EFFECTS OF FEATHER CLIPPING AND ASCORBIC ACID SUPPLEMENTATION ON PERFORMANCE AND SLAUGHTER TRAITS OF BROILERS RAISED UNDER HOT CLIMATE

[1]Jimoh, A. A. and [1]Ikeh, C. K.

[1]Department of Theriogenology and Animal Production, Faculty of Veterinary Medicine
Usmanu Danfodiyo University, Sokoto, Nigeria
Corresponding Author: Tel:+2347035166498, E-mail: aajimoh1@gmail.com

Abstract
Extremely high ambient temperature (HAT) induces heat stress in birds and affects profitability of poultry industry in hot climates. In this study, we investigated the effects of feather clipping (FC) and dietary ascorbic acid (AA) supplementation on performance and carcass traits of broilers raised under hot climate. A total of 100 day-old broiler chicks of mixed sex were allotted into five treatment groups (**G1, G2, G3, G4** and **G5**), each containing 20 chicks. The broilers in **G1** (positive control) were managed under controlled temperature (28-30°C), unclipped and fed on basal diets. In addition to managing the broilers in **G2, G3, G4** and **G5** under HAT (43.0 ± 2.0°C), **G2** were unclipped and fed on basal diets (negative control), **G3** were feather-clipped and fed on basal diets, **G4** were fed on diets supplemented with 200mg AA/kg and broilers in **G5** were feather-clipped and fed on diets supplemented with 200mg AA/kg. Data were subjected to ANOVA. The results showed that HAT depressed feed intake, fat deposition and breast muscle size significantly ($p<0.05$) but increased thigh muscle size in broilers. The birds in **G5,** treated with feather-clipping and ascorbic acid supplementation compared relatively significant ($p<0.05$) with **G1** in terms of feed conversion ratio (FCR) and weight gain. While HAT caused worst performance indices in the broilers kept under **G2** (negative control), the best two performances were recorded in broilers kept under G1and G5. Therefore, feather-clipping combined with 200mg/kg AA supplementation is recommended for ameliorating heat stress in broilers.

Key words: *Feather clipping, hot climate, broilers.*

Introduction

Heat stress is one of the most important environmental stressors challenging poultry production in the tropical regions worldwide (Lara and Rostagno, 2013). The Sahel savannah vegetation of the northwestern Nigeria is a relatively hot climate, with ambient temperature often measuring up to 43.0 ± 2.0 ^{O}C during the hot-dry season. These extremely high ambient temperatures exceed the thermo-neutral ranges (12°C to 26°C) reported by Holik (2009), and are thus capable of inducing heat stress in broilers. As behavioral responses, birds under hot climate exhibit frequent panting and elevation of wings away from their body in order to expose the skin to air (DEFRA, 2005).

Feathers play major roles in thermoregulation in birds. They are good insulators for heat conservation during cold weather but may prevent free heat dissipation from bird's body during hot weather (Hughes *et al.*, 1986). Full genetic potentials for growth and body weight are not attainable by birds under hot conditions due to feathers which hinder heat dissipation from their body (Cahaner *et al.* 2008). Heat stress effects are further aggravated in birds by high metabolic heat production due to high growth rate (especially in broilers) and lack of sweat glands. Common adverse effects of heat stress in broilers include high mortality, decreased feed intake, lower body weight, poor feed utilization efficiency and poor growth performance (Mack *et al.*, 2013). These depressions in performances of broilers eventually affect the profitability of poultry industry in hot climates. Moreover, management practices aimed at alleviating heat stress are quite expensive and hence not economically feasible in most developing countries. Effectiveness of dietary ascorbic acid supplementation in heat-stressed chickens has been reported (Sahin, 2003). This

study therefore, investigated ameliorative effects of feather clipping alone or in combination with ascorbic acid supplementation on heat-stressed broilers.

Materials and Methods

Experimental birds and design

One hundred (100) broiler chicks of mixed sex were used for this study were randomly allotted into 5 groups (**G1-G5**). Birds in **G1** were kept in temperature-controlled pen, unclipped (Positive control) and fed on the basal diets, **G2** were exposed to HAT, unclipped and fed on the basal diets, **G3** were exposed to HAT, feather-clipped and fed on the basal diets, **G4** were exposed to HAT and supplemented with 200mg AA/kg diets and **G5** were exposed to HAT, supplemented with 200mg AA/kg diets and feather-clipped. Feathers were clipped on the third and the fifth week using method described by Adeyomo *et al.* (2011). Clipping was carefully done to avoid injury on the birds. Water and feeds were served *ad libitum* throughout the seven weeks of the study.

