THERMOREGULATORY PARAMETERS OF LACTATING FRIESIAN X BUNAJI COWS AS AFFECTED BY FEED GRADE SELENIUM AND VITAMIN E SUPPLEMENTATION

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ABSTRACT
The study was conducted to evaluate the effects of selenium and vitamin E supplementation on lactating Friesian x Bunaji cows. Twenty (20) lactating Friesian x Bunaji cows were used. The study consisted of four treatments with five animals per treatment in a Completely Randomized Design (CRD). Treatment I served as control without selenium or vitamin E supplementation, Treatment II was supplemented with 3 mg of feed grade selenium; Treatment III, with 20 mg of feed grade vitamin E; and Treatment IV was administered a combination of 3 mg feed grade selenium and 20 mg of vitamin E. The treatments were given once a week, while the animals were given free access to grazing and water provided ad libitum. Thermoregulatory parameters of respiratory rate (RR), rectal temperature (RT) and pulse rate (PR) were measured monthly for three months. The respiratory rate was higher (P<0.05) in the control treatment for lactating Friesian x Bunaji cows than other treatments. Rectal temperature and pulse rate for lactating Friesian x Bunaji cows were higher (P<0.05) in the control and selenium treatments, respectively than any other group. It can be concluded that selenium and vitamin E as antioxidants were effective in maintaining thermoregulatory parameters within the normal ranges thereby ameliorating heat stress.
Keywords: Friesian x Bunaji, thermoregulatory, selenium, vitamin E and Lactating.

INTRODUCTION

Assessing the potential consequences and understanding the adaptive capabilities of animals under tropical and subtropical conditions is imperative when considering perceived thermal challenges. Climate and weather are important environmental factors that could affect the feeding and management of livestock all over the world (Nienaber *et al*., 1990). Therefore, it has been shown that an effective physiological regulation under high climatic conditions seem to be expressed by animals through systematic reduction of heat load or increasing heat loss via rectal temperature and respiratory rate (Aggarwal and Singh, 2008).

An animal's temperature is actually the result of the balance between heat produced by the basal metabolism and muscular activity of the body, and the heat lost from the body (Hahn *et al*., 1990; Jeffrey and Michael, 2010). Babayemi *et al*. (2014) reported that approximately 85% of heat loss is through the skin, while the remainder is through the lungs, digestive and urinary secretions in cattle.

Respiration consists of inspiration, or the expansion of the chest or thorax and expiration, or the expulsion of air from the lungs. In examining respiration in an animal, check movement and sound at the nostrils and in the chest area are measured with attention paid on the following factors: Rate (number of inspirations per minute), depth (the intensity or indication of straining), character (normal breathing involves an observable expansion and relaxation of the ribs (costa) and abdominal wall) (Babayemi *et al*., 2014). Any interference in breathing that may show more or less effort in either of these areas affects the character of the breathing (Gaughan *et al*., 1999). The pulse may be defined as the rhythmic, periodic thrust felt over an artery in time and rhythm with the heartbeat. The important factors to be observed include: the pulse, frequency, rhythm and quality (Hopster and Blokhuis, 1994; Babayemi *et al*., 2014). Frequency is the number of heart beats occurring in one minute and is measured by the use of a stethoscope and stop-watch.

MATERIALS AND METHODS

Study Location

The study was conducted at the Dairy Research Programme Farm, National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Shika-Zaria, Nigeria.

Experimental Design and Management of Animals

Twenty (20) pregnant Bunaji cows were used for the study consisting of four treatments. The animals were divided into four treatments with each treatment having five animals, and the animals were randomly assigned the treatments in a completely randomized design (CRD).

The animals were allowed to graze on pastures (*Digitaria smutsi*), crop residues and supplemented with a concentrate diet, consisting of 48 % cotton seed cake, 13.7% wheat bran, 35.3% maize, 2% bone meal, 1% common salt; the diet comprised about 88% dry matter, 15% crude protein and 55% total digestible nutrients. Water was provided *ad libitum*. All the experimental animals were ear-tagged for ease of identification. The animals were dipped once a week during the dry season and twice a week during the wet season for effective control of ectoparasites.

Source of mineral and vitamin: Selenium and vitamin E were purchased from Hi-nutrients International, Lagos, Nigeria.

Permission was obtained from the Committee on Animal Use and Care, Ahmadu Bello University, Zaria with the Approval No: **ABUCAUC/2017/004**

Data collection

The thermoregulatory parameters were measured in the morning between 7:00 a.m. and 8:00 a.m. The following parameters were measured monthly for a period of three months:

Respiratory Rate

This was determined by counting the number of flank movements per minute using a stop watch.

Rectal Temperature

This was measured on each animal using a digital thermometer. The sensory tip was disinfected and inserted into the rectum via the anus, at the display of L °C (indicating that the thermometer was set for temperature reading), and removed after the sound of the alarm signal was heard. The displayed body temperature was then recorded.

