

THE INFLUENCE OF VARIED ACETYLSALICYLIC ACID AND SODIUM CHLORIDE LEVELS ON PERFORMANCE, CLOACAL AND AXILLARY TEMPERATURES OF ISA WHITE COCKS

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ABSTRACT

This experiment was conducted to investigate the combined influence of varied inclusion of sodium chloride (NaCl) and supplemental levels of acetylsalicylic acid (ASA) on performance, cloacal and axillary temperatures of Isa White cocks. Four diets with different NaCl and ASA levels of 0.25/0.00% (Diet 1 or D1), 0.50/0.05% (D2), 0.75/0.10% (D3) and 1.00/0.15% (D4) respectively were formulated. The D1 served as the control diet. These diets were fed to the cocks throughout the eight weeks of the experiment during which data on weight change, feed consumption, cloacal and axillary temperatures were taken. The ambient temperature and relative humidity in the mornings (6.00 hour) afternoons (12.00 hour) and evenings (18.00 hour) were recorded from which the respective temperature-humidity indices (THI) were calculated. The results showed significant differences in final live weight, weight change, feed intake and feed conversion ratio (FCR) among the different diets. The best FCR was observed in D3 while weight change was better enhanced in the D2 and D3 diets. The morning, afternoon and evening cloacal and axillary temperatures decreased ($p < 0.05$) as the levels of NaCl and ASA increased in the diets. The respective THI for the mornings, afternoons and evenings were 18.36 ± 0.53 , 20.79 ± 0.79 and 16.89 ± 0.55 . The decrease in the core body temperature of the birds showed that using 0.15% ASA and 1.00% NaCl in combination can help mitigate the harmful effects of high ambient temperature. Also, the combined effect of 0.10% ASA and 0.75% NaCl would optimally enhance feed consumption, feed efficiency and growth in Isa White breeder cocks.

Keywords: Acetylsalicylic acid, ambient temperature, heat stress, relative humidity, sodium chloride.

INTRODUCTION

Livestock production, especially in the tropics is faced with the problem of heat stress engendered by the twin effect of high environmental temperature and relative humidity (Aro *et al.*, 2018). This problem has continued to hamper livestock productivity in this torrid region of the world with its attendant decrease in feed intake, increased morbidity, reduced livability, drop in egg production, decreased milk yield and an overall erosion of the profit margin of the average livestock producer. Heat stress is also known to impart negatively on the physiology of livestock production through its disruption of hormonal balance, causation of heat stroke, heat prostration, respiratory alkalosis, disruption of acid-base homeostasis, impaired fertility, hatchability and general decline in the reproductive performance of livestock.

The urgent need to attenuate the ill effects of heat stress on our livestock to the barest minimum has necessitated series of research in diverse fields of science all with varied rates of success and the search is still on. For instance, the design of livestock houses in the tropics has been modified severally to ensure easy dissipation of heat, allow ample ventilation and reduce solar radiation. Several cooling systems with automation have been deployed towards warding off thermal stress within the animal houses with a view to improving the thermal welfare of livestock. Other intervention strategies that have been deployed against the menace of heat stress include dietary manipulation to help the animals decrease metabolic heat generation under prevailing high environmental temperature, the use of feed additives that will put to check the proliferation of the enteric methanogenic organisms and thus curtail the emission of the greenhouse gases among others. The use of ascorbic acid, potassium chloride, sodium chloride (NaCl), Vitamins A and E and pharmaceutical preparations like the sodium salicylates and acetylsalicylic acid (ASA) or Aspirin have been experimented with as possible antidotes to thermal stress in livestock production (Wu *et al.*, 2016).

