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Gross Visceral Organs Morphometry and Carcass Characteristics of Broiler Chickens Fed Differently Processed African Locust Bean Seeds

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Abstract: *An experiment was conducted to evaluate the effects of four local processing methods i.e. sprouting, salt treatment, cooking and roasting with raw African locust bean as control on visceral organs morphometry and carcass characteristics of broiler chickens. Two hundred and fifty (250) Anak 2000 unsex broiler chicks were randomly allotted to five treatments, replicated five (5) times in a completely randomized block design (CRBD). The experiment lasted for eight weeks.Results showed that the local processing methods affected organs morphometry and carcass yield (P<0.05). All the local processing methods exerted effects on carcass yield and gut morphometry (P<0.05). However, Salt treatment and cooking proved to be more efficient methods of local processing and should be recommended to farmers wishing to use ALBS as protein source.*
Keywords: *African locust bean seeds, gut morphometry, carcass yield, cuts of parts*

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I. Introduction

The rapid increase in the population of developing countries like Nigeria without corresponding increase in food production especially food of animal origin continues to be a problem resulting to child mortality, congenital complications, under nutrition andmalnutrition (Adegbola, 1998: Sobayo*et al*.,2008). Poultry industry has been described as the fastest way to ameliorate the animal protein deficiencyin developing countries due to high turnover rate, associated with poultry production and consequence economic efficiency (Dipeolu*et al*., 2001). Poultry birds have high growth rate, high feed conversion ratio, short generation interval (5-6 months), short intestinal feed transit of 2-3 hours and traits that respond to feeding manipulations within days (Atteh, 2003: Maidala and Istifanus, 2012). Poultry production is only constrained by nutrition as aresult of high cost of conventional feed ingredients (Oyawoye, 1999). The search of unconventional plant protein sources is a continuous process in order to replace the conventional expensive ones. *Parkiabiglobosa* known as African locust bean, a tropical tree which is native to Africa and widely distributed in the savanna region (Adewusi, 1992). The tree is usually and carefully preserved by inhabitants of the areas where it grows because they are valuable source of reliable food, especially the seeds which serve as source of useful ingredients for consumption as Daddawa in Hausa and Iru in Yoruba (Campbell-Platt, 1980). Locust bean is a spreading tree of medium size with compound leaves and numerous leaflets. The fruitrepresented by bunches of pods which form the nutritive part of the plant. Each pod, which may vary between 5 and 11 inches in length, contains a yellow dry powdery pulp inside which is embedded a number of dark brown and black seed (Oyenuga, 1978). About 20% of the African locust bean seeds (ALBS) are made up of semi liquid of which 54% of the fat is unsaturated with linoleic acid predominating, while 32% consist of palmitic acid. It is low in sulphur amino acid, methionine and Cysteine and similarly low in histidine but high in lysine (Oyenuga1978; Ogundun, 2007).*Parkiabiglobosa* has high protein and better amino acidprofile that recommends it for use as a protein substitute for human food and animal feed (Odunfa, 1983; Alabi, 1993; Alabi *et al*., 2004;Obun, 2007)). However, it has some Anti-Nutritional Factors (ANFs) such as trypsin inhibitor, tannins, oxalate hydrogen cyanide,phyticacid (Alabi *et al*., 2005: Akande and Fabiyi,2010: Ijarotimi andKeshinro, 2012)). Some of these ANFS are capable of inducing adverse effects especially in monogastric animals when consumed without adequate processing (Liener, 1980:Apata, 2003:Akande and Fabiyi, 2010). ANFs had been reported (Akande and Fabiyi, 2010) to be eliminated/reduced to a tolerable limit by application of heat, sprouting and fermentation, extrusion, salt treatment, micronising, enzyme treatment etc.The methods of processing the seeds against this ANF have been a major challenge to most farmers(Okagbare and Akpodiete 2006).It is against this background this researchwork

attempt to evaluate local the effect of local processing methods of African locust bean on visceral organs morphometry and carcass characteristics of broiler chickens. of broiler chickens.

