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THERMOREGULATORY RESPONSE OF GROWING RABBITS FED DIETS SUPPLIMENTED WITH BI-CARBONATE BUFFER, VITAMIN C AND BAOBAB FRUIT PULP MEAL

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ABSTRACT

The objective of the study was to evaluate the effect of bi-carbonate buffer, vitamin C and baobab fruit pulp meal on thermoregulatory response of growing rabbit during hot season. A total of thirty (30) weaned rabbits were used. The rabbits were randomly allotted into the experimental treatments of five treatment groups with six (6) rabbits per treatment in a completely randomized design. Rabbits in the first group (T_1) was the control, animals in treatment 2 and treatment 3 (T_2) and (T_3) were fed with diets as in the control and given water containing potassium bi-carbonate ($KHCO_3$) and sodium bi-carbonate ($NaHCO_3$) buffers respectively. Rabbits in treatment four (T_4) were fed diet containing synthetic vitamin C and the fifth group (T_5) was fed diet containing Baobab Fruit Pulp Meal (BFPM). Feed and water were served *ad libitum*. All recommended managerial practices were dully observed. Environmental readings such as Ambient Temperature (AT) and Relative Humidity (RH) of the rabbitry micro-climate was taken daily from February through June. The values were used to calculate temperature-humidity index (THI), an indicator of thermal comfort level for animals in an enclosure. Parameters monitored and measured on weekly basis included thermoregulatory parameters such as respiratory rate (RR), heart rate (HR), rectal temperature (RT) and ear temperature (ET). The experiment lasted for nine weeks. It was found that THI values kept increasing from the month of February with a peak in May and declined in the month of June. The values of THI from March to May indicated that environmental conditions were stressful to the animals. Vitamin C and BFPM significantly ($P<0.05$) reduced RR, HR, RT and ET compared to bi-carbonate buffers. This study revealed that vitamin C is essential in the diets of rabbits during hot periods for optimum production.

Key Word: Vitamin C, Heat stress, Amelioration

INTRODUCTION

With the alarming rate of heart related diseases mostly arteriosclerosis, it is pertinent for individuals to change their nutritional life style because one of the causes of this disease is the excessive consumption of red meat and deposition and accumulation of cholesterol on the arteries. However, animal products are known to produce quality protein with essential amino acids that are deficient in cereals and leguminous grains and with micro nutrients that corrects amino acid deficiencies in cereal-based human diet. It is important to introduce and popularize the raising and consumption of rabbits amongNigerians because rabbits are known to contain low cholesterol compared to beef and goat meat.

One of the constraints to the successful rearing of rabbits especially improved breeds in tropical countries is heat stress. The rabbits exposed to ambient temperature of 25°C for 12 hours daily had lower weight gains than rabbits kept at 15°C (Okab *et al*., 2008). Environmental temperatures above 28 °C cause heat-induced physiological stress (Okab *et al*., 2008). Thermoregulation in rabbits is rather poor as they have

few functional sweet glands (Naqvi *et al*., 1995). It is therefore important to ameliorate heat stress nutritionally as other methods (Air conditions, fans etc) may be expensive and risky.

This study was therefore designed to evaluate the effect of bi-carbonate buffer, vitamin C and baobab fruit pulp meal on thermoregulatory response of growing rabbit during the hot season.

MATERIALS AND METHODS

Experimental Site

This study was carried out at the Rabbit unit of the National Animal Production Research Institute (NAPRI) Shika-Zaria Nigeria. Shika-Zaria lies between 11^{o} 12' 42" N and 7^{o} 33' 14" E at an altitude of 691m above sea level (Ovimaps, 2014).