Currently, there is a renewed awareness in the use of acetylsalicylic acid as a possible elixir for combating thermal stress in livestock. This is predicated on the pharmaceutical importance of ASA as an antipyretic, anti-inflammatory and analgesic agent. The use of NaCl to ameliorate heat stress in livestock has also been reported but its predisposition to wet litter has discouraged its widespread acceptability. Recently, Aro *et al.* (2018) reported on the reduction in faecal moisture and

improvement in faecal consistency of layers fed supplemental levels of ASA. Also, the reduction in rectal and axillary temperatures of two breeds of laying chickens has earlier been reported by Aro *et al.* (2017). It is therefore expedient to experiment with dietary combination of varied levels of ASA and NaCl to unravel their synergistic or antagonistic role on reduction of heat stress, enhancement of growth and change in cloacal and axillary temperatures in Isa White breeder cocks.

MATERIALS AND METHOD

Experimental site: The experiment was carried out in the Student Project Block of the livestock section of Teaching and Research Farm, Federal University of Technology, Akure, Ondo State, Nigeria. Akure is located on Latitude 7°1'N and Longitude 5°10'E with a bimodal rainfall pattern characteristic of the hot wet equatorial climate. The mean annual rainfall is about 1,500mm while the mean annual temperature is between 26-28°C.

Experimental birds and their management: Twenty Isa White cockerels with an average initial weight of 1.94kg at 16 weeks of age were purchased from a reliable source. Four experimental diets were formulated to meet the nutrient requirement of the cockerels. Acetylsalicylic acid and NaCl were respectively used at varied supplemental and inclusion levels of 0.00/0.25% (D1), 0.05/0.50% (D2), 0.10/0.75% (D3) and 0.15/1.00% (D4) of the diet. The 0.00/0.25% diet (D1) served as the control and four birds were randomly allotted to each treatment diet which was replicated four times with each bird serving as a replicate of its treatment diet. Table 1 gives the composition of the experimental diets.

Table 1: Gross composition (g/100g) of the experimental diet

Ingredients	D1	D2	D3	D4
Maize	55.10	55.10	55.10	55.10
Fish meal	1.00	1.00	1.00	1.00
Groundnut cake	9.00	9.00	9.00	9.00
Soybean meal	9.00	9.00	9.00	9.00
Wheat offal	21.00	20.75	20.50	20.25
Bone meal	2.75	2.75	2.75	2.75
Limestone	1.50	1.50	1.50	1.50
Salt (NaCl)	0.25	0.50	0.75	1.00
Premix	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
ASA	0.00	0.05	0.10	0.15

DI = Diet with 0.00% of ASA and 0.25% NaCl; D2 = Diet with 0.05% ASA and 0.50% NaCl; D3 = Diet with 0.10% ASA and 0.75% NaCl; D4 = Diet with 0.15% ASA and 1.00% NaCl; ASA = Acetylsalicylic acid.

The experiment was carried out over a period of 8 weeks. The birds were fed with the experimental diets according to their respective treatments until the end of the experiment.

Data collection and analysis: Data were collected on feed intake and weight change from which feed conversion ratio was calculated. The ambient temperature and relative humidity were taken with a combined digital thermometer and hygrometer while the cloacal/rectal and axillary temperatures were taken with a digital thermometer. All these parameters were measured three times weekly (Tuesdays Thursdays and Saturdays at 6am, 12pm and 6pm) for eight weeks thus making a total of 72 observations. From these observations, the respective temperature-humidity indices (THI) for the morning, afternoon and evening readings were calculated according to the model of Marai *et al.* (2001) for non-sweating animals i.e. $THI = t - [0.31 - 0.31 (RH/100)(t - 14.4)]$, where: THI= Temperature humidity index, RH= Relative humidity; t= Dry bulb temperature (ambient temperature). Data collected were subjected to completely randomized design of one-way analysis of variance using SAS (2012), Version 9.2 Significant differences where appropriate were determined using Duncan multiple range test (DMRT) of the same statistical package.

