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## **EFFECTS OF ASCORBIC ACID ON RECTAL TEMPERATURE IN RED SOKOTO GOATS EXPOSED TO HEAT STRESS DURING THE EARLY RAINY SEASON**

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### **ABSTRACT**

The aim of this study was to determine the effect of administration of ascorbic acid on rectal temperature of Red Sokoto goats exposed to heat stress during the early raining season. Ten goats of both sexes served as subjects for the study. Five goats(experimental) administered with ascorbic acid (AA) *per os* at a dose rate of 100 mg/kg thrice, a week apart. Five goats administered with distilled water *per os* served as controls. Rectal temperature (RT) was collected from an hour after each administration of ascorbic acid through 13<sup>th</sup>hour. The goats administered ascorbic acid had a consistently lower RT values than those of control goats throughout the study period from 1hr – 13hr post administration of ascorbic acid. The lowest hourly temperature of  $37.0\pm 0.27^{\circ}\text{C}$  was obtained in experimental goats at 12hrs post administration, while the highest value of  $38.1\pm 0.33^{\circ}\text{C}$  was recorded at 1hr post administration. The overall mean values of RT in control and experimental Red Sokoto goats were  $38.00 \pm 0.09^{\circ}\text{C}$  and  $37.55 \pm 0.08^{\circ}\text{C}$ , respectively ( $P < 0.05$ ).The goats administered ascorbic acid had a consistently lower RT values than those of control goats throughout the study period from 1hr – 13hrs post administration.Thus, the administration of ascorbic acid may be beneficial to goats during the early rainy season as it reduces the negative effects of thermal environmental stress on rectal temperature.

### **INTRODUCTION**

It has been established that heat stress is evaluated by measuring the rectal temperature, which is a true reflection of internal body temperature and a reliable index of thermal balance (Bianca, 1976; Ayo *et al.*, 1998). In heat stress, free radicals are generated in the body in such large quantity that the natural antioxidant defense systems of the body are overwhelmed (Sahota and Gillani, 1995; Altan *et al.*, 2003). This results in lipid peroxidation of cytomembranes; and consequently cell damage and destruction (Freeman and Crapo, 1982). Heat stress results from negative balance between the net amount of energy flowing from the animal to its surrounding environment and the amount of heat produced by the animal. It reduces expression of estrous (Hansen *et al.*, 2001). The best recognized effect of raised body temperature is an adaptive depression of the metabolic rate associated with appetite. Thus in domestic ruminants, a rise of body temperature marks the transition from aversive stage to noxious stage (Silanikove, 2000).

The Northern Guinea Savannah zone has two broad seasons - dry and rainy seasons. The rainy season lasts for 5-6 months, while the dry season lasts for 6-7 months. According to Fricke (1977), the dry season can further be divided into cold-dry (harmattan) and hot-dry periods. As

the rainy season prepares to set in, the weather becomes very hot and humid. The period with the greatest thermal stress for animals in the zone, therefore, covers March to May (Balogun *et al.*, 1993). High humidity and radiation, characteristic of the zone, have the same effect, poor weight gain on livestock. Climatic stressors depress the appetite; reduce feed intake and grazing time. They decrease productivity as measured by low growth rate (Fricke, 1977). Adenkola and Ayo (2009) demonstrated that AA reduced the rectal temperature (RT) values in turkeys, especially during the hot hours of the day, and that it may be of value in combating adverse effects of heat stress in turkeys during the hot-dry season. Ascorbic acid has also been found to reduce body temperature in pigs exposed to harmattan stress and, thus, alleviated the adverse effects of the season on health and productivity of pigs (Adenkola *et al.*, 2009). The aim of the study is to determine changes in rectal temperature of Red Sokoto goats and the effect of ascorbic acid supplementation on the changes, during the early rainy season in the Northern Guinea Savannah zone of Nigeria.

