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Effects of Feeding Synthetic and Natural Anti-oxidant (African Locust Lean, Boabab and Iron Wood Pulp) in Ameliorating Heat Stress in Broiler Chickens at Finisher Phase

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ABSTRACT

Heat stress exerts high deteriorating impact on the poultry industry which could be ameliorated by dietary incorporation of synthetic vitamin C. Certain herbs either alone or in combination thereof are also a rich source of ascorbic acid in natural form. Gashua is located in the semi-arid zones with temperature ranges of 38-43^{o}C especially in the months of March up to June/July which make survival and production much difficult to poultry especially broilers chickens as it was found that high ambient temperatures above 38^{0}C feed consumption, growth rate, feed efficiency, survivability, egg production and egg quality tends to decline. In order to address the problem of heat stress, an experiment was conducted in the month of March/April to determine the effect of synthetic ascorbic-acid (vitamin C), natural ascorbic from Baobab, African Locust Bean and Prosopis Africana Pulp was administer in drinking water and basal diets ad-libitum. 300 day old marshal breed chicks were used for this experiment which was divided into five treatment group with 20 birds per replicate which designated as zero, Synthetic Ascorbic Acid 40g/L, Baobab Pulp 40g/L, African Locust Pulp 40g/L and Iron Wood Pulp 40g/L for $T_{1,}$ T_2 T_3 T_4 and T_5 respectively. The experiment was lasted for eight weeks (four weeks each for the starter and finisher). Data collected were subjected to analysis of variance (ANOVA) using SAS 2002 soft wire and significant difference observed means were separated using Duncan multiple range test. The result revealed that bird on control diet were significantly ($p < 0.05$) lowered in terms total and daily weight gain and feed efficiency but significantly ($p < 0.05$) higher in terms feed intake, water intake, rectal temperature and mortality. This study concluded that ascorbic acid increased broiler performance and reduced mortality under high temperature thereby maintain the sustainability of broiler production to bridge the gap of animal protein deficit in the hot arid zone. Reduce the number of words to <250

Keywords: Ascorbic acid; Performance; Temperature; Broiler

Description of Problem

Birds have a greater challenge in maintaining homoeothermic body temperature during heat stress because of the absence of the sweat glands and higher body temperature when compared to other domestic animals. (Sahin *et al.*, 2009). Combating heat stress remains a challenge for the broiler industry in the tropics and subtropics, which is even aggravated by the changing climatic conditions. The development of novel dietary measures such as supplementation of anti-

stress agents, vitamins, and minerals may be beneficial in ameliorating heat stress and enhancing optimum performance in broiler chickens. (Erwan *et al.,* 2012), supplementation with Vitamin C is the most beneficial among other vitamins throughout the heat stress period. (Suganya *et al.,* 2015). Vitamin C is a powerful anti-oxidant and extremely important in human and animal nutrition. (Sidibe *et al.,* 1996), however; the ability to utilized Vitamin C becomes inadequate during heat stress especially from parkia and baobab trees. Therefore, it remains a prime issue to re-evaluate the poultry management in hot weather, so that heat stress is minimized. The study evaluates the effect of feeding Synthetic and Natural Ascorbic acid on the performance of broiler chickens at Starter Phase.

Material and Methods

The Study Area

The study was carried out at the poultry unit of Federal University Gashua teaching and research farm, Yobe State. Located between latitude 12°,52.547/12.8758°N and longitude 11.0120°/11°00.719E.The area falls within the Sahelian region of West Africa which is noted for its great climatic and seasonal variations. Annual rainfall ranges from 500-1000mm. While the average ambient temperature varies range between 23-28℃ in December -January and reaches up to 38-45℃ in March –April, The mean relative humidity ranges from 30-35% with minimum in February-April when it drops to as low as 10% and maximum of about 70% in August (Google map 2025).

Experimental bird's management

Three hundred (300) broiler chickens were allotted to five (5) treatments replicated thrice with twenty (20) birds per replicate in a completely randomized design (CRD). The experiment lasted for eight (4) weeks (four weeks each for the starter and finisher). Common diet and water solution were fed *ad-libitum* throughout the 28 days of experimental period. The chicks were vaccinated with first dose of Newcastle disease vaccine (lasota), at first week and first dose of Gumboro vaccine at second week, also at third week lasota booster was administered and at fourth week second dose of Gumboro vaccine was administered.

Experimental Diets

The inclusion levels of the Synthetic and Natural ascorbic Acid (NAA) were 0g/L, 40g/l, 40g/l and 40g/l for treatment 1 (control 1, 2, 3, 4 and 5 respectively.

Table 1: Ingredients composition (%) and Calculated Analysis of feed fed to broiler starter

Ingredients	% Composition	Nutrients	Calculated Composition
Sorghum	56.00	Crude protein	22.00
Wheat bran	10.00	Crude fiber	3.15
Groundnut cake	22.00	Ether extract	3.70
Bone meal	3.00	Phosphorus	0.94
Fish meal	8.00	Calcium	1.20
Salt	0.03	Lysine	1.01
Methionine	0.03	Methionine	0.36
Lysine	0.02	Metabolizable energy (Kcal/kg)	3247
Pre- mix	0.02		

*Each kg premix contains Vit. A (10000000 iu), Vit. D6 (2000000 iu), Vit. E (15000 iu), Vit. B (3000mg), Niacin (15000ng),Vit. B6 (3000mg), Vit. B12 (10mg), Vit. K3(2000mg), Biotin (20mg), Folic Acid (500mg), Calcium pantothenate (800mg), Chlorine Chloride (250000mg), Manganese (75000mg), Iron (25000mg), Copper (5000mg), Zinc (70000mg), Selenium (150mg), Iodine (1300mg), Magnesium (100mg),Ethoxyquine (500g),BHT (700g).

