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Body Linear Measurements and Bone Morphometric Parameters of Broiler Chickens Fed Wood Ash-Based Diets

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Abstract
The aim of this study was to determine the bone morphometric parameters and body linear measurements of broiler chickens fed different wood ash-based diets. A total of 180 day-old broilers chicks were used and randomly divided into four experimental groups of three replicates with 15 chicks each in a completely randomized design. Ashes were prepared from neem, shea butter and locust bean woods. Dietary treatments were limestone and bone meal (control, NOA), neem (NWA), shea butter (SWA) and locust bean (LWA). Experimental diets used were formulated to be isocaloric and isonitrogenous. At two weeks interval data on body, wing, shank, head, tarsal and back lengths were taken. While at 10 weeks, two birds were picked at random from each replicate, slaughtered and used for morphometric measurements. All data were subjected to one way analysis of variance. Where differences occurred they were separated using Duncan Multiply Range test. Of all the parameters measured only body length was significantly ($P<0.05$) influenced by wood ash based diets. It could be concluded that any of neem, shea butter and locust bean wood ashes could be used to replace bone meal and limestone in the diets of broiler chicken. However, for improved performance, neem wood is recommended as it gives the longest body.

Keywords: Ash, neem, shea butter, locust bean, bone and morphology

Introduction

Skeletal development should follow body weight to obtain the best performance in both phases. Calcium deposition in the bones is very intense during the broilers' grower stage. Calcium present in the body reserves rapidly accumulates during the first phase of life, reaching 80% of the total body calcium of mature broilers by the end of the first month of age (Moreki, 2011). Inadequate calcium supplementation during early rearing phases causes an imbalance in mineral homeostasis and inadequate bone development (Muniz *et al.*, 2007). Consequently, bone calcification is abnormal, resulting in skeletal abnormalities (Muniz *et al.*, 2007) and worse performance since the two parameters are positively correlated. Ryssen (2014) reported that wood ash was as effective as feed lime in supplying calcium to chickens after using wood ash as part of the feed ingredients on bone characteristics for poultry under subsistence farming conditions. He also reported that there were no significant differences in tibia weight, diameter, volume, density and breaking strength between calcium sources. This means that the calcium, phosphorus and magnesium concentrations in bone ash and wood ash were similar. However, there are no reports on the effect of dietary inclusion of wood ashes from neem, shea butter and locust beans wood on the bone integrity of broiler chickens.

The objective of this study is to determine the body measurement and bone integrity of broiler chickens fed different wood ash based diets.

Materials and Methods

The study was carried out in the Poultry Section of Teaching and Research Farm of the Department of Animal Production, Federal University of Technology, Gidan-kwano Campus Minna, Niger State. Broiler birds used in the experiment were purchased from Globus Resources Limited, in Ijesha-Tedo, Lagos state, Nigeria. Other ingredients used in the formulation of the feed were purchased from the Central Market (Kure) in Minna, Niger State. Fresh *Azadirachta indica* (neem), *Parkia biglobosa* (African locust bean) and *Vitellaria paradoxa* (Shea tree)woods were collected from Gidan-kwano Campus. This is because of their abundance, availability and accessibility.

The woods, including barks collected were broken into pieces, to fasten the drying process and sun dried before burning to ashes. The woods were separately burnt in open air. Ashes produced were collected in plastic bags and taken to the laboratory for storage and subsequent analysis to determine their mineral content. Use of fuel for burning was avoided to minimize contamination. Four experimental diets was formulated and designated as control, Neem Wood Ash (NWA), Shea butter Wood Ash (SWA) and Locust bean Wood Ash (LWA). Diet 1 was designated as the control without wood ash while diets 2, 3 and 4 contained 2 % wood ash of neem tree, Shea tree and African locust bean, respectively. The wood ash in diets 2, 3 and 4 were used to replace Limestone and Bone meal contained in diet 1. The diet compositions of the two phases are shown in table 1.