II. Materials and Methods

Experimental site

Experiment was conducted at teaching and research poultry unit of School of Undergraduate Studies College of education Azare. Azare is located in Katagum Local Government Area of Bauchi State. It is located between latitudes $11^{o}30$"N and $11^{o}45^{o}$N and longitude $10^{o}10$'E and $10^{o}10$'E (Anon, 2009) It is 250km north of the capital. It covers an area of 915,045km with a population of 293,970.00 people (NPC, 2006).

Experimental birds and their Management.

Prior to the arrival of the day- old chicks, the brooding room and pens were thoroughly washed and disinfected using detergent Z- Germicide and the open sides of the pens were covered with empty cement bags. The brooder and pens were fumigated using 35g of potassium permanganate crystals and 2mls of 40% formaldehyde solution (per pen) which produced formalin gas that killed all germs and pathogens in the room. The rooms were locked for three days. The equipment's such as feeders and drinkers were also disinfected. Three days to arrival of the chicks.

Sources and processing of Ingredients.

The maize and Soybean and were purchased in Azare Central Market. The locust bean seeds were purchased in Gamawa local government. Fresh bones used as Bone meal and wheat bran were purchased in Azare central market. The premix, lysine and methionine were purchased in Animal care Kano, Kano state.

Methods of Processing of Feed Ingredients

Roasting African locust bean seeds were sand roasted by making a bed of alluvial sand in half drum and heating the sand to about 100^{o}C. Sufficient quantities of the ingredients to cover two third of the area of sand will be placed on the sand. Stirring of the ingredients will be done constantly until they are roasted for the duration of twenty to thirty minutes (20-30). Roasted African locust bean seeds are produced.

Cooking of African locust bean seeds by bringing water in a half drum to boiling point and poured the ingredients in the boiling water for thirty minutes (30) to produced full fat cooked African locust bean seeds they are then sun dried for 3-4 days.

Salt treatment was prepared by solution of saltwas prepared by adding 3% salt of total weight of sample, dissolved in water and soaked the protein sources for twenty four hours (24 hours) they are then sun dried for 3-4 days and stored in bags. African locust bean will be produced.

Sprouting of African locust bean seeds was prepared by soaking the seeds in water for twenty-four hours (24). The seeds are removed and germinated by spreading the seeds on jute bags and covered them with the same material and apply water on jute bags twice daily until the seeds begin to sprout. The sprouts were sun dried for 3-4 days. Five isonitrogenous and isocaloric diets were formulated to include the different processed African locust bean seeds. The percentage compositions of the experimental diets were presented in Table 1 and 2 respectively.

At the end of each of the experiment ten (10) birds per treatment i.e.2 birds per replicate were randomly selected for organs morphometry and carcass analysis. The birds were fasted from 6.00 pm. to 6.00am, individually weighed early in the morning (6.00 am) and slaughtered by severing the jugular vein and allowed blood to drain for five minutes. Slaughtered birds were scalded in hot water (about 50^{o}C) for one (1) minute, then plucked and eviscerated manually. The eviscerated chicken was dressed by removing the neck and the shank and the dressed chicken (carcass) was weighed and carcass yield calculated by expressing the weight of the dressed chicken as percentage weight of live chicken.

$$\text{Carcass yield (\%)} = \frac{\text{weight of dressed chicken (g)}}{\text{weight of live chicken (g)}} \times 100$$

Some cut up parts (thigh, drum sticks, wings breast muscle) and the abdominal fat were also remove, weighed and expressed as percentage of their live weight. The skin is crease between the thigh and the body was cut from to expose and dislocate the hip joint (Articulation Coxoe).The tendons and ligament around the joint were then cut to remove the thighs. The thigh and the drum stick were separate at the stipple joint (articulation genus). A cut was made in the vertical side of the carcass at the shoulder joint (Articulation humeri) to remove the wings. The breast was gently separated from the sternum using the tip of the knife.

