%)	T4 (22.5%)	T5 (30%)	SEM	P-value
Dry matter (%)	85.01	84.28	85.58	75.49	75.95	3.06	0.22
Crude protein (%)	80.82	84.37	84.34	73.37	67.49	2.08	0.34
Crude fibre (%)	63.48^{ab}	62.20^{b}	64.94^{a}	57.62^{b}	54.37^{c}	2.70	0.03
Ether extract (%)	63.17^{c}	79.89^{a}	81.93 ^{a}	80.56 ^{a}	66.40^{b}	2.89	0.01
Ash (%)	58.71	69.13	67.99	63.10	58.06	3.31	0.49
Nitrogen free extract (%)	83.30^{b}	69.97^{c}	87.53^{a}	85.40^{a}	72.75^{bc}	1.27	0.33

abc= mean with different superscripts on the same row are significantly different (P<0.05), SEM= Standard error of mean, P = Probability value.

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