At two weeks interval, three birds were selected at random from each replicate, the birds were marked on their back and wings with permanent marker and the following parameters were taken from each one of them according to the procedures described by Winker, (1998).

Table 1: Ingredients and chemical composition of experimental diet

	Starter phase				Finisher phase			
Ingredients	Control	NTA	STA	LTA	Control	NTA	SWA	LTA
Maize	50.00	50.00	50.00	50.00	62.00	62.00	62.00	62.00
Maize bran	9.00	9.00	9.00	9.00	5.00	5.00	5.00	5.00
GNC	26.00	26.00	26.00	26.00	20.00	20.00	20.00	20.00
Fish meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
SBM	8.00	8.00	8.00	8.00	6.00	6.00	6.00	6.00
Bone meal	2.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00
Limestone	2.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00
Wood ash	0.00	2.00	2.00	2.00	0.00	2.00	2.00	2.00
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100	100	100
CP (%)	22.35	22.35	22.35	22.35	19.39	19.39	19.39	19.39
ME(Kcal/Kg)	2934.00	2934.00	2934.00	2934.00	2939.00	2939.00	2939.00	2939.00

Body length (cm): Body length was taken with measuring tape stretched from bird's nasal opening, along its gently stretched neck and back, to the tip of its pygostyle. *Body girth (cm):* Body girth was taken by looping a measuring tape round the region of the breast under the wings. *Wing length (cm):* Wing length was as the distance from the humerus-coracoid junction to the distal tip of the longest feather on the phalange digits, using measuring tape. *Shank length (cm):* The shank length was taken as the distance between the foot pad and the hock joint, measured with the use of measuring tape. Head length (cm): Head length was measured as the distance between the back of the skull and the base of the beak, measured with the use of a measuring tape. *Tarsal length (cm):* Tarsal length was taken from the inner bend of the tibiotarsal articulation to the base of the toes, measured with the use of measuring tape. *Beak length (cm):* Beak length was taken from the anterior edge of the nostril to the tip of the upper mandible with the use of measuring tape. *Bone weight (g):* this was determined using sensitive scale. Bone widths were taken using micrometer screw gauge. *Bone volume (cm):* a measuring cylinder was used to take volume of each bone, known quantity of water was measured as initial reading before placing each bone inside cylinder and final reading was taken. Volume was obtained by subtracting initial reading from final reading. Bone density was determined by dividing weight of each bone by it corresponding volum**e.**

Results and Discussion

The results of the body measurements of broiler chickens fed different wood ash based diets are presented in Table 2. In all body measurement parameters measured, only body length was influenced ($p<0.05$) by the wood ash treatments. Birds on neem wood ash had the highest body length and the length were significantly higher ($p<0.05$) than all the other treatments which had similar body length.

Table 2: Body linear measurements of broiler chickens fed different wood ash based diets

	Treatment				
Parameters (cm)	Control	NWA	SWA	LWA	SEM
Wing length	15.43	16.12	16.20	15.85	0.157
Shank length	7.20	7.59	7.66	7.58	0.086
Tarsal length	5.62	5.93	5.60	5.58	0.074
Head length	5.93	6.03	5.91	5.77	0.086
Beak length	2.41	2.49	2.49	2.43	0.027
Body length	33.22^{b}	36.41^{a}	34.21^{b}	33.98^{b}	0.453
Body girth	21.04	22.36	21.20	20.79	0.326

a,b – Means within the same row with different superscripts are significantly different at ($p<0.05$); NWA – neem wood ash, SWA – shea butter wood ash, LWA – locust bean wood ash, SEM – standard error of mean

The improvement observed in the body length of bird on neem wood ash diet could be attributed to the antibiotic properties of the neem wood. Numerous biological and pharmacological activities have been reported in neem tree, they including antibacterial (Singh and Sastry, 1997) and anti-inflammatory (Khera and Chaurasia, 1997). Ayoola *et al.* (2015) reported that there was significant different in the dietary inclusion of neem leaf meal only on average weight gain. In another study, Egena *et al.* (2014) reported a positive pair-wise correlation between body weight and linear body measurements were positive and highly significant and that body length had the greatest direct effect on body weight (path coefficient = 0.417 in males; 0.428 in females, respectively).