Pulse Rate

This was determined by counting the number of contractions of the heart in one minute using a stethoscope (Model: BK3002) Wenzhou Bokang Instruments Co. Ltd, Ningcum Village, Haibin Sub District, Longman District, Wenzhou City, China.

Statistical Analysis

Data generated were analysed using the General Linear Model of SAS (2002). Significant means were compared using Dunnett (1964).

RESULTS AND DISCUSSION

Table 1 represents the results of thermoregulatory parameters of lactating Friesian x Bunaji cows supplemented with Se, Vitamin E and Se + Vitamin E. The respiratory rate, rectal temperature, and pulse rate measured were significantly ($P < 0.05$) different. Respiratory rate was higher ($P < 0.05$) for the control (no supplementation) in lactating Friesian x Bunaji cows. Rectal temperature and pulse rate for Friesian x Bunaji cows was higher ($p<0.05$) in the control treatment tan in vitamin E and Se + vitamin E treatments, respectively. The control treatment recorded the highest values in all the parameters, followed by Se, Vitamin E and Se + Vitamin E treatments, respectively.

The result reveals that respiratory rate, rectal temperature, and pulse rate measured were similar ($P < 0.05$) in treated and control groups. Respiratory rate was higher ($P < 0.05$) for the control and Se treatments in lactating Friesian x Bunaji cows. Rectal temperature and pulse rate for Friesian x Bunaji cows were higher ($P < 0.05$) in the control and Se treatment. The respiratory rate (40.00 – 41.60 breaths/min) was higher than the value reported by Gaughan *et al*. (1999) in crossbreds steers. This could be due to excitement or the prevailing microclimatic conditions during which the respiratory rate was recorded. Respiratory rates were slightly higher than the values of 10 – 3- breaths per minute, reported by Gaughan *et al*. (1999) for apparently healthy animals. Any anomaly in respiration, nasal discharge, nasal cavities, submaxillary lymph nodes, larynx and trachea, surface of thorax (chest), and thoracic sounds could be a sign of respiratory impairments (Babayemi *et al*., 2014).

Rectal temperature (38.24 – 39.76°C) which is the measure of warmth of a living body (Jeffrey and Michael, 2010) is a good index for assessing health status of animals. An animal's temperature is actually the result of the balance between heat produced by the basal metabolism and muscular activity of the body, and the heat lost from the body (Hahn *et al*., 1990; Jeffrey and Michael, 2010). The rectal temperature range (38 – 40°C), recorded in the present study was not above 40°C in the study with Se and vitamin E supplementation, which suggests that the animals were healthy without fever. This result agrees with the findings of other investigators who reported that ≤ 40°C body temperature suggests healthy animals (Nienaber *et al*., 1990, Oladimeji *et al*., 1996 and Ayo *et al*., 1998; Suthar *et al*., 2012).

Domestic animals do not have stable normal temperatures and substantial variations occur in the body temperature values of normal animals under diverse conditions. In a broad sense, animal temperatures differ, depending on physical activity, stage of pregnancy, the time of day and environmental conditions (Prendiville *et al*., 2002). Thus, measuring cattle temperature in the afternoon, even on a cold day, and allowing cattle to stand in for three or four hours before processing may identify cattle for treatment whereas the animals may actually be healthy (Nienaber *et al*., 1990; Paula-Lopes *et al*., 2003). Inspite of the varying factors that induce variations in the body temperature of cattle, the animals have developed adequate mechanism of regulating their rectal temperature to ensure its maintenance within the normal range. Pulse rate (69.40 – 74.60 beats/min) was slightly above the normal range of 40 – 70 beats/min (John *et al*., 2013). The increased pulse rate could be attributed to excitement or environmental condition. Other factors such as age, size, sex and exercise could be responsible for deviation from the normal ranges (Hopster and Blokhuis, 1994; Suthar *et al*., 2012; Babayemi *et al*., 2014).

Table 1: Effect of Selenium, Vitamin E and Selenium + Vitamin E supplementation on thermoregulatory parameters of lactating Friesian x Bunaji cows

Parameters	Control	Se	Vit-E	Se + Vit-E	SEM	P-value
RR(breaths/min)	41.60^{a}	41.00^{ab}	40.20^{b}	40.00^{b}	0.32	0.0088
RT(^{0}C)	39.76^{a}	39.46^{a}	38.94^{b}	38.24^{c}	0.09	<.0001
PR(beats/min)	74.60^{a}	72.60^{ab}	70.80^{bc}	69.40^{c}	0.59	<.0001

^{abc}Means within the same row having different superscript letters are significantly (P<0.05) different. RR - respiratory rate, RT - rectal temperature, PR - pulse rate, Se - Selenium, Vit-E - Vitamin E, SEM - Standard Error of the Mean.

CONCLUSION

From the findings of the study, it can be concluded that selenium and vitamin C as antioxidants were effective in maintaining thermoregulatory parameters within the normal ranges thereby ameliorating heat stress.

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