EFECT OF SEX ON HEAT STRESS OF WEST AFRICAN DWARF GOATS REARED IN NASARAWA STATE NIGERIA

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ABSTRACT
Give two or three sentences to indicate justification for this study. Thus, this study was conducted to evaluate the effect of sex on heat stress of West African Dwarf (WAD) goat. The study was conducted using 200 (100 bucks and 100 does) mature WAD goats comprising of 100 (50 bucks and 50 does) from the Southern and Northern Agricultural zones. Parameters measured were rectal temperature, respiratory rate, pulse rate and heat stress index. Data generated were analysed using the T test procedure of the SPSS software version 21. The result obtained indicated that sex had significant (P<0.05) effect on rectal temperature and pulse rate in Southern Agricultural Zone and combination of Northern and Southern Agricultural Zone. Doe had significantly (P<0.05) higher rectal temperature (40.74±0.04) while the Buck had significantly (P<0.05) higher pulse rate (100.43±0.54) in the Southern Zone. Respiratory rate and heat stress index was not significant in the two agricultural zones. From the outcome of this research, it could be recommended that characterization of WAD goats could be done using heat tolerance traits in Nasarawa State due to the fact that they have the potential to adapt to the prevailing environmental conditions in the area.
Keywords: heat stress index, pulse rate, rectal temperature, respiratory rate

INTRODUCTION

There is much concern 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. In mammals, exposure to hypothermia or hyperthermia has been related to morphological and physiological alterations (Scharf *et al.,* 2010). Heat stress influences embryonic development and ovarian function which Results in decreased fertility (Gupta *et al.,* 2013). Heat stress redistributes the body resources including protein and energy at the cost of decreased growth, reproduction, production and health of animals (Gupta *et al.,* 2013). Also, it reduces the quality of milk yield (Salama *et al.,* 2012). The general homeostatic responses in goats to heat stress include increased respiration rate, body temperature, pulse rate, decreased feed intake, water consumption, dry matter intake and also lowers natural immunity, making animals 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). The needs to better understand the genetic relationship between the animals and their environment is very crucial as it has a great role in the productivity, production, adaptability and survivability of the animals. To establish an economically viable farming system, it is important to look for breeds or individuals that have better genetic potential for adaptation to local environmental conditions and at the same time provide better quality meat and milk. The objective of this study was to evaluate effect of sex on heat-tolerance traits of 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. 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 Traits (HTT) were determine on each goat on a monthly basis for four months. 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 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. The 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) 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 (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

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

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

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

RESULTS AND DISCUSSION

Table 1 presents the effect of Sex on heat tolerant traits of West African Dwarf goat in two Agricultural Zones of Nasarawa State. Sex had significant (P<0.05) effect on rectal temperature and pulse rate in Southern Agricultural Zone and combination of northern and southern agricultural zone. In the southern zone, Doe had significantly (P<0.05) higher rectal temperature (40.74±0.04) while the Buck had significantly (P<0.05) higher pulse rate (100.43±0.54). Similarly, Doe had significantly (P<0.05) higher rectal temperature (40.38±0.04) and pulse rate (103.52±0.42). Respiratory rate and heat stress index was not significant in the two locations. However, in the Northern Agricultural Zone, sex had no significant (P>0.05) effect on any of the heat stress traits.

The significant effect of location on pulse rate and rectal temperature in this study is in line with the report of Maurya *et al.* (2017). These authors reported that the major problems experienced in the arid and semi-arid tropical environment are non-availability of water supply, seasonal forage biomass and inconsistent climatic fluctuations. Animals reared in such regions are expose to heat stress and such changes could directly be accessed from some physiological measurements such as respiratory rate, rectal temperature, and pulse rate, which may be influenced amongst other factors by breed, sex and age of goats (Alam *et al.,* 2011; Yakubu *et al.,* 2017). Thermal stress due to extreme changes in the thermal environment is a critical issue in goat production. Many previous findings have shown a decrease in feed intake, growth rate, milk yield and reproductive efficiency when subjected to thermal stress (Chang-Fung-Martel et al., 2021). Therefore, choosing thermo-tolerant animals is the primary goal of the efficiency of breeding programs to reduce those adverse impacts.

