EFFECT OF FERMENTED BAMBARA GROUNDNUTS AND *MORINGA OLEIFERA* LEAF MEAL ON THE ORGAN CHARACTERISTICS OF BROILER CHICKENS

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ABSTRACT
The effect of fermented bambara nuts and Moringa oleifera leaves meal (MOLM) on the organ morphology of broilers was examined using a total number of one hundred and eighty (180) day old Arbor-Acres breed of broiler chickens. The birds were randomly divided into four (4) treatments replicated thrice with 15 birds per replicate in a complete randomized design (CRD) as follows: Treatment 1 has fermented bambara nuts with MOLM, treatment 2 has fermented bambara nut with premix, treatment 3 has raw bambara nut with MOLM and treatment 4 raw bambara nut with premix. The birds were kept in a deep litter system while feed and water were provided to the birds daily and all standard routine management practices were strictly observed throughout the experiment period. After the feeding trails, the relative's internal organs measurements were taken. The result reveals no significant ($p>0.05$) variations between gizzard with content, empty gizzard, liver, kidney, heart, lungs, spleen, intestinal length, and intestine weight without content in the internal organs except for the intestine with content. Perhaps, the insignificant results might be due to rearing the birds on deep litter system of production. Therefore, future research may be required on this topic using battery cage system of production.
Keywords: Bambara nuts, Broilers, *Moringa Oleifera* leaves, Morphology, Organs.

INTRODUCTION

The animal protein intake of most people living in developing countries has declined in recent year, especially Nigeria and other African countries, where the animal protein deficit involves more than 70% of the population (Oyeleke *et al.,* 2022). This deficit in animal protein has been accentuated by an increasing urbanization and galloping demography resulting from human population that grows at the rate of 3% per year (Oyeleke *et al.,* 2022). The demand for animal protein cannot be satisfied by the present level of livestock in Nigeria. Fielding, 1991 and (Ani *et al*., 2015) had attributed the low protein intake to low level of animal protein production and high cost of animal products and therefore suggested the intensification of production of highly reproductive animals with short generation intervals such as poultry, pigs and rabbits. However, the major factor militating against intensive animal production in Nigeria is the high cost of energy and protein feed ingredients like maize, Soybean , groundnut and cotton cakes. This ever-increasing cost in animal protein requires exploration of alternative feed ingredients that are cheaper and locally available. One of the ingredients that may enhance poultry production is bambara groundnut (*Vigna subterranean* BGN) as reported by (Oyeleke *et al.,* 2022). Raw bambara nut contains several anti-nutritional factors (ANF) in variable amounts that affect the utilization of bambara nut products by monogastrics [Otunola et al., 2012). Different types of fermentation procedures have been adopted in the processing of oil seeds used as feed materials to both human and livestock (Ari *et al*., 2012). Furthermore, inclusion of phytogenic feed additives (plant-derived products) such as MOLM in food animal diets has proven effective in improving the general performance of birds (Onunkwo *et al*., 2015). This class of feed additives has recently gained increased interest, especially with increased urbanization and associated consumer awareness. This also appears to be strongly driven by the ban, followed with enforcement on most of the antibiotic feed additives within the European Union in view of the speculated risk of generating antibiotic resistance of pathogenic microbes in host animals (Windish *et al*., 2007). Therefore, the present study aims to determine the effects of fermented Bambara nuts and *Moringa oleifera* leaf meal (MOLM) on the organ characteristics of broilers.

MATERIALS AND METHODS

Experimental site

The study was conducted at the poultry unit of the Research and Teaching farm of the faculty of Agriculture, Nasarawa State University, Keffi, Shabu-Lafia campus, Nasarawa State, Nigeria. The current study covers the research process within week five to eight only.

Source and processing of feed materials

Raw maize grains, bambara nuts, Moringa leaves and premix were procured from Alamis market in Lafia local government and Star Mega Feed Mill Limited at Karu local government of Nasarawa State Nigeria. A quantum of 100 kg of raw Bambara nut was poured into aluminum pots of 10 liters of boiling water per batch of 20 kg and allowed to boil at 100^0C for 30 minutes according to the methods described by (Ari et al., 2011). The boiled

bambara nuts were drained, cooled at room temperature and placed in a plastic basket covered with polythene bag and kept to ferment for 48 hours after which the products were sun dried and milled. The Moringa leaves were allowed to dry at room temperature and pounded/grinded into powder which was used as MOLM.

Experimental diets
Experimental diets were formulated to be isocaloric and isonitrogenous diet having 2850 kcal and 23% crude protein, respectively (see Table 2). The experimental feed was formulated using least cost feed formulation software feedwin®. The proximate composition of the experimental diet is presented in Table 2 and Table 1 indicating the composition of the diet of finisher phase.

