GROWTH PERFORMANCE AND MORPHOMETRICS OF THE THIGHS AND DRUMSTICKS OF MARSHALL BREEDER COCKS FED DIETARY SUPPLEMENTATION OF ACETYLSALICYLIC ACID.

Samuel O. Aro
Department of Animal Production & Health, Federal University of Technology, Akure, Nigeria.
E-mail: soaro@futa.edu.ng Phone No: 07062329254

Abstract
A sixteen week experiment was conducted to investigate the effect of varied dietary supplementation of acetylsalicylic acid (ASA) on growth and morphometrics of the drumsticks and thighs of Marshall broiler breeder cockerels. Four treatment diets labelled D_1, D_2, D_3 and D_4 were formulated and were supplemented with 0.00, 0.05, 0.10 and 0.15% ASA respectively. The D_1 served as the control diet. The birds were fed with these diets for the sixteen weeks of the experiment during which feed intake, weight gain, feed conversion ratio and morphometrics of the drumsticks and thighs were taken as response criteria. Results showed that growth rate, weight gain and feed conversion ratio were best improved at 0.10% ASA supplementation. The moisture content of the tibia and femur bones increased with increase in the supplemental levels of ASA relative to the control. The flesh to bone index of the thigh differed significantly ($P<0.05$) between the control and D_4. The percentage dry matter content of the tibias and femora also decreased with increase in ASA supplementation in the diets. The flesh weight of the thighs of birds fed the control diet was only superior to those of the ASA supplemented diets at 0,15% level while the flesh weight of the drumsticks in the ASA supplemented diets were significantly ($P<0.05$) superior to the control especially at 0.10% level. The drumsticks were significantly ($P<0.05$) heavier in the ASA supplemented diets in comparison with the control. It can be concluded that growth, muscular and bone development of Marshall broiler breeder are better enhanced at 0.10% ASA supplementation in the diet. Also the use of ASA in the diets ensures better muscling of the drumsticks than the thighs and results in heavier total retail cuts of the drumstick and thighs.

Keywords: Acetylsalicylic acid, Drumstick, Femur, morphometrics, tibia, thigh.

Introduction

Broiler breeders or broiler parent stock are male and female domestic chickens kept for the ultimate aim of producing broilers or meat-type chicks for the ever expanding poultry enterprise. The rapid growth rate of broiler birds highlights the fact that the skeletal structure to carry the rapid rate of fleshing should develop synchronously with the rate of muscular accretion. This growth synchrony between the skeletal and muscular structures is often compromised by both genetic and environmental variables. Genetically, the modern day broiler birds have been bred with the focus of the breeders on rapid rate of muscular growth to the detriment of other body organs especially the skeletal structure that is needed to carry the added load derived from muscular accretion. The environment on the other hand has also impacted on the physiology of growth of the broiler breeds of the domestic chicken. Such environmental variables like extremes of temperature, relative humidity, draught and solar radiation are inimical to global livestock production (Molik *et al*., 2013). For instance, high ambient temperature coupled with high relative humidity has been reported to hamper poultry production especially in the tropical regions of the world (Lara and Rostagno, 2013; Aro *et al*., 2018a).

One of the suggested intervention strategies to combat environmental heat stress is the use acetylsalicylic acid (ASA) or Aspirin which has been reported to promote growth, liveability and egg production in poultry (Aro *et al*., 2018b). The ASA has also been shown to be involved in the physiology of bone formation and in the maintenance of bone integrity through its role in the cyclo-oxygenase pathway (Cheng *et al*., 2001; Liu *et al*., 2015). The genetic improvement of the modern day broiler breeds has concentrated most of the growth on choice portion of the carcass like the drumstick, thigh and breast muscles. Of these three choice portions, the drumstick and the thigh with their accompanying bones (the tibia, fibular and the femur) are mostly the bearer of the entire body weight of the birds. The weight bearing function of the tibia, fibular

and femur is very important to the reproductive success of the male broiler breeds of poultry since they need sound bone integrity of their legs to enable them chase the prospective females, trap them, mount and thread on them before the eventual intromission, ejaculation and final dismounting. Disproportionate accretion of the bones and muscles of the leg especially under the dietary influence of ASA could adversely affect this all important reproductive capacity of the male broiler breeder stock. There is dearth of information on the effect of dietary supplementation of ASA on growth and morphometrics of the drumsticks and thighs of the broiler breeder stock of the domestic chickens. This experiment was thus conducted to investigate the effect of varied supplementation of ASA on growth and the morphometrics of the drumsticks and thighs of Marshall Broiler breeder cocks.