Experimental Animals and Diet

A total of thirty (30) weaned rabbits of mixed sex were used in this study. The study was carried out during the hot period in Zaria (March – June). The rabbits were divided into 5 groups of 6 rabbits per group. The groups were randomly allotted to 1 of 5 experimental treatment- groups in a Completely Randomized Design. The treatment groups consisted of Control (Water without anti-stress), Potassium bicarbonate ($KHCO_3$), Sodium Bicarbonate ($NaHCO_3$) dissolved in drinking water and offered as anti-stress agents. The water was offered *ad libitum* but changed daily in the morning. Feed with Vitamin C, and Baobab Fruit Pulp constituted the rest of the treatment (designated T1, T2, T3, T4 and T5 respectively). All recommended managerial practices were dully observed.

Meteorological Data of Rabbit Microclimate

The microclimate (temperature and relative humidity readings) within the rabbit house were recorded twice daily at 08:00 h and 15.00 h during the study period using a digital thermometer (Cocet, Shenzhen-Guangdong, China). The data collected was used to compute the temperature humidity index (THI), an indicator of the thermal comfort level of the rabbits. . The temperature-humidity index was calculated using the modified formula for rabbit by Marai *et al*. (2001):

$$THI = t - [(0.31 – 0.31 \times RH) (t – 14.4)]$$

Where RH = relative humidity /100.

t = ambient temperature.

The values of THI obtained were compared to that classified for tropical regions as shown below:

a. <27.8 ^{o}C = absence of heat stress,

b. 2). 27.8 - 28.9 ^{o}C = moderate heat stress,

c. 28.9 – 30 ^{o}C = severe heat stress

d. above 30 ^{o}C = very severe heat stress.

Thermoregulatory Parameters Measurement

Parameters measured included Rectal Temperature (RT) and Ear Temperature (ET), Respiratory Rate (RR) and Heart Rate (HR), Measurements were taken at 14.00h to 15.00h of the day. Rectal and Ear Temperature were measured with a digital thermometer. The ear temperature was measured by placing the digital thermometer in direct contact with the central area of the auricle. RR was measured by visually counting the flank movement for one minute with the help of a stop clock. HR was measured by counting the heart beat for one minute with the help of a stethoscope.

STATISTIC ANALYSIS

Data generated from the study was analyzed using the general linear model of SAS software (SAS, 2002). Significant differences in means were separated using the pair wise difference (PDIFF) in the SAS package.

RESULTS AND DISCUSSION

The monthly temperature humidity index (THI) inside the rabbitry during the experimental period is shown in Figure 1. THI in the mornings averaged 26.44^{o}C and 28.74^{o}C during the afternoon. This graph also shows that the THI values kept increasing from the month of February with a peak in May. There was a decline in THI in the month of June. The THI value of 27^{o}C (Feb) indicated that the month of February had absence of heat stress in the rabbit house, while the THI values of 28^{o}C (March), 29.5^{o}C (April), 31.2^{o}C (May) and 28^{o}C (June) are indications that the rabbit house was moderately, severely and very severely thermally stressful (Marai, *et al.* 2001) in these months. The averaged THI 28.74^{o}C during the experimental period indicated that the rabbit house was thermally stressful and may have had adverse effects on the rabbits (Marai, *et al.* 2001). Overall data obtained indicated that THI in the afternoon was higher by 1.24 % than THI in the morning.

