ISSN 2714-4410
J. Anim. Prod. Res. (2019) 31(2):80-87

National Animal Production Research Institute
Ahmadu Bello University
P.M.B 1096, Shika-Zaria,
Kaduna State, Nigeria.
Email:japr@napri.gov.ng Url:journals.napri.gov.ng

EFFECTS OF TREE LEGUME CHEMICAL COMPOSITION OF BUSH MANGO *(Irvingia gabonensis)* SEED WASTE MEAL AND EFFECTS ON PERFORMANCE OF BROILER CHICKENS

[1]Okosun, S. E. and [*2]Eguaoje A. S.

[1]Department of Animal Science, Faculty of Agriculture, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

[2]Department of Animal Science, Faculty of Agriculture, University of Benin, Benin City, Edo State, Nigeria.

[*]Corresponding Author: eguaojeabiodunstanley@gmail.com; +2347031677645; +2348162931998

ABSTRACT

A four week feeding trial was conducted to evaluate the growth performance characteristics of starter broiler fed varying levels of bush mango seed waste (BMSW) meal as a partial replacement for maize. The test ingredient was analyzed for chemical composition and some mineral content prior to the feeding trial. The control diet had no BMSW, while treatments 2, 3, and 4 had BMSW replacing maize at 25, 50 and 75% respectively. 120 birds were randomly assigned to four treatment diets in a completely randomized design (CRD) and each treatment had three replicates of ten birds each. The chemical composition reflected that the BMSW has CP comparable to maize as well some essential minerals needed for the growth and development. The highest final weight of broilers was from those placed on 50% BMSW and control with values of 1.72 and 1.91kg respectively. The broiler chickens showed significant (P<0.05)difference in weekly and daily feed intake with highest values (726.67and 106.67g/bird) recorded in control while similar values were recorded in diet 2, 3 and 4 respectively. Weekly and daily weight gain also significantly (P<0.05) differ among birds fed treatment diets with highest value from those fed 50% BMSW and lowest in diet 4. The feed conversion ratio showed significant difference with birds fed the control and 50% BMSW recording the best result. This study reveals that BMSW is adequate in basic nutrient and that 50% replacement of maize in broiler starter diet gave the highest live weight and more efficient nutrient utilization.

Keyword: Bush mango seed, Broiler chickens, Chemical composition, Growth performance

INTRODUCTION

Cereal grains constitute the major source of energy in poultry diet in the tropics (Oluyemi and Roberts, 2000). Maize has remained the main source of energy in compounded diet and it constitutes about 50% of poultry ration (Ajaja *et al*., 2002). Pressure on maize has been on the increase worldwide with emphasis being placed on export in Nigeria, since recent trends have seen massive exploitation of corn in ethanol production as an alternative source of fuel (Doki, 2007). This trend has necessitated the search and use of agro industrial by products in livestock feed compounding. Some of the industrial by-product and Agro by- product include; kola nut testa meal (Oke *et al*, 2005), cashew nut meal (Adeyeye 2005), Bambara groundnut meal (Omoikhoje 2004), Cassava root meal (Tuleum *et al*, 2005), Cassava grit (Okosun and Eguaoje, 2017), Bread waste meal (Animashaun and Omoikhoje, 2014), Biscuit waste (Omoikhoje *et al.*, 2018) as well as Indomie waste meal (Omoikhoje *et al.*, 2019). Onuh, (2005) opined that Agro-industrial by product (AIBs) could be included at 10% level in the diet of poultry without any adverse effect on performance as well as reduction in the feed cost per weight gain of the birds. Oke *et al*, (2005) reported that broilers fed kola nut testa

meal (KTM) at 5% level replacement for maize has significant increase on the weight gain as well as a reduction in the cost of feed per weight gain of the birds. Okosun and Eguaoje, (2017) reported that cassava grit at 33.3% level of inclusion can substitute for maize in cockerel ration without any detrimental effect. Varying levels of sun-dried cocoyam corm meals as substitute ingredient in finisher broiler rations was found to have positive economic implications for diets with 15% cocoyam replacement (Uchegbu, 2010).