Materials and Methods

Experimental site

This research work was carried out at the Teaching and Research Farm (Livestock section) of the Federal University of Technology, Akure. The farm is located in the humid rain forest zone of western Nigeria which is characterized by two rainfall peaks and high humidity during the rainy season. The mean annual rainfall is about 1,500mm and rain lasts for 9 months usually from March to November every year. The mean annual relative humidity is over 75% and that of temperature is about 27ºC.

Source of Birds, Sample Size and Experimental Layout

Thirty Marshall Broiler breeder cockerels at fourteen weeks of age were purchased from Obasanjo's breeders Farms, Lanlante, Oyo State, Nigeria. They were acclimatized for two weeks after which 24 of them were selected and randomly allotted to four standard broiler breeders' diets at six birds per diet (treatment) and one bird per replicate. The first diet was the control with 0.00% of acetylsalicylic acid (ASA) and labelled as D_1 while the remaining three (3) diets were labelled as D_2, D_3 and D_4 with 0.05kg, 0.10kg and 0.15kg of ASA per 100kg of feed respectively. The diets also contained crude protein and energy level of 16.70% CP and 2360 $KCalKg^{-1}$ (10.50$MJkg^{-1}$) respectively. The gross composition of the experimental diets is as given in Table 1 below.

Table1: Gross composition (g/100g) of the broiler breeder cocks' diets

Ingredients	D_1	D_2	D_3	D_4
Maize	55.00	55.00	55.00	55.00
Soybean	9.00	9.00	9.00	9.00
Wheat offal	21.00	21.00	21.00	21.00
Groundnut cake	9.00	9.00	9.00	9.00
Fish meal	1.00	1.00	1.00	1.00
Bone meal	2.75	2.75	2.75	2.75
Limestone	1.50	1.50	1.50	1.50
Methionine	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10
Breeders' Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**
ASA	0.00	0.05	0.10	0.15

D_1 = Diet with 0.00% ASA; D_2 = Diet with 0.05% ASA; D_3 =Diet with 0.10% ASA; D_4 =Diet with 0.15% ASA; ASA = Acetylsalicylic acid.

Breeder Premix: *Supplied in a kg of the diet; Vit. A, 10,000 IU; Vit. D3, 2,800 IU, Vit. E, 35,000 IU, Vit. K, 1,900 mg; Vit. B12, 19 mg; Riboflavin, 7,000 mg; Pyridoxine, 3,800 mg; Thiamine, 2,200 mg; Pantothenic acid, 11,000 mg; Nicotinic acid, 45,000 mg; Folic acid, 1,400 mg; Biotin, 113 mg; Cu, 8,000*

mg; Manganese, 64,000 mg, Zinc, 40,000 mg; Iron, 32,000 mg; Selenium 160 mg; Iodine, 800 mg; Cobalt, 400 mg; Choline, 475,000 mg; Methionine, 50,000 mg; BHT, 5,000 mg; Spiramycin, 5,000 mg.
The birds were fed with these diets for the sixteen weeks of the experiment during which data on feed intake, weight gain and feed conversion ratio were taken. At the end of the feeding period, the birds were sacrificed while the left drumsticks and thighs were dissected out and weighed. Each of the drumstick (tibia and fibula) and thigh (femur) bones was cleansed neatly of the adhering musculature and tendons and weighed. The muscles removed from the drumstick and thigh bones were equally weighed and the various weights recorded. Data collected were subjected to statistical analysis using the completely randomized design of SPSS (2016) version 22.0 statistical package. Mean separation wherever applicable was done with Duncan's multiple range test of the same statistical package.

Results and Discussion

The growth performance of the breeder cocks fed supplemental levels of acetylsalicylic acid is as presented in Table 2. The final weight of the birds varied ($p<0.05$) between 4.57±0.33 in D_2 to 5.27±0.10 in D_3. The highest weight gain and best feed conversion ratio were recorded in D_3. All these growth performance parameters supported the growth enhancing attributes of ASA as reported in the literature (Rokade *et al*., 2016). The only mortality recorded in this experiment was in D_1 and this corroborates the immuno-modulatory role of ASA in the physiology of livestock (Alagawany, *et al.*, 2017).

Table 2: Growth performance of Marshall breeder cockerels fed dietary supplementation of acetylsalicylic acid.