Organmeasurements

Internal organs were excised and measured in grams and length of small intestine and large intestine were measured in centimeter. Individual organs were placed on an electric sensitive balance and the weight recorded. The length of the intestine and caeca were taken using metal meter rule. The weights of the various organs measured were expressed as a percentage of live weight.

Data Analysis

Data generated were analyzed using Analysis of variance techniques (Steel and Torrie, 1980) using the Minitab software and means were separated using Duncan's multiple range test (DMRT)

III. Results

The internal organ weight and carcass yield is presented in Table 3 while the cut up parts are presented in Table 4. All parameters measured were express as percentage of live weight in order to remove the effect of difference in body weights of birds slaughtered. The carcass parameters studied include live weight (1720-2300 g), slaughter weight (1619-2041 g), plucked weight (1610-2033 g), eviscerated weight (1606-2016 g) and dressed weight (69.77-77.00 %) and the differences between the values were statistically significant ($P<0.05$). Similarly the organs of broilers chickens fed differently processed African locust bean seeds include abdominal fat (0.33-0.57 %), gizzard (1.61-2.49 %), heart (1.62-2.31 %), liver (1.14-3.22 %), lungs (0.12-0.45 %), pancreas (0.15-0.26 %), small intestine (0.36-0.83 %), large intestine (3.29-3.76 %), Ceca (1.08-1.51 %), small intestine (44.40-60.60 cm), large intestine (136.30-164.20 cm) and all the values were statistically significant ($P<0.05$).

The percentages of cuts up parts are presented in Table 5. The parameters considered include neck (2.64-3.52 %), breast muscle (18.47-21.80 %), thigh (18.57-21.08 %), back (6.19-8.38 %), and wings (5.05-7.62 %) and the difference between the values were statistically significant ($P<0.05$).

IV. Discussion

The low level of carcass weight in the raw ALBS ($P<0.05$) can be attributed to poor performance characteristics of birds fed raw ALBS and the better performance of birds in the differently processed ALBS diets can be attributed to various reduction in ANFs levels of ALBS (Alabi *et al*., 2005). The highest live weight was obtained in cooked ALBS (2300 g) and this support earlier report made by Abeke*et al.* (2011) that boiling is an efficient method of processing. The plucked weight, eviscerated weight and carcass weight followed the same trend with raw African locust bean having the least values compared to the differently processed ALBS. The cooked ALBS hadthe best plucked weight (2023 g) and eviscerated weight ($P<0.05$). The dressing percentage of differently processed ALBS are higher than the raw ALBS ($P<0.05$)(Table 3). The best dressed percentage was obtained in cooked ALBS (77.00%), as dressing percentage is related to live weight of broilers since the surface area determine the amount of feathers and visceral organs required. The dressed weight is within the range of reports of Iheukwumere*et al*. (2007).

Heavy deposit of abdominal fat ($P<0.05$) reported in birds fed raw ALBS is attributed to the fact that birds with higher abdominal fat showed poor carcass quality (Medugu*et al*., 2010). High liver weight (3.22%) and pancreas (0.21%)($P<0.05$) reported in raw ALBS indicated hyper activity pancreas in attempting to overcome the effects of ANFS. The values of pancreas reported in this study are slightly lower than (0.28-0.32%) reported by Tamburawa*et al*., 2017 on fermented and soaked ALBS. The heart, lungs, small intestine and large intestine are significantly affected ($P<0.05$) with lower values in the control group. The development of these organs are in line with live weight since their development take toll in the development of carcasses with higher carcasses having higher values of these organs and lower carcasses having lower values. The weights of most of the organs are in line with the earlier reports of Obun(2007).The depressed cut up parts in broilers fed raw ALBS were attributed to poor performance and carcass of broilers fed raw ALBS compared to differently processed ALBS. The superior cut up parts of sprouted ALBS can be attributed to higher crude protein in the proximate composition of sprouted ALBS as earlier reported by Ijarotimi and Keshinro (2012). The cooked ALBS were followed by sprouted African locust bean seeds in the cut up parts of broilers fed differently processed ALBS. Breast muscle is one of the main features that increase high quality of finished broiler chickens (Medugu*et al*., 2010). The breast muscle is given in the following sequence sprouted ALBS<cooked ALBS<roasted ALBS< raw ALBS< salt treated ALBS. The cuts of parts are within the range of values reported by Tamburawa*et al*., 2017 on soaked and fermented ALBS.