For this study a byproduct known as Bush mango seed waste gotten from the inner body coat of the kernel of African Bush Mango was used because of its high energy value, availability and affordability. The African Mango (Bush Mango) Kernels comes from an African tree called *Irvingia gabonensis. Irvingia gabonensis* bears a fruit that looks like a mango. The fruit, which is green, turns bright orange when ripe and is almost round in shape. The fruit contains one seed - *the kernel* - which has a texture akin to a nut. The kernel goes by many names in Africa - *Ogbono, Etima, Dika, and Wild Mango*, to name a few. Unlike other trees, the African Mango Tree has not been fully domesticated and most of the kernels are harvested from wild trees. Like other nuts and seeds, African Mango seeds are high in fat, containing at least 50% fat. The kernel can be eaten raw or roasted, like cashew nuts, but most times, they are processed. The oil rich dicotyledonous kernel is wrapped inside a brown seed coat (Ogunsina *et al*., 2008). This brown shell or waste is mostly discarded as waste along with the mesocarp and other part which constitute over 80% of the fruit and left to rot in dumps, water bodies, pits or nearby bushes (Ladipo *et al*., 1996; Etebu *et al*.,2012). Other studies have been on the functional properties of the seed. However, there is a need to carry out studies on the waste or shell of the seed.

This study is therefore embarked upon to evaluate the proximate composition of African bush mango seed waste on the performance of broiler chickens**.**

MATERIALS AND METHODS

Location and duration of the study

The experiment was carried out at the Poultry Unit of the Livestock Section, Teaching and Research Farm, Ambrose Alli University, Ekpoma for a period of six (6) weeks..

Sourcing and processing of African bush mango seed waste

The brown shell or waste discarded as waste along with the mesocarp after the breaking of the hard coat of the dried African bush mango seed waste (BMSW) was collected from local processing centres and in-house ducanut seed processors in Ekpoma Esan West Local Government area of Edo State. The African bush mango seed waste (BMSW) was collected bagged and store at room temperature to avoid molding. It was then milled to fine particles using a hammer mill with 2mm sieve and stored until ready for use. Samples were taken to the Animal Science Laboratory for proximate analysis after which it was incorporated into broiler's diets at varying levels stipulated in the study.

Experimental diets and treatments

Four experimental diets were formulated to contain African bush mango seed waste (BMSW) to replace maize at 0, 20, 40 and 60% and labelled as T1, T2, T3 and T4 respectively. Diet 1 was the control diet with no African bush mango seed waste (BMSW) while diets 2, 3 and 4 will contained African bush mango seed waste (BMSW) supplementation of maize in control diet at 20, 40 and 60% respectively. All diet was formulated to be Iso-nitrogenous and Iso-caloric. The experimental diets composition is presented in Table 1.

Management of experimental birds and design

A total of one hundred and twenty (120) day old Anak 2000 broiler chickens were used for

the experiment. The birds were initially brooded for two weeks. On arrival they were given Vitalite mixed with glucose to reduce stress of transportation from the hatchery. The birds were then placed on doxy-gen antibiotics for the following three days. After brooding they were randomly sub-divided into 4 dietary treatments of three replicates, with ten birds each in a completely randomized design. Feed and water was given to the birds' *ad-libitum*. The birds were reared on deep litter in an open-sided wire mesh constructed poultry house to allow for adequate ventilation. Medications and other routine management practices were strictly followed. The birds were offered experimental diets and cool, clean water *ad-libitum* throughout the eight weeks period of the experiment.

Proximate analysis of African bush mango seed waste

Bush mango seed waste samples was taken to a laboratory and analyzed for proximate composition according to the method of AOAC (1990). Energy was estimated to be 3885.95Kcal. The proximate composition includes Moisture content of 8.90, crude protein of 5.33, crude fibre of 3.20, ether extract of 22.80, ash content of 8.00 and nitrogen free extract of 51.77. BMSW contains essential minerals like calcium, magnesium, potassium, sodium, phosphorus, iron, zinc and manganese.