Experimental design, birds, and their managements
A total of (180) one hundred and eighty day old broilers (Arbor-Acres) were randomly allotted to four treatment groups labeled; T_1 (Raw maize and fermented bambara nut with MOLM), T_2 (Raw maize and fermented bambara nut with premix), T_3 (Raw maize and raw bambara nut with MOLM), T_4 (Raw maize and raw bambara nut with premix), replicated thrice with 15 birds per replicate in a complete randomized design (CRD). The one hundred and eighty (180) birds were used for the study. All the experimental birds were weighed to determine the initial weight and were provided with feed and water *ad-libitum*. Routine management practices were carried out throughout the eight weeks period of the experiment.

Data collection
At the end of the study, relative organ measurements were made. The liver, kidney, heart, lungs, spleen, intestine and gizzard were disserted from a sample of three birds replicate (i.e., 36 birds were disserted). The organs were blotted clean with tissue paper, weighed with a digital scale. The weight of each organ was expressed in percentage (%) of the organ to body weight.

Statistical analysis
Data obtained were subjected to analysis of variance (ANOVA) using SPSS version 22. And significant differences ($p<0.05$) separated using least significant differences (LSD).

RESULTS AND DISCUSION
Table 3 shows the effects on internal organs of broilers chickens fed diet containing fermented Bambara nuts and MOLM which revealed the value of gizzard with content (GWC) did not differ from 64.77g (T_1) to 72.10g (T_4). Which was not statistical significantly ($p>0.05$). The values of empty gizzard (EG) in the table shows that treatment one (T_1) with values recorded 48.03g, treatment two (T_2) 48.13g, Treatment three (T_3) 55.00g, and treatment four (T_4) 51.17g are not significantly ($p>0.05$) different. The values recorded of Liver 31.07g (T_1), 36.77g (T_2), 40.73g (T_3) and 33.60g (T_4) respectively are not significantly ($p>0.05$) different.

The values of kidney recorded did not vary from 8.50g (T_1), 8.77g (T_2) and 8.73g (T_3) respectively, not significant ($p>0.05$) difference. The therefore has no significantly ($p>0.05$) different with the value recorded for treatment four (T_4) 6.40g. All the values recorded for Heart 10.27g (T_1), 8.23g (T_2), 38.73g (T_3), and 9.93g (T_4) respectively, in the table did not significantly ($p>0.05$) differ. The values of Lungs recorded in the table shows 8.10g (T_1), 8.13g (T_2), 11.27g (T_3) and 10.87g are not significantly ($p>0.05$) different. The Spleen values recorded in the table from 2.70g in T_1 to 8.43g in T_4 are not significantly ($p>0.05$) varied. No significant ($p>0.05$) variation ol served in the values recorded for Intestine length (IL) in T_1, T_2, T_3 and T_4 with 172.33, 185.00 and 195.67cm respectively.

The value of intestine weight with content (INT. wt with C) varied in treatment one T_1 (83.93g) with that of treatment two T_2 (97.57g). Treatment one T_1 shows the lowest value which was significantly ($p>0.05$) different from other's treatment (T_2 T_3 and T_4) WITH 97.57g, 89.13g respectively. Treatment two (T_1) recorded the highest intestinal weight with content (97.57g), which is significantly ($p>0.05$) different from the value for T_3 and T_4. Treatment three T_3 recorded the second highest value (89.13g) which is not significantly ($p>0.05$) different from the value for treatment four T_4 (85.93) the second lowest. Intestine weight without content (IWtWC) values recorded 60.13g 55.100g, 63.70g and 66.23g for T_1, T_2, T_3 and T_4 respectively did not vary. Treatment one (T_1) with recorded values 60.13g has second to the lowest value recorded with no significantly ($p>0.05$) different from T_2, T_3 and T_4 values. Treatment two T_2 recorded the lowest value (55.00g) with no significantly different ($p>0.05$) from T_3 and T_4. Treatment three T_3 shows the second highest (63.70g) with no significantly ($P>0.05$) different from T_4 with 66.23g value which has the highest value recorded in intestine without content.

The result obtained revealed that there were no significant ($p>0.05$) difference between gizzard with content, empty gizzard, liver, kidney, heart, lungs, spleen, intestinal length and intestinal weight without content except

intestine weight with content that were significantly ($p<0.05$) different. This may be as a result of keeping the birds on deep litter system, where the birds fed on their faeces. The result of this study agreed with that of (Oloyele *et al*., 2010) and (Ironkwe *et al*., 2012), who observed that there was no significant ($p>0.05$) variation between organs of birds fed oilseed meal.