V. Conclusion and Recommendation

Considering the results of these study all the local processing methods exerted effects on organ morphometry and carcass yield, however salt treatment and cooking were more effective and should be recommended for poultry farmers who want to use ALBS as a source of protein.

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Table 1: Ingredients and nutrient compositions (%) of different processed African locust bean seed diets fed to broiler chickens at the starter phase (1-5 weeks)

	Diets				
1	2	3	4	5	
Ingredients			**Raw**	**Sprouted**	**Salt**	**Roasted**	**Cooked**
Maize			37.52	37.52	37.52	37.52	37.52

African locust bean seeds		26.10	26.10	26.10	26.10	26.10
Soybeans (full fat)		17.48	17.48	17.48	17.48	17.48
Wheat offal		10.00	10.00	10.00	10.00	10.00
Fishmeal		5.00	5.00	5.00	5.00	5.00
Limestone		1.00	1.00	1.00	1.00	1.00
Bone meal		2.00	2.00	2.00	2.00	2.00
Sodium chloride		0.25	0.25	0.25	0.25	0.25
Lysine		0.20	0.20	0.20	0.20	0.20
Methionine		0.20	0.20	0.20	0.20	0.20
Vitamin/mineral premix*		0.25	0.25	0.25	0.25	0.25
Total		100.00	100.00	100.00	100.00	100.00
Nutrient composition (Calculated)						
Crude protein %		23	23	23	23	23
Metabolisable energy (Kcal/kg)		2800	2800	2800	2800	2800
Crude fibre		5.25	5.25	5.25	5.25	5.25
Ether extract		10.83	10.83	10.83	10.83	10.83
Calcium		1.42	1.42	1.42	1.42	1.42
Available phosphorus	0.92	0.92	0.92	0.92	0.92	

Note : * Each kilogram contains; vit. A, 10,000,000 IU, vit. D_3 2,000,000 IU, Vit. E 23,000mg, Vit. K_3 2.000mg, Vit, B_1 1,800mg, Panthothenic Acid 7,500mg, Vit. B_6 3,000mg, Vit. B_{12} 15mg, Folic acid 750mg, Biotin 11260mg, Choline Chloride 300,000mg, Cobalt 200mg, Copper 3,000mg, Iodine 1,000mg, iron 20,000mg, Manganese 40,000mg, Selenium 200mg, Zinc 30,000mg, Antioxidant 1,250mg

Table 2: Ingredients and nutrient compositions (%) of broiler finisher (21 % CP) diets containing different processed African locust bean

	Diets				
1	**2**	**3**	**4**	**5**	
Ingredients	**Raw**	**Sprouted**	**Salt**	**Roasted**	**Cooked**
Maize	39.93	39.93	39.93	39.93	39.93
African locust bean seeds		29.42	29.42	29.42	29.42	29.42
Soybean (fullfat fat)		6.75	6.75	6.75	6.75	6.75
Wheat offal		15.00	15.00	15.00	15.00	15.00
Fishmeal		5.00	5.00	5.00	5.00	5.00
Limestone		1.00	1.00	1.00	1.00	1.00
Bone meal		2.00	2.00	2.00	2.00	2.00
Lysine		0.20	0.20	0.20	0.20	0.20
Methionine		0.20	0.20	0.20	0.20	0.20
Sodium chloride		0.25	0.25	0.25	0.25	0.25
Vitamin/mineral premix*		0.25	0.25	0.25	0.25	0.25
Total		**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Nutrient composition (calculated)						
Crude protein %		21	21	21	21	21
Metabolisableenergy(Kcal/kg)		3000	3000	3000	3000	3000
Crude fibre		5.07	5.07	5.07	5.07	5.07
Ether extract		8.97	8.97	8.97	8.97	8.97
Calcium		1.43	1.43	1.43	1.43	1.43
Available phosphorus	0.92	0.92	0.92	0.92	0.92	