Table 1: Gross composition of Experimental broiler Starter Diet

	Inclusion levels of BMSW (%)			
	0	**25**	**50**	**75**
	Diets			
Ingredients	**1**	**2**	**3**	**4**
Maize	53.50	40.13	26.75	13.38
BMSW*	0.00	13.38	26.75	40.13
Soya bean meal	37.00	37.00	37.00	37.00
Wheat offal	5.00	5.00	5.00	5.00
Dicalcium phosphate	3.50	3.50	3.50	3.50
Salt	0.50	0.50	0.50	0.50
Premix*	0.50	0.50	0.50	0.50
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis:				
Crude protein (%)	21.00	21.00	21.00	21.00
Crude fibre (%)	3.36	4.27	4.63	5.04
ME. (Kcal/kg)	3007	3005	3000	3023

* Composition of Premix

Vitamin A 1.300IU, Vitamin D3 250.000IU, Vitamin E 1.5OOmg, Vitamin K3 200mg, Vitamin B1 200mg, Vitamin B12 1.500mg, Vitamin B6 400mg, Niacin 3.000mg,, Calcium, Pantothenate 1.000mg, Biotin 10.000g, Folic acid 50.000g, Choline chloride 70,00mg, Methionine 40..000mg, Iron 3,000mg, Copper 800mg, Manganese 8.000mg, Zinc 5.000mg, Iodine 50.000g, Selenium 15.000g, Cobalt 20.000g, Coccidiostatic-Avatec 15% 50.000mg, Antioxidant BHT 10.000mg.
**BMSW- Bush mango seed waste.*

Performance characteristics

During the feeding trial, daily feed consumption and weight changes were recorded while weight gain, feed conversion ratio and protein efficiency ratio were estimated. Daily feed intake was determined by subtracting the weight of leftover of feed from the initial weight of feed supplied. Weekly weight gain was determined as the difference between the weight at the beginning of the week and the weight at the end of each week. Feed conversion ratio was estimated as the ratio of the feed intake to that of the weight gain.

Statistical analysis

All the data collected were subjected to analysis of variance (ANOVA), and differences between means and treatments were separated using Duncan's Multiple Range Test (DMRT) at 5 percent level of probability. All statistical procedures were according to (Steel and Torrie, 1990) using SPSS version 20.

RESULTS

Chemical composition of bush mango seed waste meal

The proximate composition of Bush mango seed waste (*Irvingia gabonensis*) meal as compared to maize (*Zea mays*) is shown in Table 2. Percentage moisture content was higher (12.00%) in maize compare to (8.90%) recorded in bush mango seed waste. Percentage crude protein content was higher in maize with an average value of (9.80%) compare to (5.33%) recorded in bush mango seed waste. Crude fibre content of bush mango seed waste was higher (3.20%) compared to maize with crude fibre content of (2.40%). Higher metabolizable energy value of 3885.95kcal/kg was recorded in bush mango seed waste compare to 3315.45kcal/kg reported for maize.

Table 2: Proximate composition and mineral content of BMSW

Parameters	BMSW	MAIZE
Moisture content(%)	8.90	12.00
Crude protein (%)	5.33	9.80
Crude fibre (%)	3.20	2.40
Ether extract (%)	22.80	4.20
Crude Ash (%)	8.00	1.90
Nitrogen free extract (%)	51.77	69.70
Calorific Value (Kcal/kg)	3885.95	3315
Calcium (mg/kg)	5130.00	5203.03
Magnessium (mg/kg)	972.50	1022.00
Potassium (mg/kg)	4338.00	3422.08
Sodium (mg/kg)	344.70	283.64
Phoshorus (mg/kg)	756.80	546.61
Iron (mg/kg)	1252.30	1183.12
Zinc (mg/kg)	39.40	32.05
Manganese (mg/kg)	128.10	134.31

Performance characteristic studies of broiler starter fed bush mango seed waste based diet

