EFFECT OF SEASON ON THERMOPHYSIOLOGY OF WEST AFRICAN DWARF GOATS REARED IN NASARAWA STSTE, NIGERIA

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ABSTRACT
Heat stress is one of the major factor affecting production of animals. This has become more worrisome due climate change as a result of depletion of ozone layers. Therefore, this study was conducted to determine the effect of season on heat-tolerance traits of West African Dwarf (WAD) goat using 200 (100 bucks and 100 does) mature WAD goats at both wet and dry season. Heat tolerance traits: respiratory rate, pulse rate and rectal temperature were determined eat 30 days intervals for four months each for both wet and dry season. Data were analysed using T-test of the SPSS software version 21. Results indicated that season had significant effect on heat stress parameters. Values (41.19±0.46 vs 39.13±0.46) for rectal temperature was significantly higher in dry season compared to wet season. However, pulse and respiratory rates were higher in wet season. From the outcome of this research, it could be recommended that characterization of WAD goats could be done using heat tolerance traits so as to stimulate production of WAD goats in Nasarawa State due to the fact that they have the potential to adapt to the prevailing environmental conditions in the area.
Keywords: Dry season, wet season, buck, doe, parameters.

INTRODUCTION

Globally, small ruminants play a significant role in the economy of millions of people who earn their livelihood by rearing these animals in different climatic conditions (Silanikove *et al.,* 2010). Goats (*Capra hircus*) are diverse species and principal animal genetic resources of the developing world. According to the Food and Agriculture Organization, the world goat population has been estimated to be around 921 million animals, with an increase of more than 21% during the last 10 years (Thornton, 2010). Goats provide a persistent supply of meat, milk, fibre, skin and are adapted to a wide range of grazing environments (Gupta *et al.,* 2013). However, there are much concern currently about the thermal comfort of animals due to the tropical climate of the country, characterized by solar radiation and high temperature that can cause heat stress and affect the productive performance of the animals. Heat stress provokes sorts of complex responses which are essential in the preservation of cell survival. Heat stress influences embryonic development and ovarian function which Results in decreased fertility (Gupta *et al.,* 2013). Heat stress redistributes the body and the general homeostatic responses in goats thereby Results in decreased feed intake, water consumption, dry matter intake and also lowers natural immunity, making goat more vulnerable to diseases (Gupta *et al.,* 2013). Excessive heating load if experienced by the animal may Results to collapse and eventual death of the animals (Barnes *et al.*, 2004). There is therefore the needs to better understand the genetic relationship between the goat and their environment as it changes from season to season. The objective of this study was to evaluate the effect of season on heat tolerance traits in West African Dwarf goat.

MATERIALS AND METHODS

This research was carried out in two Agricultural zones of Nasarawa State (Southern and Northern Agricultural Zones). Two hundred matured pure bred West African Dwarf (WAD) goats comprising of one hundred (50 each for bucks and does, respectively) each from the Southern and Northern Agricultural zones at two seasonal periods (wet and dry season) with similar management system were randomly sampled and used for the experiment. Arrangement was made with the owners of the goats to allow completion of the experiment before any sales of the goats to avoid distortion of data collection. The same goats were used for both dry and wet season for data collection. The goats were tagged for four months' data collection each for dry and wet season, respectively. The experimental animals were managed by their owner in a semi intensive management system. Luckily, no mortality

was recorded during the period of data collection and no animal was sold due to the aforementioned arrangement with the farmers.

Heat-Tolerance Data Collection

Heat Tolerance Traits (HTT) were measured/determine on each goat on a monthly basis for four months each for wet and dry season. Measurements of HTT such as respiratory rate (RR), rectal temperature (RT) and pulse rate (PR) of the goats were taken following the procedure of Adedeji (2012).

Respiratory Rate (RR): - Respiratory Rates (RR) were determined for each goat by counting the number of abdominal movements per minute using a stopwatch. This was recorded as breadths/minute.

Rectal Temperature (RT): - Rectal Temperature (RT) was determined with the aid of clinical thermometer which was inserted into the rectum of the goat for at least one minute and thereafter readings were taken in degree Celsius (^{0}C).