### MATERIALS AND METHODS

The experiment was performed at the Livestock Research Pen, Faculty of Veterinary Medicine, Ahmadu Bello University, Samaru, Zaria (11° 10'N, 07° 38'E), located in the Northern Guinea Savannah zone of Nigeria during the early rainy season, in July. Ten apparently, healthy Red Sokoto goats of both sexes approximately 1-2 years' old and weighing 10-14 kg served as subjects. They were kept in a pen made of concrete floor, cement block wall and wire-mesh with asbestos roofing. The pens measured 2.42 m × 7.39 m wide and 1.12m high of wire-mesh from the floor, which provided for adequate ventilation. The goats were kept under a semi-intensive system of management. They were allowed to graze during the day and they were fed with beans offal later in the evening. Water was given *ad libitum*. The goats were pre-conditioned for three weeks before the commencement of the experiment were prophylactically treated once with oxytetracycline long-acting (Oxytet® LA) at a dose of 20 mg/kg by deep intramuscular injection. Deworming was done using albendazole (Sambezole®) orally at a single dose of 10 mg/kg.

On experimental day, ascorbic acid was administered *per os* to the five experimental animals at the dose of 100 mg/kg (Chervyakov *et al.*, 1977), dissolved in 10ml of sterile water. 10 ml of sterile water was administered *per os* to five goats that served as controls. The RT was measured every hour using a standard procedure (Zaytsev *et al.*, 1971; Ayo *et al.*, 1998) for 3 days, a week apart. Measurement of rectal temperature was done using digital clinical thermometer (the Hartman's Company PLC, England) hourly for 12 hours. After slight restraining of the animals, the thermometer was inserted about 4 cm into the rectum of each goat. Readings were taken after signals were produced, usually after about 1 minute, indicating the end of the reading. At the same hourly period, the dry- and wet-bulb thermometer readings were also taken in the animal pen.

### Statistical Analysis

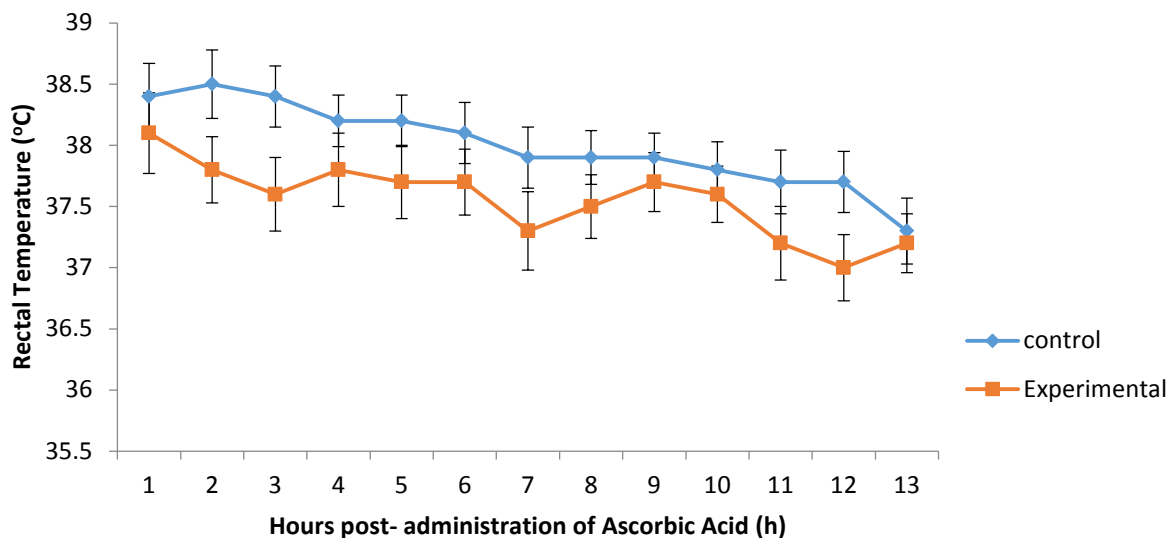
Data obtained were subjected to correlation analysis and Student's *t*-test. Data were expressed as mean ± standard error of mean (Mean ± SEM). Values of  $P < 0.05$  were considered significant.

### Results

The meteorological data obtained in the present study indicated that the Dry Bulb Temperature, which ranged between  $20.4 \pm 1.0 - 23.92 \pm 0.4^{\circ}\text{C}$ , was almost outside the thermoneutral zone of

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12 - 24°C established for the goats (Nikitchenko *et al.*, 1988). The RH values recorded from the study period were characterized by high values, established to induce heat stress in goats (Ayo *et al.*, 1998). The mean dry – bulb temperature during the study period was  $22.8 \pm 0.3^{\circ}\text{C}$ . The extreme maximum dry – bulb temperature was recorded at 1h post-administration of AA with a mean value of  $25.3 \pm 0.7^{\circ}\text{C}$ , while the extreme minimum dry – bulb temperature was recorded at 8h post-administration of AA with a mean value of  $22.0 \pm 1.3^{\circ}\text{C}$ .