The performance parameters of broiler starter as affected by the treatment diets is shown in (Table 3). Dietary treatments significantly ($P<0.05$) affected the average weekly feed intake, average daily feed intake, average weekly and daily weight gain as well as feed

conversion ratio. Broiler fed the control diets had higher ($p<0.05$) DFI than those on BMWM diets which are similar ($p>0.05$) No mortality was recorded throughout the starter phase of the experiment. Average daily weight gain also showed significant ($P<0.05$) variation among birds fed the treatment diets with highest value 61.33g/bird recorded among broiler chickens on 50% BMSW followed by 42.33g/bird in birds fed the control, and then by 38.00g in birds fed 25% BMSW. Feed conversion ratio significantly ($P<0.05$) differ among birds fed the various treatment diets with treatment 1 having the best conversion ratio of 1.69 comparable to 1.96 recorded in diet 3, followed by 2.13 recorded in birds fed diet 2 while poorest feed conversion with a value of 3.91 was obtained from broiler chickens placed on 75% BMSW replacement of maize.

Table 3: Performance characteristic studies of broiler starter fed bush mango seed waste based diet

	Inclusion levels of BMSW (%)				
	0	**25**	**50**	**75**	
	Diets				
	1	**2**	**3**	**4**	**SEM±**
Initial weight (g/bird)	55.66	57.33	55.33	56.00	0.56
Final weight gain (kg/bird)	1.19^{ab}	1.10^{c}	1.72^{a}	0.54^{d}	0.87
Weekly feed intake (g/bird)	726.67^{a}	576.67^{b}	596.67^{b}	573.33^{b}	1.04
Daily feed intake (g/bird)	106.67^{a}	83.33^{b}	83.33^{b}	80.00^{b}	1.03
Weekly weight gain (g/bird)	296.67^{b}	273.33^{b}	430.00^{a}	146.67^{c}	1.00
Daily weight gain (g/bird)	42.33^{b}	38.00^{c}	61.33^{a}	21.33^{d}	1.17
Feed conversion ratio	1.69^{c}	2.13^{b}	1.96^{bc}	3.91^{a}	1.23
Mortality (%)	0.00	0.00	0.00	0.00	0.00
Feed cost/Kg weight gain(₦)	268.46	236.73	212.92	208.37	

abcd: Means in the same row with varying superscript differ significantly ($P<0.05$)
SEM± : Standard error of mean

DISCUSSION

Chemical composition of bush mango seed waste compared to maize

The lower moisture content values recorded in bush mango seed waste compared to maize could be as a result of longer period of sun drying compared to maize purchased at the open market. This finding is supported by earlier report of Adeyeye, (2013) who observed lower moisture content of 6.00% in Dika nut meal. The higher crude protein observed for maize compared to bush mango seed waste could be as a result of the fibrous nature of the test material compare to maize with lower fibre. However the value reported was lower compared to the value as reported by Adeyeye, (2013). Ekundayo *et al.*, (2013) also recorded lower crude protein content when bush mango seed waste was

subjected to microbial fermentation. The higher fiber values recorded in bush mango seed waste compared to maize connote higher cellulose they contain which could serve as an absorber of water and provide roughage for better functioning of the alimentary system as well as combine with intestinal cholesterol for excretion in the feaces (Makkar and Goodchild, 2006). The higher ether extract reported in this study could be as result of higher oil content in the test ingredient compare to maize. Onimawo (2003) reported in his proximate composition of bush mango seed a value of 7.70% crude fat which was lower to the one reported in this study. The highest crude ash content recorded in bush mango seed waste compare to maize indicate that the test ingredient is a good source of mineral compare to maize. Ogunlana *et al.,* (2012) however reported lower crude ash content for bush mango kernel. Metabolizable energy was higher in bush mango seed waste compare to maize and this is traceable to the high fat content in the test ingredient compare to maize with lower fat content. This finding also collaborates the report of Adeyeye, (2013).