RESULTS AND DISCUSSION

The results of the performance parameters of cockerels fed varied levels of dietary salt (NaCl) and supplemental acetylsalicylic acid (ASA) are as presented in Table 2 below. The final weight was higher ($p<0.05$) in D2 ($2.60\pm0.37\text{kg}$) and D3 ($2.58\pm0.40\text{kg}$) than in D1 ($2.50\pm0.25\text{kg}$) and D4 ($2.53\pm0.37\text{kg}$). The same trend was observed in the weight change over the entire period where both D2 and D3 recorded the same growth accretion of 0.65kg while D1 and D4 recorded 0.57kg and 0.60kg increase in growth respectively. The feed intake parameters were better ($p<0.05$) in the ASA supplemented and high salt diets than those in the D1 except for the D3 diet. The best feed conversion ratio (FCR) was however recorded in the D3 diet. Neither morbidity nor mortality was recorded during the course of the experiment. The higher growth accretion recorded in the high salt and ASA fed birds supports the report in literature of the role of dietary NaCl and ASA at enhancing the growth rate of livestock (Alagawany *et al.*, 2017). This also explains why birds fed diets higher in NaCl and ASA had higher feed intake values than those on the control diet.

Table 2: Performance parameters of Isa White cockerels fed varied levels of dietary salt (NaCl) and supplemental acetylsalicylic acid (ASA)

Parameters	D1	D2	D3	D4
Initial weight (kg)	1.93 ± 0.03	1.95 ± 0.05	1.93 ± 0.03	1.93 ± 0.04
Final weight (kg)	2.50 ± 0.25^b	2.60 ± 0.37^a	2.58 ± 0.40^a	2.53 ± 0.37^b
WC (kg)	0.57 ± 0.03^b	0.65 ± 0.03^a	0.65 ± 0.04^a	0.60 ± 0.05^b
DFI (g)	94.92 ± 10.55^b	102.25 ± 5.37^a	95.58 ± 8.49^b	112.67 ± 11.13^a
WFI (g)	664.44 ± 62.03^b	715.75 ± 15.73^a	669.06 ± 40.11^b	788.67 ± 80.33^a
TFI (kg)	5.32 ± 0.67^b	5.73 ± 0.87^a	5.35 ± 1.13^b	6.31 ± 0.97^a
FCR	9.33 ± 0.77^a	8.81 ± 0.97^a	8.23 ± 0.65^b	10.10 ± 1.33^a
Mortality	Nil	Nil	Nil	Nil
Morbidity	Nil	Nil	Nil	Nil

a, b = Means in the same row but with different superscripts are statistically ($p<0.05$) significant. D1 = Diet with 0.00% of ASA and 0.25% NaCl; D2 = Diet with 0.05% ASA and 0.50% NaCl; D3 = Diet with 0.10% ASA and 0.75% NaCl; D4 = Diet with 0.15% ASA and 1.00% NaCl; ASA = Acetylsalicylic acid.

Table 3 shows the morning, afternoon and evening cloacal and axillary temperatures of Isa White cocks fed dietary supplementation of ASA and inclusion of NaCl under prevailing ambient temperature, relative humidity and their calculated temperature humidity indices. The average ambient temperature recorded in the mornings, afternoons and the evenings in the course of the experiments were $23.83\pm0.58^\circ\text{C}$, $28.27\pm0.51^\circ\text{C}$ and $24.78\pm0.45^\circ\text{C}$ respectively. Of these three daily readings, only the morning and evening ambient temperatures fell within the $18\text{--}24^\circ\text{C}$ thermo-neutral zone proposed for the tropical regions. The relative humidity data recorded for the corresponding periods of the day stood at $87.83\pm1.52\%$, $77.21\pm0.89\%$ and $77.04\pm1.63\%$ respectively. These are temperature and relative humidity values characteristic of the hot, wet equatorial climatic regions of the world with year-round high temperature and relative humidity - the two climatic variables that are the precursors of thermal stress in this torrid zone. The calculated temperature humidity indices (THI) for the mornings, afternoons and evenings (18.36 ± 0.53 , 20.79 ± 0.79 and 16.89 ± 0.55 respectively) showed that the birds were well within the comfort zone in the mornings and evenings but in the borderline of alert and danger zones in the afternoons. The implication of these is that the birds in the current study were only heat-stressed in the afternoons and any intervention strategy to reduce thermal stress on them should be directed at this period of the day.