Parameters	D_1	D_2	D_3	D_4
Initial wt. (kg)	2.80±0.17	2.77±0.15	2.80±0.15	2.82±0.14
Final wt. kg)	$4.88±0.12^{ab}$	$4.57±0.33^{b}$	$5.27±0.10^{a}$	$5.07±0.12^{ab}$
Weight gain (kg)	$2.08±0.38^{b}$	$1.80±0.23^{b}$	$2.47±0.22^{a}$	$2.25±0.20^{a}$
Feed intake/day/bird (g)	193.33±0.00	193.33±0.00	193.33±0.00	193.33±0.00
Total feed intake/bird (kg)	20.27±0.00	20.27±0.00	20.27±0.00	20.27±0.00
Daily intake of ASA/bird (mg)	0.00	90.536	180.98	271.47
Total intake of ASA/bird (mg)	0.00	10,140	20,270	30,405
Feed conversion ratio	$9.75±0.96^{b}$	$11.26±2.17^{a}$	$8.21±1.03^{c}$	$9.01±0.86^{bc}$
Mortality	16.67	0.00	0.00	0.00

^{a,ab,b,bc,c} *= Means in the same row but with different superscripts are statistically significant ($p<0.05$). D_1 = 0.00% ASA; D_2 = 0.05% ASA; D_3 = 0.10% ASA; D_4 = 0.15% ASA; ASA = Acetylsalicylic acid.*

Table 3 shows the morphometrics of the drumsticks and thighs of broiler breeder cocks fed supplemental levels of acetylsalicylic acid. The moisture content of the tibias and femora of cocks fed the ASA supplemented diets was higher ($p<0.05$) than those fed the control diet. The flesh to bone indices of the drumstick (FBILDs) were statistically similar ($p>0.05$) while those of the thigh (FBILTh) had statistically similar values for D_1, D_2 and D_3 all of which differed ($p<0.05$) from D_4.

Table 3: Morphometrics of the thighs and drumsticks of Marshall Broiler breeder cockerels fed dietary supplementation of acetylsalicylic acid.

Parameters	D_1	D_2	D_3	D_4
MCLTb (g)	$9.87±0.45^{b}$	$14.40±2.21^{a}$	$16.17±2.50^{a}$	$13.59±2.95^{b}$
MCLFe (g)	$9.10±0.89^{b}$	$12.23±1.62^{a}$	$11.93±1.39^{a}$	$12.30±0.92^{a}$
FBILDs	8.10±0.53	8.10±1.47	7.79±1.80	7.49±0.56
FBILTh	$12.66±2.77^{a}$	$10.01±0.62^{a}$	$9.99±1.75^{a}$	$9.24±1.32^{b}$
DMWLFe (g)	$18.80±1.83^{b}$	$19.20±0.56^{b}$	$21.83±2.50^{a}$	$20.33±1.40^{ab}$
DMWLTb (g)	$27.70±2.02^{b}$	$28.37±1.36^{ab}$	$30.86±2.80^{a}$	$29.87±1.57^{a}$
%DMLFe	$67.38±2.01^{a}$	$61.09±3.41^{c}$	$64.64±2.36^{b}$	$62.31±0.29^{b}$
%DMLTb	$73.73±2.20^{a}$	$66.33±4.03^{c}$	$65.62±2.93^{c}$	$68.73±0.95^{b}$
FlWLTh (g)	$320.87±49.88^{a}$	$282.70±16.02^{ab}$	$296.77±11.94^{ab}$	$267.10±27.88^{b}$

FlWLDs (g)	267.23±29.46[b]	301.43±49.19[ab]	310.03±39.96[a]	281.10±18.65[ab]
FrWOLTb (g)	37.57±1.72[b]	42.77±2.15[ab]	47.03±7.92[a]	43.46±2.86[ab]
FrWOLFe (g)	27.90±2.46[c]	31.43±1.59[b]	33.77±3.87[a]	32.63±2.31[b]
WLTh (g)	348.77±47.42[a]	314.13±16.38[a]	330.53±6.10[a]	299.73±26.744[b]
WLDs (g)	304.80±30.92[b]	344.20±47.06[a]	357.07±37.95[a]	324.57±19.28[a]

[a, ab, b, c] = Means on the same row but with different superscripts are statistically ($p<0.05$) significant. MCLTb = moisture content of left tibia; MCLFe = moisture content of left femur; DMWLTb = dry matter weight of left tibia; DMWLFe = dry matter weight of left femur; %DMLFe = percentage dry matter of left femur; %DMLTb = percentage dry matter of left tibia; FBILDs = flesh to bone index of left drumstick; FBILTh = flesh to bone index of left thigh; FlWLTh= flesh weight of left thigh;; FlWLDs= flesh weight of left drumstick; FrWLOTb= fresh weight of left tibia; FrWOLFe = fresh weight of left femur; WLTh = weight of left thigh; WLDs = weight of left drumstick.