Pulse Rate (PR): - Pulse Rate (PR) was determined by stethoscope on the left hand side of the chest-wall and counting of the number of heart beat per minutes were recorded as heart-beats/minute.

Heat Stress Index (HSI): -Heat stress index (HIS) was measured as the relationship between respiratory rate and pulse rate. HSI values were determined following the procedure described by (Adedeji, 2012). Mathematically, HIS can be determine as follow:

$$HSI = \frac{AR}{AP} \times \frac{NP}{NR}$$

Where HSI =Heat stress index value
AR=Average value of respiratory rate
AP=Average value of pulse rate
NP=Normal pulse rate value and
NR=Normal respiratory rate value

Data Analysis

Data were analysed using T-test Procedure of SPSS version 21. This was used to test the effects of Season on heat tolerant parameters. These were fit into the following model.

$Y_{ij} = \mu + S_i + + E_{ij}$

Y_{ij}= mean of individual observation
μ = population mean
S_i=season effect (1 and 2)
E_{ij}= error term effect.

RESULTS AND DISCUSSION

The effect of season on heat tolerance traits of West African Dwarf Goat in two Agricultural Zones of Nasarawa State is presented in table 1. Season had significant ($P<0.05$) effect on rectal temperature and pulse rate in the buck. Dry season had significantly ($P<0.05$) higher rectal temperature while wet season had significantly ($P<0.05$) higher pulse rate. The result of this study agrees with the report of Marai *et al*. (2007) and Sanusi (2008) who reported a higher rectal temperature, respiratory rate and pulse rate during the late dry season among different breeds of sheep. In the females (Doe), dry season had significantly ($P<0.05$) higher rectal temperature (40.84±0.46) while wet season had significantly ($P<0.05$) higher respiratory and pulse rate (20.31±0.17 and 100.97±0.59) compared to dry season. Conversely, season had significant ($P<0.05$) effects on rectal temperature, pulse rate heat stress index. Wet season had significantly (($P<0.05$) higher rectal temperature (40.38±0.04) and pulse rate (103.52±0.41) while the dry season had significantly ($P<0.05$) higher heat stress index (0.72±0.001) compared to wet season (0.65.92±0.01). The dry season being characterized by high ambient temperature and high humidity, could take the animal beyond the comfort zone, thus resulting in increased heat production and energy dissipation. Rectal temperature and heat stress index were not significant in the male goat. The lower values of heat tolerant parameters and heat stress index experienced was as a result of lower temperature during the wet seasons and nutrition owing to availability of pasture (Butswat *et al*., 2000).

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Table 1: Effect of season on heat tolerance traits of West African Dwarf Goat in two Agricultural Zones of Nasarawa State

	Male		Female		Combined Sex	
Trait	**Dry Season**	**Wet Season**	**Dry Season**	**Wet Season**	**Dry Season**	**Wet Season**
RT	41.19±0.46[a]	39.13±0.46[b]	40.84±0.46[a]	39.07±0.46[b]	39.29±0.03[b]	40.38±0.04[a]
RR	19.47±0.17[a]	19.67±0.17[a]	19.49±0.17[b]	20.31±0.17[a]	19.57±0.11[a]	19.90±0.12[a]
PR	94.06±0.59[b]	101.47±0.59[a]	94.06±0.59[b]	100.97±0.59[a]	91.92±0.24[b]	103.52±0.41[a]
HIS	0.70±0.01[a]	0.67±0.01[a]	0.70±0.01[a]	0.68±0.01[a]	0.72±0.001[a]	0.65±0.01[b]

N = number of observation, RR = Respiratory Rate, RT = Rectal Temperature, PR = Pulse rate, HSI = heat stress index, * = significant at 5% probability, [ab] = mean with same superscript are not significantly different.

CONCLUSION

Heat stress parameters such as rectal temperature, respiratory rate and heat stress index was noted more in dry season than the wet season in both male and female rabbits. However, pulse rate was observed more in wet season than the dry season. It was therefore concluded that characterization of WAD goats could be done using heat tolerance traits so as to stimulate production of WAD goats in Nasarawa State due to the fact that they have the potential to adapt to the prevailing environmental conditions in the area.

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