Data collection and Laboratory Analysis

Source of Experimental materials

Source of the materials Baobab, African locust bean, Prosopis Africana pulp and synthetic Vitamin C were be purchase from Gashua market and environ.

Data analysis

All data collected were subjected to analysis of variance using general linear model SAS (2007). Comparative analysis of variance for the responses of birds to the control, Ascorbic acid and tamarind fruit pulp were performed. Where significance difference observed means were separated using Duncan Multiple range Test (Steel and Torrie, 1980).

Results and Discussion

Weight gain

The values recorded for final weight, total weight and daily gain were range from 1450.31-1637.47g, 650.24 - 834.63g and 23.22 - 29.81g respectively (Table 2) significantly ($p<0.05$) higher values were recorded in birds fed NAA when compared with those birds fed non supplemented NAA. It has been previously examined that vitamin supplementation can effectively minimized the negative impacts associated with high temperature (Kutlu, 2003). The present finding agreed with the report said that supplementation of 100mg AA/Kg improved body weight of broiler chicken during period of hot environment (Raja and Qureshi, 2000).

Feed intake

The values recorded for total feed intake and daily feed intake were range from 3138.80 - 3368.12g and 112.10 - 120.29g respectively (Table 2). significantly ($p<0.05$) higher feed intake were recorded in birds fed supplemented NAA when compared with non supplemented NAA and there insignificant ($p>0.05$) different among bird fed SAA and NAA supplementation. The present study agreed with the finding of Khoso *et al* (2018) who reported that feed intake was lower in bird fed non supplemented vitamin when compared with supplemented vitamin in

broiler chickens reared under hot environmental temperature.

Feed Conversion Ratio

The values of FCR recorded for this study were range from 3.75 - 5.18 (Table2) significantly ($p<0.05$) lower values were recorded in birds fed both SAA and NAA that was the best when compared with the birds fed control diet. This agreed with the work of Opoola *et al* (2022) who reported that broiler chickens fed vitamin c supplementation had the best FCR compared to chickens given water without vitamin supplementation and also Khoso et al (2018) who found considerable improvement in feed conversion efficiency of broiler chickens when given vitamin and minerals supplementation with their routine feed.

Rectal Temperature

The values of rectal temperature recorded for this study were range from 41.30 - 42.87^{0}C (Table 2). significantly ($p<0.05$) higher value was recorded in birds fen non supplemented vitamins when compared with bird fed supplemented vitamin c, elevation in body temperature is one of the responses of birds to high ambient temperature. Exposure to high ambient temperature can result in high rectal temperature (Naila *et al* 2014).

Water intake

The average daily water intake recorded in this study were range from 329.79 - 335.30ml/day (Table 2). significantly ($p<0.05$) higher water intake was recorded in birds fed non supplemented SAA and NAA, this revealed that birds fed control diet were under heat heat stress compared to birds fed test diet as increased in water intake might be the mechanism to alleviate heat stress especially when the environmental temperature is high (Opoola *et al.*, 2022).

Mortality

The percentage mortality recorded in this study were range from 0.33 - 2.00% (Table 2). Significantly ($p<0.05$) higher mortality were recorded in birds fed control diet (0% SAA/NAA) while similar ($p>0.05$) percentage mortality were recorded in birds fed test diets (NAA/SAA). This finding were supported by many workers who found that vitamin C possess antioxidative properties and help in improving immune response of broiler chickens similarly have synergistic effects in reducing heat stress (Sahin *et al* 2002) .

Conclusion and Application

This study concluded that both synthetic and natural ascorbic acid from african locust bean, baobab and *Prosopis africana* pulp could ameliorate heat stress in broiler chickens production thereby sustained their production in hot climatic regions.

Table 2: Performance of Broiler Chickens at the Finisher Phase

Parameter	T1 (0g)	T2 (SAA 40g/L)	T3 (ALBP 40g/L)	T4 (BBP 40g/L)	T5 (PAP 40g/L)	SEM
Initial Wt	800.07	800.05	800.01	800.04	800.01	0.002
Final Wt	1450.31^{b}	1620.67^{a}	1637.47^{a}	1634.67^{a}	1634.95^{a}	41.28
Total Weight Gain	650.24^{b}	820.62^{a}	837.46^{a}	834.63^{b}	834.94^{a}	41.33
Weight gain/Day	23.22^{b}	29.31^{a}	30.91^{a}	29.81^{a}	29.82^{a}	1.62
Total Feed intake	3,368.12^{a}	3,148.04^{b}	3,138.80^{b}	3,150.0^{b}	3,156.44^{b}	17.65
Feed intake/day	120.29	112.43	112.10	112.50	112.73	11.39
FCR	5.18^{a}	3.84^{b}	3.75^{b}	3.77^{b}	3.78^{b}	0.01
Rectal Temperature	42.87	41.30	41.07	41.47	41.30	0.13
Water intake	35.30^{a}	31.60^{b}	30.95^{b}	29.79^{b}	29.98^{b}	1.82
Mortality	2.00^{a}	0.67^{b}	1.00^{b}	0.33^{b}	0.67^{b}	0.68

SAA = Sythetic ascorbic acid; ALBP = African locust bean pulp; BBP = Baoba pulp,; PAP = Prosopis africana pulp; a.b. means differed significantly at P<0.05); SEM = Standard error of the mean

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