The flesh to bone index measures the rate of muscle formation relative to bone (Hayse and Marion, 1973). The higher this ratio, the higher the premium on the retail cut of the carcass under consideration.

The percentage dry matter content of both the femur and tibia bones decreased significantly ($p<0.05$) in the ASA supplemented diets in comparison with the control. The lowest dry matter content of the femur bones was recorded in D_2 (61.09±3.41%) while the highest value was recorded in D_1 (67.38±2.01). The dry matter content of the tibia bone ranged from 65.62±2.93% in D_3 to 73.73±2.20% in D_1.Supplemental ASA in the diets of the cocks improved the weight of the left drumstick relative to the control while it decreased the weight of the left thigh significantly only at 0.15% ASA supplementation. The flesh weight of the left thighs (FlWLTh) was only inferior to the control at 0.15% ASA supplementation while those of the drumsticks (FlWLDs) were superior ($p<0.05$) to the control at 0.10% ASA supplementation. The tibias and femora of cocks fed ASA supplemented diets weighed more than those in the control probably as a result of more moisture content of the former. The ASA supplemented diets probably promote more muscular accretion in the drumstick than in the thigh.

Conclusion and Recommendations

The highest weight gain and best feed conversion ratio were recorded in the diet supplemented with 0.10% ASA. No mortality was recorded in the ASA diets. Conclusively, growth, muscular and bone development of Marshall Broiler breeder are better enhanced at 0.10% ASA supplementation in the diet. Also the use of ASA in the diets promotes better muscular accretion of the drumstick than of the thigh that resulted in heavier total retail cuts of the combined weight of the drumstick and the thigh.

References

Alagawany, M., Farag, M. R., Abd El-Hack, M. E., Dhama, K. and Fowler, J. (2017). Use of acetylsalicylic acid in poultry nutrition. *World's Poult. Sci. J.,* 73(3): 633-642 DOI:10.1017/S0043933917000253

Aro, S. O., Faluyi, O. B., Arogbodo, J. O. and Taylor, O. G. (2018a). Blood viscosity and osmotic fragility of two breeds of chickens fed dietary supplementation of acetylsalicylic acid (ASA). 43rdAnnu. Conf. Nig. Soc. for Anim. Prod. (NSAP), held at Federal University of Technology, Owerri, Imo State, Nigeria. 18th – 22nd March, 2018. Pp. 1148-1151.

Aro, S. O., Faluyi, O. B. and Adekambi, A. O. (2018b). Growth, livability and egg production performance in two breeds of commercial layers fed dietary supplementation of acetyl salicylic acid. *FUTA 2018-Alexander Von Humboldt Kolleg International Conference 2nd - 5th October, 2018.* Book of Abstracts, Pp. 34

Cheng, B., Kato, Y. and Zhao, S. (2001). PGE2 is essential for gap junction mediated intercellular communication between osteocyte MLO-Y4 cells in response to mechanical strain. *Endocrinology.* 142(8): 3464-3473.

Hayse, P. L. and Marion, W. W. (1973). Evicerated yield, component parts, and meat, skin and bone ratios in the chicken broiler. *Poult. Sci.,* 52(2): 718-722.

Lara, L. J and Rostagno, M. H. (2013). Impact of heat stress on poultry production. *Anim. (Basel).* 3(2): 356-369.

Liu, H., Li, W., Liu, Y., Zhang, X. and Zhou, Y.(2015). Co-administration of aspirin and allogeneic adipose-derived stromal cells attenuates bone loss in ovariectomized rats through the anti-inflammatory and chemotactic abilities of aspirin. *Stem Cell Res. Therapy*. 6(1): Article No: 200

Molik, E., MIsztal, T. and Zieba, D. A. (2013). The effect of physiological and environmental factors on prolactin profile in seasonally breeding animals. DOI: 10.5772/51465.

Rokade, J. J., Bhanja, S. K., Shinde, A. S. and Mandal, A. B. (2016). Evaluation of aspirin (ASA) in broiler chicken during hot dry summer using zootechnical, molecular and physio-biochemical tools. *Indian J. Anim. Res.*, 51(1): 97-104.

SPSS (2016). Statistical Package for Social Sciences Version 22.0. Chicago, Ill.