Table 3 shows bone weight, volume and density of broiler chickens fed different wood ash based diets. The results showed that the tibia, femur, humerus, ulna and radius weights, volume and density were not influenced ($p>0.05$) by wood ash based diets. Although there were not significant differences in the bone weight, volume and density, the results indicated that ashes from all the woods used can be used to replace both bone meal and limestone in the diets of broiler chickens.

Table 3: Bone weight, volume and density of broiler chickens fed different wood ash based diets

	Treatments				
	Control	NWA	SWA	LWA	SEM
Bone weight (g)					
Tibia	10.17	11.83	10.00	10.83	0.486
Femur	7.67	8.50	8.00	8.33	0.418
Humerus	5.00	5.83	5.00	5.50	0.233
Ulna	3.00	3.33	3.83	2.83	0.218
Radius	1.00	1.17	1.17	1.17	0.065
Bone volume (cm)					
Tibia	7.00	7.33	6.67	7.33	0.336
Femur	5.67	5.33	5.33	5.33	0.288
Humerus	3.00	3.33	3.33	3.00	0.112
Ulna	2.00	2.33	2.33	2.00	0.112
Radius	1.00	1.00	1.00	1.00	0.00
Density					
Tibia	1.49	1.62	1.50	1.48	0.041
Femur	1.42	1.60	1.49	1.57	0.072
Humerus	1.67	1.77	1.50	1.83	0.068
Radius	1.00	1.17	1.17	1.17	0.065
Ulna	1.50	1.44	1.69	1.41	0.099

NWA – neem wood ash, SWA – shea butter wood ash, LWA – locust bean wood ash, SEM – standard error of mean

Conclusion

This study show that only the body length of broiler chickens was influenced by the dietary treatment however, bone integrity were not influenced. It could be concluded that any of neem, shea butter and locust bean wood ashes could be used to replace bone meal and limestone in the diet of broiler chickens without any deleterious effect.

References

Ayoola, A.A. ,Egbeyale, I.T., Ekunseitan, D.A., Adegoke, A.V., Adeyer, O.P. (*2015).*The effect of neem (*Azadirachta indica*) leaf meal on the growth performance and carcass characteristics of broiler chickens. *Nig. J. Anim. Prod.,* 42:57-59.

Egena, S.S.A., Ijaiya A.T. and Kolawole, R. (2014). An assessment of the relationship between body weight and body measurements of indigenous Nigeria chickens (*Gallus gallus domesticus*) using path coefficient analysis. *Livestock Research for Rural Development..26, Article #51.*

Kher, A. and Chaurasia, S.C. (1997). Antifungal activity of essential oils of three medical plants. *Indian Drug,* 15: 41–42.

Moreki1, J.C., Merwe, H.J. and Hayes, J.P. (2011). Effect of dietary calcium intake on its retention by caged broiler breeder hens. *Research Opinions in Animal and Veterinary Sciences*, 1(4): 258-265.

Muniz, E.B., Varela-Arruda, A.M., Fassani, E.J., Teixeira, A.S. and Sales, E.P. (2007). Avaliação de fontes de cálcioparafrangos de corte. *Revista Caatinga,* 20(1):5-14.

Ryssen, J.B.J., Phosa, M.A. and Rensburg, J.V. (2014). Different levels of macadamia oil cake meal and wood ash vs. feed lime as dietary sources of calcium on bone characteristics of slow-growing chickens. *South African J. Anim. Sci.,* 44(1): 71-79.

Singh, N. and Sastry, M.S. (1997). Antimicrobial activity of Neem oil. *Indian Journal of Pharmacology*, 13: 102–106.

Winker, K. (1998). Suggestions for measuring external characters of birds. *Ornitologia Neotropical,* 9: 23–30.