Experimental diets

Table 1. Composition of the experimental feeds

	Starter feed (kg)		Finisher feed (kg)	
Ingredients	**Basal diet**	**Supplemented diet**	**Basal diet**	**Supplemented diet**
Maize	42.03	42.03	50.34	50.34
Soybean	12.66	12.66	9.00	8.55
GNC	25.31	25.31	17.11	17.11
Wheat offal	15.00	15.00	19.00	19.00
Bone meal	2.50	2.50	2.50	2.50
Limestone	1.50	1.50	1.50	1.50
Salt	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20
Methionine	0.25	0.25	0.25	0.25
*Premix	0.30	0.30	0.30	0.30
AA (200mg/kg)	-	0.0002	-	0.0002
Total	**100.00**	**100.0002**	**100.00**	**100.0002**
Calculated values				
Crude protein (%)	23.00	23.00	19.00	19.00
Energy (kcal/kg)	2753.73	2753.73	2780.21	2780.21

*Premix to supply Vitamin D (2,000mg), Vitamin K_3 (2,000mg), Vit. B_{12} (10,000mg), pantothenic acid (10,000mg), niacin (26,000mg), folic acid (1,000mg), biotin (100,000mg), choline (150,000mg), manganese (10,000mg), zinc (50,000mg), cobalt (250mg), iron (40,000mg), copper (6,000mg), iodine (500mg), selenium (100mg). **KEY: GNC:** Groundnut cake, **AA**: Ascorbic acid

Data collection, analysis and presentation

Data collected were subjected to analysis of variance (ANOVA) at 5% probability using the parametric analytical tools of InStat version 3.0 statistical software (d, Software, Inc., San Diego, CA USA). The data were presented in tables.

Results and Discussions

Feed intake reduced significantly ($p < 0.05$) in the groups (**G2-G5**) exposed to HAT ranging between 1290g/b and 1353g/b compared to 1560g/b in **G1** (Table 2). It was observed that birds in **G2** had similar feed intake (1290g/b) to those in **G3** (1320g/b), **G4** (1353g/b) and **G5** (1292g/b). Hughes *et al* (1986) has reported 15% increase in feed intake in poorly feathered birds. This depression in feed intake could be the cause of poor performance in the exposed groups. The best weight gain (1920 g/bird) was recorded in **G1**, which were kept under controlled temperature. This shows the positive impacts of cooler environment on

performance indices of the broilers. The birds in **G5** had second best feed intake (1735 g/bird) and best FCR (0.74) indicating the ameliorative effects of feather-clipping and AA supplementation combination on the heat-stressed broilers.

The results on slaughter traits of the broilers are presented in Table 3. Feather-clipping and AA supplementation significantly ($p< 0.05$) decreased breast muscle size and abdominal fat deposition but increased thigh muscle insignificantly ($p>0.05$). The reduction in abdominal fat values in the groups (**G2**:0.48, **G3**:0.61, **G4**:0.87 and **G5**:0.90) exposed to HAT compared to its value in **G1** (1.12) shows that heat-stressed broilers poorly deposit fat. This findings agree with earlier reports that, exposure to chronic heat decreased fat deposition (Lu, *et al.*, 2007), and proportion of breast muscle, but increased thigh muscle in broilers (Zhang *et al*., 2012). The least values of liver (1.82), spleen (0.12), proventriculus (0.42) and abdominal fat (0.48) were also recorded in **G2** (negative control) indicating the negative effect of HAT on the broilers.

Table 2. Performance indices of broilers managed with feather clipping and ascorbic acid

Parameters	(28-30°C) G1 (PC)	Exposed to High Ambient Temperature (43.0 ± 2.0°C) G2 (NC)	G3 (FC)	G4 (AA)	G5 (AA+FC)	SEM
AIW (g/b)	30.00	30.00	30.00	30.00	30.00	0.00
AFW (g/b)	1950	1590	1580	1700	1765	0.01
AWG (g/b)	1920	1560	1550	1670	1735	0.01
AFI (g/b)	1560[a]	1290[b]	1320[b]	1353[b]	1292[b]	0.03
FCR	0.81[a]	0.83[a]	0.85[a]	0.77[b]	0.74[b]	0.02

ab: means in the same row with different superscripts are significantly (p<0.05) different.
KEYS: G1(PC): Positive control (Unclipped), **G2(NC):**Negative control **(**Unclipped**), G3(FC):** (Feather Clipped), **G4(AA):** (200mg AA/kg diet), **G5(AA+FC):** (200mg AA/kg diet + Feather Clipped), **AIW:** Average Initial Weight, **AFW:** Average Final Weight, **AWG:** Average Weight Gain, **AFI:** Average Feed Intake, **FCR:** Feed Conversion Ratio, **g/b:** Gram per bird