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

	South Zone		North Zone		Combined zone	
Trait	Male	Female	Male	Female	Male	Female
RT	38.81±0.02^b	40.74±0.04^a	39.77±0.05^a	40.00±0.06^a	39.29±0.03^b	40.38±0.04^a
RR	19.46±0.15^a	19.66±0.16^a	19.38±0.16^a	20.45±0.20^a	19.57±0.11^a	19.90±0.13^a
PR	100.43±0.54^a	94.58±0.61^b	96.16±0.54^a	99.72±0.69^a	91.92±0.34^b	103.52±0.42^a
HIS	0.65±0.01^a	0.70±0.01^a	0.66±0.01^a	0.71±0.01^a	0.72±0.01^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

This research has clearly demonstrated that characterization of WAD goats could be done using heat tolerance traits in Nasarawa State due to the fact that WAD goat in the study area have the potential to adapt to the prevailing environmental conditions in the area. The respiratory rate, pulse rate, and heat stress index values can be used in the classification/characterization of goat into genetically distinct categories of heat tolerance traits

REFERENCES

Adedeji, T. A. (2012). Effect of some qualitative traits and non-genetic factors on heat tolerance attributes of extensively reared West African Dwarf (WAD) goats. International Journal of Applied Agricultural and Apicultural Research, 8: 68–81.

Alam, M. M., Hashem, M. A., Rahman, M. M., Hossain, M. M., Haque, M. R., Sobhan, Z and Islam, M. S. (2011). Effect of heat stress on behaviour, physiological and blood parameters of goat. Progress. Agric. 22(1 & 2), 37 – 45.

Barnes, A., Beatty, D., Taylor, E., Stockman, C., Maloney, S and McCarthy, M. (2004). Physiology of heat stress in cattle and sheep. Project number LIVE.209, Australia. Meat and Livestock Australia Limited, 35 pp.

Chang-Fung-Martel, J., Harrison, M.T and Brown, J.N. (2021). Negative relationship between dry matter intake and the temperature-humidity index with increasing heat stress in cattle: a global meta-analysis. International Journal of Biometeorology; 65: 2099–2109.

Gupta, M., Kumar, S., Dangi, S. S and Jangir B. L. (2013). Physiological, biochemical and molecular responses to thermal stress in goats. International Journal of Livestock Research, 3:27–38.

Maurya, V.P., Sejian, V., Kumar, D and Naqvi, S. M. K. (2017): Biological ability of Malpura rams to counter heat stress challenges and its consequences on production performance in a semi-arid tropical environment. Biological Rhythm Research http://dx.doi.org/10.1080/09291016.2017.1381451

Salama, A. A. K., Hamzaoui, S and Caja, G. (2012). Responses of dairy goats to heat stress and strategies to alleviate its effects. Proceedings of the XI International Conference on Goats, held from 23-27 September, 2012, Gran Canaria, Spain, p. 15.

Scharf, B., Carroll, J. A., Riley, D. G., Chase Jr, C. C., Coleman, S. W., Keisler, D. H., Weaber, R. L and Spiers, D. E. (2010). Evaluation of physiological and blood serum differences in heat tolerant (Romosinuano) and heat-susceptible (Angus) Bos tauruscattle during controlled heat challenge. Journal of Animal Science, 88: 2321-2336.

Yakubu, A., Salako, A.E., De Donato, M., Peters, S.O. Takeet, M.I., Wheto, M., Okpeku, M., and Imumorin, I.G. (2017). Association of SNP variants in MHC-Class II DRB gene with thermo-physiological indices in tropical goats. Tropical Animal Health and Production, 49 (2), 323-336.