**Figure 1: Temperature variation in both Control and Experimental goats**

The range in dry – bulb temperature was  $3.0 \pm 0.2^{\circ}\text{C}$  during the study period. In experimental animals, the extreme mean maximum rectal temperature value  $38.1 \pm 0.3^{\circ}\text{C}$  was observed at 1h post-administration of AA (Figure 1), the same time the extreme mean maximum ambient temperature was recorded with a value of  $25.3 \pm 0.7^{\circ}\text{C}$ . At this same time, the second lowest mean relative humidity value of  $78.3 \pm 3.0\%$  was recorded (Figure 2). The temperature humidity index was also highest at 1h post-administration of AA.

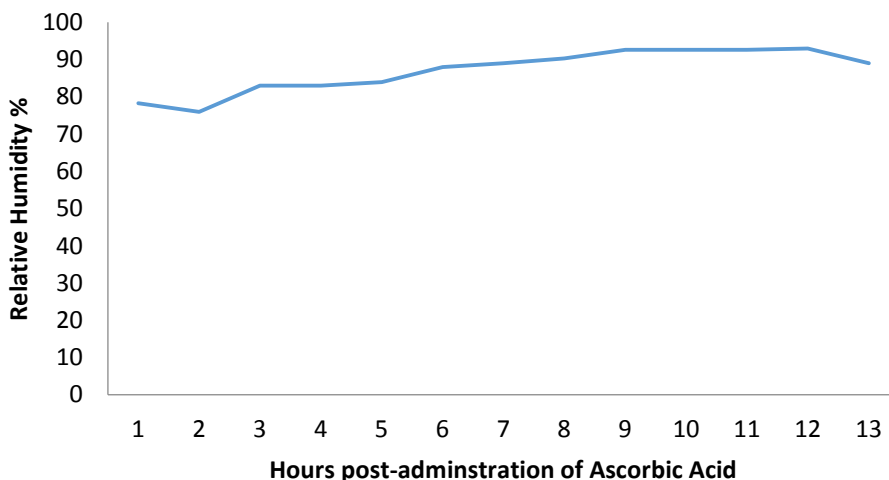


Figure 2: Mean Relative Humidity during the study period

Extreme mean minimum rectal temperature value was observed at 12h post-administration of AA, which was the time ambient temperature was lowest with a value of  $21.8 \pm 0.7^{\circ}\text{C}$ . The mean relative humidity during the study period was  $87.1 \pm 1.6\%$ . The extreme maximum humidity was recorded at 12h post-administration of AA with a mean value of  $93.0 \pm 1.5^{\circ}\text{C}$ , while the extreme minimum humidity was obtained at 2h post-administration of AA with a mean minimum value of  $76.0 \pm 1.0^{\circ}\text{C}$ . The range value of relative humidity was  $9.0 \pm 1.7\%$  during the study period. The goats administered ascorbic acid had a consistently lower RT values than those of control goats throughout the study period from 1hr – 13hrs post administration. The Values of thermal environmental parameters obtained during the study period showed that the early rainy season was characterized by high relative humidity and high ambient temperature values. Thus, the season was hot-humid. These results agree with the findings that the season was thermally stressful to livestock (Balogun *et al.*, 1993; Ayo *et al.*, 2008). Ascorbic acid may be beneficial to goats during the early rainy season as it reduces the negative effects of thermal environmental stress on erythrocyte fragility. The lowering of RT by AA in goats was similar to what has been reported by Asala *et al.*, 2010, in pigs exposed to transport stress.

### CONCLUSION

It was concluded that ascorbic acid administration reduces rectal temperature of goats exposed to heat stress during the early rainy season in the Northern Guinea Savannah Zone of Nigeria. Ascorbic acid is a cheap and readily available antioxidant which can be administered to goats during the early raining season to ameliorate heat stress.

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