Performance characteristics of broiler chickens fed treatment diets

The higher value recorded for daily feed intake of birds fed the control compare to those of other treatments with lower values could be as a result of reduced palatability as the inclusion of the test ingredients increases. This finding is line with the report of Nikolakakis *et al.,* (2014) who reported a significant variation in the feed intake of broiler chickens fed graded levels of sesame seed waste based diet. The least value recorded among those fed diet 4 (75% BMSW) could be attributed to the high concentration of fibre of the bush mango seed waste compared to that of maize it was replacing. It has been documented that high amounts of crude fiber in broiler diets can have negative effects on feed intake, weight gain and/or feed conversion ratio (Kras *et al.,* 2013; Kalmendal *et al.,* 2011). The significantly ($P<0.05$) variation in the daily weight gain value with highest mean recorded in those on 50% BMSW could be ascribed to the quality level, palatability as well as the higher synergy of nutrient by the ingredient at that level of incorporation. This finding is supported by the report of Magareth *et al.,* (2017) who reported a significant variation in the weight gain values of broiler chickens fed varying levels of Rain tree (*Sarmania saman*) seed meal. The reduction in the weight gain of broiler chickens fed 75% bush mango seed waste could be due to the reduced feed intake and the inability of the birds to utilize the diets as a result of poor digestion and absorption probably due to the high fibre content of the basal diet. The significant ($P<0.05$) variation in the values recorded for feed conversion ratio among birds fed with the least best value recorded among birds fed the control diet compare to other treatment diets. This finding negates the report of Farran *et al.,* (2000) who reported no significant variation in the feed conversion ratio of broiler chicks fed graded levels of sesame seed waste. However, the zero mortality rate recorded among broiler chickens fed the treatment diets at the starting phase reveals that the various inclusion levels of the test ingredient tested in this trial does not have any detrimental effect on the health status and performance of the birds.

CONCLUSION

It is concluded from the study therefore that BMSW is adequate in basic nutrient that can partially replace maize at lower level other than that reported in this study. However the control diet had better performance from this study.

RECOMMENDATION

The findings of this research is subject to futher study with the use of BMSW at lower inclusion levels as Bush mango seed waste is said to be adequate in basic nutrients that can partially replace maize.

REFERENCES

Adeyeye, E. I (2013) Proximate, mineral and antinutrient composition of dika nut (I*rvingia gabonensis*) kernel. *Elixir Food Science 58: 14902-14906*

Adeyeye, S. A. (2005). Nutritional significance of cashew (Anacardium occidentiale) nut meal in broiler chicken. *M. Agric thesis Department of Animal production and Health Federal University of technology Akure Nigeria 1-11p*

Ajaja, K., Agbede, J. O. and Aletor, V. A. (2002). Replacement Value of Sorghum Dust for Maize in Diets for Broiler Chicks.Proc., *27th Annual Conference of the Nigeria Society for Animal Production.* March 17 – 21, Federal University of Technology, Akure, pp: 109 – 112.

Animashahun R.A and Omoikhoje S.O (2014). Haematological Traits and Serum Chemistry of Broiler Chicken Fed Bread Waste Based Diets. *Journal of Animal Health and Production* 2 (4): 51 – 54.

AOAC (Association of Official Analytical Chemists), (1990). Official Methods of Analysis of the AOAC international.16th ed 4th revised method 944.02. The Association, Gaithersburg, MD.

Doki, T. (2007). Benue Gives Land to NNPC. In: Saturday Independent, January 27, Tunde Abatan (ed). 1(86): 44.

Ekundayo, F. O., Oladipupo,O. A. and Ekundayo, E. A. (2013). Studies on the effects of microbial fermentation on bush mango (Irvingia gabonensis) seed cotyledons. pp. 4363-4367, 23

Etebu, E. (2012). Postharvest pathology and phytochemicals of *Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke) fruits and wastes. *Agricultural Science Research Journal, 2*(6), 285-294.

Farran, M. T., Uwayjan, M. A. Miski, M. A., Akhdar, N. M. and Ashkarian, V. M. (2000). Performance of broilers and layers Fed graded levels of sesame waste. *Journal of applied Poultry Research.* 9:453–459.

Kalmendal, R., K. Elwinger, L. Holm, R. Tauson, (2011). High-fibre sunflower cake affects small intestinal digestion and health in broiler chickens. British Poultry Science. 52, 86-96

Kras, R. V., Kessler, A. M. L., Ribeiro, J. D. I., Henn, S. I., Dos, H. D. P. and Bockor, L. (2013). Effect of dietary fiber and genetic strain on the performance and energy balance of broiler chickens. Rev. Bras. Cien. Avic. 15, 15-20.