Table 3. Slaughter traits of broilers managed with feather clipping and ascorbic acid

Parameters (g)	G1	G2	G3	G4	G5
Live weight	1950	1590	1580	1700	1765
Dressed weight	1850	1510	1560	1675	1735
% Dress weight	**97.44**	**97.49**	**98.73**	**98.53**	**98.31**
Thighs	10.32	11.12	11.67	11.61	11.69[a]
Wings	3.84	3.94	3.35	4.32	5.04
Breast	23.12[a]	14.35[b]	15.00[b]	26.78[a]	26.78[a]
Lumber	9.32	5.65	6.45	6.94	8.13
Back	9.79	9.76	7.81	10.09	7.83
Neck	5.21	6.29	5.42	5.41	5.83
Liver	2.53	1.82	2.03	2.09	2.87
Spleen	0.26	0.12	0.16	0.16	0.17
Kidney	0.37	0.47	0.71	1.55	0.96
Heart	0.42	0.56	0.45	0.58	0.52
Gizzard	3.62	2.88	3.08	3.09	3.04
Proventriculus	0.53	0.42	0.58	0.58	0.78
Abdominal fat	1.12[a]	0.48[b]	0.90[b]	0.61[b]	0.87[b]

ab: means in the same row with different superscripts are significantly (p<0.05) different.

Conclusion and Recommendation

Extremely high temperatures have a much greater negative effects on the growing and highly feathered broilers. Therefore, exposure of broilers' skin through feather-clipping (for dissipating excess body heat) combined with ascorbic acid supplementation provided ameliorative effects in heat-stressed broilers. It is therefore recommended among small and medium scale poultry farmers.

References

Adeyemo, A. A. Ayorinde, K. L. and Apata, D. F. (2011): Effect of clipping feathers, dietary ascorbic acid supplementation and season on performance of laying chickens, *Int. J. Liv. Prod.* 1(1): 7-10.

Cahaner, A., Ajuh, J. A., Siegmund-Schultze, M., Azoulay, Y., Druyan, S. and Zarate, V. (2008): Effects of genetically reduced feathercoverage in naked-neck and featherless broilers on their performance under hot conditions. *Poult. Sci.* **87**:2517-2527.

DEFRA. (2005): Heat stress in poultry: solving the problem. department of environment, food and rural affairs. www.defra.gov.uk. Pp 1-24.

GraphPad Instat (2013): Version 3.10 statistica software (software, Inc,) San Diego, CA USA, updated Sept. 2nd 2013.

Holik, B. (2009): Management of laying hens to minimize heat stress. *Lohmann info*, 44: 16-29.

Hughes, B. O., Gilbert, A. B. and Brown, M. F. (1986): Categorisation and causes of abnormal egg shells: relationship with stress. *Br. Poult. Sci.*, **27**: 325-337.

Jag, M. (2006): Thrust areas for mitigation of stress in poultry, In P.V.K. Sasidhar (Ed.) *Poultry Research Priorities to 2020, Proceedings of National Seminar (November 2-3).Central Avian Research Institute, Izatnagar*-243122 (India).

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

Lu, Q., Wen, J. and Zhang, H. (2007): Effect of chronic heat exposure on fat deposition and meat quality in two genetic types of chicken. *Poult. Sci.* **86**, 1059–1064.

Mack, L. A., Felver-Gant, J. N. and Dennis, H. W. (2013): Genetic variation alters production and behavioral responses following heat stress in 2 strains of laying hens. *Poult. Sci*, **92**: 285-294.

Sahin, K. (2003): Effects of chromium and ascorbic acid supplementation on growth, carcass traits, serum metabolites and antioxidant status of broiler chickens reared at a high ambient temperature (32ºC). *Nutr. Res.*, **23**: 225-238.

Zhang, Z.Y., Jia, G. Q., Zuo, J. J., Zhang, Y., Lei, J., Ren, L. and Feng, D. Y.(2012) Effects of constant and cyclic heat stress on muscle metabolism and meat quality of broiler breast fillet and thigh meat. *Poult. Sci.* **91**, 2931–2937.