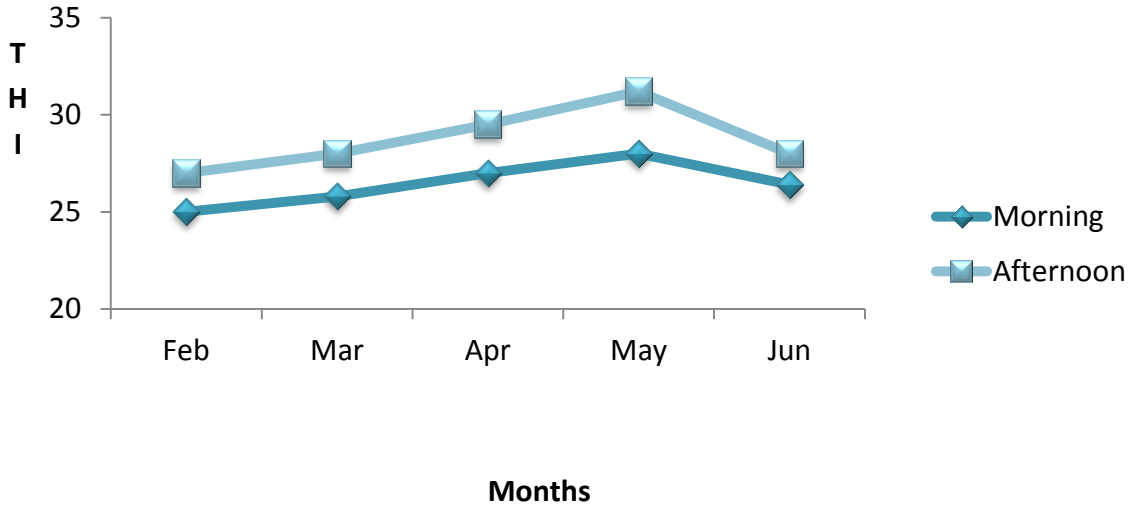


Figure 1: Monthly Temperature Humidity Index inside the Rabbit house during the Experimental Period

It was noticed in this study that supplementing vitamin C and BFPM in rabbit diets significantly ($P<0.05$) reduced respiratory rate, heart rate, rectal and ear temperature compared to using buffers ($KHCO_3$ and

Na_2CO_3). It was also noticed that heart rate and respiratory rate increased in treatments with $KHCO_3$ and Na_2CO_3. This result is in concordance with the reports of Teeter *et al.,* (1985) who reported that $NaHCo_3$ could increase respiratory alkaloids severity which might have led to the increased heart rate and respiratory rate noticed in this study. Contrary to the findings of this study Marai *et al.,* (1994) found that 1.25 or 2.5% $NaHCo_3$ reduced rectal temperature, respiration rate and improved blood components due to correcting acid–base balance disturbances, under stress conditions. Haydon and West (1990) suggested that the improvement resulted from adding $NaHCo_3$ to heat stressed rabbits may be probably due to increase blood buffering capacity. Supplemental vitamin C has been reported to be effective in ameliorating heat stress as was noticed in this study. Verde and Piquer (1986) noted that the plasma vitamin C concentration was significantly reduced in animals exposed to stress. Supplementary vitamin C has been shown to be beneficial in reducing the effects of stress. This metabolic factor is essential for growth and counteracting infections caused by pathogenic bacteria and viruses. This means that the metabolic need for vitamin C increases under certain conditions. BFPM has been reported to lower rectal temperature of the birds than the value obtained with the control diet (Adeosun, 2012). This could be due to the high vitamin C content baobab is reported to contain (Agbessi Dos-Santos, 1987) which may also have the antioxidant properties that scavenges for free radicals as vitamin C does.

Table 1 Effect of Buffer, Vitamin C and BFPM on Thermoregulatory Response of Growing Rabbits

	Treatments					
Parameters	**Control**	**$KHCO_3$**	**Na_2CO_3**	**Vit. C**	**BFPM**	**SEM**
Respiratory Rate (br/min)	97.94^{a}	79.56^{b}	83.45^{b}	78.11^{bc}	76.59^{c}	2.60
Heart Rate (beats/min)	141.03^{b}	143.36^{a}	143.19^{a}	141.35^{b}	141.29^{b}	0.53
Rectal Temperature (^{o}C)	37.68^{b}	36.56^{bc}	37.27^{a}	35.87^{c}	35.73^{c}	0.31
Ear Temperature (^{o}C)	35.68^{a}	34.13^{b}	35.48^{a}	33.96^{b}	33.23^{c}	0.56

Means within rows with different superscripts are significantly different: P<=0.05.

CONCLUSION

Vitamin C and BFPM was effective in reducing thermoregulatory parameters, and had no adverse effect on the rabbits. The buffers increased heart rates of the rabbits and also improved thermoregulation compared to the control. This study revealed that vitamin C is essential in the diets of rabbits during hot periods for optimum production.

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