Ladipo, D. O., Fondoun, J. M and Gana, N. (1996). Domestication of the bush mango (Irvingia spp) : Some exploitable intra-specific variation in West and Central Africa. In: Domestication and Commercialization of Non-Timber Forest Products for Agroforestry (eds.) Leakey, R.R.B., Temu, A.B., Melnyk, M. and Vantomme, P. *Non-Timber Forest Products Paper 9, FAO Rome.* Pp. 193-206.

Makkar H. P. S. and Goodchild, A. V. (2006). Quantification of Tannins: A Laboratory Manual. International Centre for Agricultural Research in the Dry Areas, Aleppo, Syria.

Margaret, A. S. H., Armstrong, D. and Dadson, A. (2017). Growth performance and economic evaluation of broiler Chicken fed with rain tree (S*amanea saman*) seed meal. *Journal of Applied animal Research*. 45(1): 1-8

Nikolakakis, E. B., Eleni, K, A. K. and Paraskevi, M. (2014) Effect of dietary sesame seed wastes on broiler performance, carcass traits and lipid oxidation of the meat. *European Poultry Science Journal.*, 78. 2014, ISSN 1612-9199, Pp: 1-9.

Ogunlana, O. E., Ogunlana, O. and Farombi, O. E. (2012). *Morinda lucida*: Antioxidant and reducing activities of crude methanolic stem

bark extract. *Advance Natural and Appllied Science.* 2:49–54

Ogunsina, B. S., Koya, O. A. and Adeosun, O. O. (2008). Deformation and fracture of dika nut (Irvingia gabonensis) under uni- axial compressive loading . *International Journal of Agricultural Reseach*. 22:249–253.

Ogunsina, B. S., Bhatnagar, A. S., Indira, T. N. and Radha, C. (2008) the proximate composition of african bush mango kernels (irvingia gabonensis) and characteristics of its oil. *Ife Journal of Science 14(1):*177-182.

Oke, D. B., Oke, M. O., Fasina, O. E., Ohugbe San, O. T. (2005). The Evaluation of Kolanut testa meal as replacement for maize in broiler diet. *Proceedings of 9th annual conference. Ebonyi Stat University Abakaliki. 25:515-517*

Okosun, S. E. and Eguaoje, S. A. (2017). Growth Performance, Carcass Response and Cost Benefit Analysis of Cockerel Fed Graded Levels of Cassava (*Manihot esculenta*) Grit Supplemented With Moringa (Moringa Oleifera) Leaf Meal. *Animal Research International.14(1):2619-2628.*

Oluyemi, J. A. and Roberts. R. A. (2000). Poultry Production in Warm Wet Climates. Macmillian Press, London. 2nd Edition, p. 692.

Omoikhoje, S. O. (2004). Effect of processing on the biochemical nutritional qualities and some anti-nutrient. Components of Bambara groundnut (Vigna subterranea) fed to broilers. PHD thesis, Department of Animal Science, Ambrose Alli University. Nigeria.

Onimawo, I. A., Oteno, F., Orokpo, G. and Akubor, P. I. (2003). Physicochemical and nutrient evaluation of African bush mango (Irvingia gabonensis) seeds and pulp. p: 1-6.

Onuh, S.O. (2005). Evaluation of the Performance of Broiler Fed Different Agro-Industrial by-products. *Proceedings of 30th Annual Conference. Nigeria Society of Animal Production 30:169-171.*

Steel, R. G. O. and Torrie, J. H. (1980). Principle and procedure of statistics. McGrawhill book company Inc. New York, Toronto and London.

Tuleum, C. D., Njike, M. C., Ikurior, S. A. and Ehidou, N. G. (2005) Replacement of maize with cassava200t meal/brewer yeast sherry in the dietof broiler chicks. *Proceedings of 30th Annual Conference of Nigeria Society of Animal Production 20th-24th March 2005*. University of Nigeria, Nsukka. 2005; 183-185.

Uchegbu, M. C. and Udedibie, A. B. I. (1998). Maize sorghum-based dried brewers grain in broiler finisher diets. *Nigerian Journal of Animal Production*. 25(1): 13-17.