Note: Each kilogram contains Vit A 3600, 000 IU. Vit. D_3 600.000 IU. Vit E 4.000.000mg. Vit B_1-B_6 640, 1600, 600, 4.00mg. Panthothenic acid 2000mg, Biotin 300mg. Manganese 16000mg. Manganese 16000mg. Selenium80mg. Vit. K_3 600mg. Cobalt 80mg. Copper1200mg. Zinc 12,000mg. Folic acid 200mg. Choline chloride700000mg. Antioxidant 500mg.

Table 3: Carcass yield, internal organ weights and gut characteristics (% live weight) of broilers feddifferently processed African locust bean seeds (ALBS)

	Diets					
1	2	3	4	5		
Parameters	Raw ALBS	Sprouted ALBS	Salted ALBS	Cooked ALBS	Roasted ALBS	SEM
Live weight (g)	1720^{b}	2100^{ab}	2140^{ab}	2300^{a}	2140^{ab}	281*

Slaughter weight (g)	1619[b]	2012[a]	2069[a]	2033[a]	2041[a]	260*
Plucked weight (g)	1610[b]	2000[a]	2059[a]	2023[a]	2033[a]	243*
Eviscerated weight (g)	1606[b]	1867[a]	1959[a]	2014[a]	2016[a]	208*
Dressing percentage (%)	69.77[b]	75.00[a]	75.65[a]	77.00[a]	76.00[a]	3.47*
Abdominal fat (%)	0.57[a]	0.54[a]	0.48[ab]	0.39[b]	0.32[b]	0.15*
Gizzard (%)	2.40[a]	2.30[a]	2.49[a]	1.80[b]	1.61[b]	0.33*
Heart (%)	2.08[ab]	2.31[a]	2.50[a]	1.80[b]	1.62[b]	0.62*
Liver (%)	3.22[a]	0.34[d]	0.45[cd]	1.29[b]	1.14[b]	0.43*
Lungs (%)	0.38[a]	0.12[b]	0.15[b]	0.45[a]	0.45[a]	0.18*
Pancreas (%)	0.21[a]	0.17[b]	0.18[b]	0.16[b]	0.15[b]	0.12*
Small intestine (%)	0.83[a]	0.48[bc]	0.56[b]	0.68[a]	0.36[c]	0.19*
Large intestine (%)	3.70[b]	3.54[bc]	4.38[a]	3.29[c]	3.76[b]	0.53*
Ceca (%)	1.35[a]	1.51[a]	1.31[ab]	1.08[b]	1.30[ab]	0.27*
Small intestine (cm)	44.40[b]	60.60[a]	46.80[b]	47.40[b]	45.00[b]	8.32*
Large intestine (cm)	164.20[a]	145.90[b]	136.30[b]	155.00[a]	144.00	49.85*

SEM=Standard error of means, abc= Means bearing superscripts within the same raw are statistically different (P<0.05), ALBS= African locust bean seeds

Table 4: Cuts up parts (% carcass weight) live weight of broiler chickens fed differentlyprocessed African locust bean seeds

	Diets					
1 Parameters	2 3 Raw ALBS	4 Sprouted ALBS	5 Salted ALBS	Cooked ALBS	Roasted	SEM
Neck		2.64[d]	3.52[a]	2.94[c]	2.85[c]	3.19[b]	0.12*
Breast		18.47[b]	21.80[a]	19.10[a]	20.91[a]	19.64[a]	2.18*
Thigh		18.57[b]	21.08[a]	18.64[a]	19.90[a]	20.09[a]	2.05*
Back		6.19[c]	8.38[a]	7.09[b]	7.14[b]	7.09[b]	0.74*
Wings	5.05[b]	7.62[a]	7.07[a]	7.41[a]	6.94[a]	1.43*	

SEM= Standard error of means,abc= means bearing different superscripts within the same row are statistically different (P<0.05)

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