Table 1: Ingredients and nutrient composition of finisher experimental diets

Ingredients (%)	T1	T2	T3	T4
Blood meal	5.00	5.10	3.50	3.50
Bone meal	4.00	3.40	2.40	2.51
Fish meal	3.70	4.00	7.00	7.00
Methionine	0.15	0.14	0.10	0.10
Lysine	0.05	0.05	0.20	0.02
Maize	50.00	50.00	48.50	48.50
Salt	0.20	0.25	0.50	0.50
Wheat bran	18.25	18.41	18.72	18.72
Moringa leaf meal	0.25	0.00	0.25	0.00
Fermented Bambara nut	17.00	17.00	0.00	0.00
Raw Bambara nut	0.00	0.00	17.40	17.40
Premix	0.00	0.25	0.00	0.25
Palm oil	1.40	1.40	1.50	1.50
Total	**100**	**100**	**100**	**100**
Calculated composition				
Crude protein	18.97	19.01	19.00	19.05
Crude fibre	3.66	3.36	3.66	3.60
Energy (MJ/Kg ME)	3093.04	3113.72	3087.39	3093.77
proximate composition				
Dry matter	14.00	8.00	10.00	6.00
Ash	7.00	7.90	5.70	5.30
Crude fibre	2.00	2.00	2.50	1.50
Ether extract	5.00	5.00	5.00	1.50
Crude protein	20.00	20.00	20.00	20.00
Nitrogen Free Extract	52.00	60.60	56.80	52.20

*T_1= Raw maize grain and fermented bambaranut with moringa olelfera. T_2 = Raw maize grain and fermeted bambara nut with premix meal. T_3 = Raw maize grain and Raw bambara nut with moringa olelfera. T_4 = Raw maize grain and raw bambara nut with premix meal respectively.

**Premix to provide the following per kg of diet: Vitamin A, 9,000 IU; Vitamin D3, 2,000, Iu; Vitamin E, 18 IU; Vitamin B1, 1.8 mg; Vitamin B2, 6.6 mg; Vitamin B3, 10 mg; Vitamin B5, 30 mg; Vitamin B6, 3.0 mg; Vitamin B9, 1 mg; Vitamin B12, 1.5 mg; Vitamin K3, 2 mg; Vitamin H2, 0.01 mg; Folic acid, 0.21 g; Nicotinic acid, 0.65 mg; Biotin, 0.14 mg; Choline chloride, 500 mg; Fe, 50 mg; Mn, 100 mg; Cu, 10 mg; Zn, 85 mg; I, 1 mg; Se, 0.2 mg.

Table 2: Proximate composition and gross energy content of Bambara nut and Moringa leaf meal (100g feed)

Parameter (%)	Fermented Barbara nut	Raw Barbara nut	*Moringa oleifera* leaves meal *MOLM
Crude protein	17.10	15.75	28.90
Crude fibre	2.10	3.50	8.51
Ether extract	3.50	25.00	6.73
Ash	10.00	15.00	13.20
NFE	57.90	30.75	42.60

*MOLM= *Moringa oleifera* leaf meal; NFE=Nitrogen Free Extract.

Table 3: Effect of fermented Bambara nut and Moringa leaf meal on the internal organs of boiler chickens (5 – 8 weeks)

Organ (g)	T_1	T_2	T_3	T_4	SEM
GWC	64.77	74.27	73.90	72.10	±2.44
EG	48.03	48.13	55.00	51.17	±1.71
Liver	31.07	36.77	40.73	33.60	±2.58
Kidney	8.50	8.77	8.73	6.40	±0.80
Heart	10.27	8.23	38.73	9.93	±7.05
Lungs	8.10	8.13	11.27	10.87	±0.62
Spleen	2.70	1.63	2.13	2.43	±1.20
IL (cm)	172.33	185.00	104.00	195.67	±6.82
IWt with C	83.13^{b}	97.57^{a}	89.13^{ab}	85.93ab	±2.34*
IWtWC	60.13	55.00	63.70	66.23	±1.96

a, b,c; = mean in the row with different superscripts are significantly ($p<0.05$) different. (±) SEM = Standard Error mean. GWC = Gizzard with content, EG = Empty gizzard, IL = Intestine length, IWt with C= intestine weigth content, IWt= intestine weight without content.

CONCLUSION AND RECOMMENDATION

From the result of the present study, it can be deduced that there were no significant ($p>0.05$) differences in the internal organs of birds fed Bambara nuts and MOLM except that of intestine weight with content. Perhaps, the insignificant result in the case of gizzard with content, empty gizzard, liver, kidney, heart, lungs, spleen, intestinal length, and intestine weight without content was due to raring the birds on deep litter system of production. Therefore, future research may be required on this topic using battery cage system of production.

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