There are well documented evidences of the decrease in the body temperature of livestock especially with dietary administration of ASA (Alagawany *et al.*, 2017; Aro *et al.*, 2017). The antipyretic role of ASA is thus evident in the significant reduction in both the cloacal and axillary temperatures of the birds thus helping them to cope better in their effort to maintain homeothermy when physiologically challenged with high air temperature. Furthermore, ASA was able to lower the birds' cloacal and axillary temperatures in the current experiment in combination with dietary increase in the levels of NaCl. This showed that ASA was able to work in synergy with NaCl to achieve this.

Table 3: Morning, afternoon and evening cloacal and axillary temperatures of Isa White cocks fed dietary supplementation of ASA and inclusion of NaCl under prevailing temperature, relative humidity and their calculated temperature humidity indices.

Diets	AMT (°C)	Morning Data			
		RH (%)	THI	CT (°C)	AXT (°C)
D1	23.83±0.58	87.83±1.52	18.36±0.53	41.54±0.01 ^a	40.59±0.02 ^a
D2	23.83±0.58	87.83±1.52	18.36±0.53	41.39±0.01 ^b	40.43±0.01 ^b
D3	23.83±0.58	87.83±1.52	18.36±0.53	41.30±0.01 ^c	40.29±0.01 ^c
D4	23.83±0.58	87.83±1.52	18.36±0.53	41.16±0.01 ^d	40.08±0.01 ^d
Afternoon Data					
Diets	AMT (°C)	RH (%)	THI	CT (°C)	AXT (°C)
D1	28.27±0.51	77.21±0.89	20.79±0.79	41.52±0.01 ^a	40.61±0.02 ^a
D2	28.27±0.51	77.21±0.89	20.79±0.79	41.36±0.01 ^b	40.44±0.01 ^b
D3	28.27±0.51	77.21±0.89	20.79±0.79	41.27±0.01 ^c	40.31±0.01 ^c
D4	28.27±0.51	77.21±0.89	20.79±0.79	41.16±0.01 ^d	40.01±0.01 ^d
Evening Data					
Diets	AMT (°C)	RH (%)	THI	CT (°C)	AXT (°C)
D1	24.78±0.45	77.04±1.63	16.89±0.55	41.55±0.01 ^a	40.54±0.02 ^a
D2	24.78±0.45	77.04±1.63	16.89±0.55	41.35±0.01 ^b	40.41±0.01 ^b
D3	24.78±0.45	77.04±1.63	16.89±0.55	41.11±0.01 ^c	40.24±0.01 ^c
D4	24.78±0.45	77.04±1.63	16.89±0.55	41.02±0.01 ^d	39.95±0.01 ^d

^{a,b,c,d} = Means in the same column but with different superscripts are statistically ($p < 0.05$) significant.

D1 = Diet with 0.00% of ASA and 0.25% NaCl; D2 = Diet with 0.05% ASA and 0.50% NaCl; D3 = Diet with 0.10% ASA and 0.75% NaCl; D4 = Diet with 0.15% ASA and 1.00% NaCl; ASA = Acetylsalicylic acid; AMT = Ambient temperature; RH = Relative humidity; THI = Temperature humidity index; CT = Cloacal temperature; AXT = Axillary temperature.

CONCLUSION AND RECOMMENDATIONS

The decrease in the core body temperature as revealed by lower cloacal and axillary temperatures with incremental levels of both ASA and NaCl in the diets showed the synergy between these two additives at lowering the body temperature. Also, both ASA and NaCl will work optimally in favour of growth accretion when combined at 0.10 and 0.75% of the diet respectively. The THI as calculated in this study showed that the Isa White cocks were mostly heat-stressed in the afternoons. Therefore, any intervention strategy to mitigate heat stress at this particular location and in similar climes should be directed towards the afternoon period of the day.

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