EFFECT OF L-CARNOSINE ON DIURNAL VARIATIONS IN PHYSIOLOGICAL PARAMETERS OF MID-GESTATION YANKASA EWES DURING THE HOT-DRY SEASON

*[1]YAQUB, L.S., [1]AYO, J.O., [1]KAWU, M.U., [2]REKWOT, P.I., [1]DZENDA, T., [1]HABIBU, B. AND[1] ADAMA, I.F.
[1]Department of Veterinary Physiology, Ahmadu Bello University, Zaria; [2]National Animal Production Research Institute, Shika, Zaria; Corresponding Author: yaqvet@gmail.com; Tel: +234 803 387 5044

ABSTRACT
The study was designed to determine diurnal variation in physiologic parameters of mid-gestation Yankasa ewes, and the effects of L-carnosine administration during the hot-dry season. Thirty Yankasa ewes were divided into three groups: Group I ewes were pregnant and administered daily with L-carnosine, Group II were pregnant and Group III non-pregnant. Group I was administered with L-carnosine at 100 mg/kg dissolved in 10 ml of distilled water for one week. Group II and III were administered 10 ml distilled water for the same period. Physiologic parameters of rectal temperature (RT), respiratory rate (RR) and heart rate (HR) were taken bihourly on days 3 and 7 of L-carnosine administration, from 06:00 hour – 19:00 hour. The dry-bulb (DBT) and wet-bulb (WBT) readings were recorded concurrently with aid of hygrometer at the experimental site. Values of RT and RR obtained in the morning (07:00 h-11:00 h) were lower (P□0.001) than those obtained in the afternoon (12:00 h-19:00 h). The RT and HR values obtained were within the normal range for sheep, but RR was above the normal range throughout the study period, indicating that the ewes adopted increasec RR* in dissipating body heat. Carnosine administration had insignificant effect on physiological parameters, except for slight insignificant decreased in RR, RT and increased HR in L-carnosine administered group. The HR was higher in the pregnant group relative to the non-pregnant group, while the RR was significantly ($P < 0.05$) higher relative to non-pregnant at 11:00 h. The DBT significantly (P□0.001) correlated with RT in all the groups. The RR in non-pregnant group correlated more ($r = 0.8982$; $r = 0.8176$; P □ 0.01) with DBT than the pregnant group ($r = 0.8176$; P □0.05). In conclusion, carnosine did not exert effect on physiologic parameters, but physiological status significantly influenced the RR in Yankasa ewes.

Keywords: Diurnal variation, Pregnancy; Physiological parameters; L-carnosine

INTRODUCTION
After attainment of reproductive age, female domestic ruminants spend most part of their reproductive lives in pregnancy. Gestation has been shown from extensive research to induce generation of free radicals (Gur et. al., 2011) and it causes changes in vital physiological parameters (Dzenda *et al.*, 2011). Unfortunately for animals reared in the tropics, the high ambient temperature prevailing during the hot period further exacerbates the physiological stress induced by pregnancy. Therefore, the dam may benefit from administration of carnosine, an antioxidant, during the hot-dry season.

MATERIALS AND METHODS
The experiment was performed at experimental pen of the Department of Veterinary Physiology, Faculty of Veterinary Medicine, Ahmadu Bello University, Samaru-Zaria, (11^0 10′ N, 07^0 38′E), located in the Northern Guinea Savannah zone of Nigeria during the hot-dry season. A total of thirty Yankasa ewes were used for the study. The animals weighed between 25-33kg and aged 2-3years. They were fed *Digitaria smithsi* obtained from the Division of Agricultural Colleges, Ahmadu Bello University, Zaria and supplemented with concentrate and bean husk.

Feed and water were provided *ad-libtum*. Ultrasonography was conducted to confirm pregnancy status of the ewes. They were ear-tagged and kept in the same pen during the experimental duration. The ewes were divided into three groups of ten animals each: Group I was non-pregnant; Group II was pregnant and Group III was pregnant and administered with L-carnosine. Groups I and II were administered with distilled 10 ml of distilled water daily for a week. Group III was administered with 100 mg/kg of L-carnosine, dissolved in 10 mls of distilled water for the same period. Physiologic parameters of RT, RR and HR were taken bihourly on the days 3 and 7of L-carnosine administration, from 06:00 h-19:00 h. The DBT and WBT were recorded concurrently with the aid of hygrometer at the experimental site. RT, RR and HR were determined as described by Fadare *et al.* (2012). The values obtained were expressed as mean (±SEM). The data were subjected to Pearson's correlation analysis and repeated measures Analysis of variance followed by Tukey multiple comparison test. The statistical package used was Graphpad Prism

Version 4.0 for windows (2003) from Graphpad software, San Diego, California, USA (www.Graphpad.com). Values of P □ 0.05 were considered significant.

RESULTS

The RT and RR gradually rose in all the groups from 09:00 h and attained the highest peak at 15:00 h. This was followed by decrease in RT and RR from 17:00 h -19:00 h in all the groups. There was a statistically significant (P □ 0.001) difference in RT and RR between the afternoon hours (13:00 h and 15:00 h) in comparison to the morning (07:00 h-11:00 h) or evening hours (17:00 h-19:00 h). Rectal temperature was insignificantly lowered in pregnancy+carnosine relative to pregnant group during the morning hours (07:00h-11:00h). The prevailing DBT positively correlated with RT and RR in all the groups. The non-pregnant group had a stronger correlation (P<0.01) of RR with DBT relative to other groups (P < 0.05).

DISCUSSION

A gradual sustained increase in RT from 09:00 h – 17:00 h in all groups clearly indicated that the RT rose as the ambient temperature increased during the study period. This result is supported by significant positive correlations between the dry-bulb temperature and rectal temperature in all the groups. This finding is in agreement with report in donkeys (Ayo *et al.*, 2008; Ayo *et al.*, 2014). Insignificant higher RT in pregnant and pregnant + carnosine relative to non-pregnant may indicate more severe effect of prevailing thermal stress on the pregnant groups. The insignificant effect of L-carnosine in the present study clearly requires a detailed study on the optimum dose of L-carnosine in pregnant and non-pregnant ewes.

The RR followed similar trend to RT, with gradual and sustained increase up to 15:00 h , this obviously indicates that the ewes adopted respiratory evaporation in dissipating heat load, imposed by increasing ambient temperature during the day. This was further supported by significant correlation between the DBT and RR. This finding is in agreement with the report in normal pack donkeys (Ayo *et al.*, 2008; 2014), and in feed-deprived Yankasa sheep (Ayo *et al.*, 2013). Pregnant ewes had the highest RR throughout the study, which was significant (P < 0.05) at 11:00h.This finding may indicate that they were more affected by heat stress. Similarly, finding of higher RR in pregnant Red Sokoto does at late gestation during the hot-dry season in the same environment was reported (Habibu *et al.*, 2014). The concomitant increase in metabolic rate in pregnancy and the thermal load imposed by the prevailing environmental temperature, apparently exacerbate the heat stress in the pregnant ewes. This assertion is further supported by a higher significant correlation of RR with DBT in non-pregnant ewes relative to the pregnant groups. This results suggests that other factors may be involved in increasing the RR in the pregnant group. In conclusion, there was insignificant effect of carnosine on physiologic parameters, but physiological status significantly influenced the RR in Yankasa ewes.

REFERENCES

Habibu, B., Kawu, M. U., Makun, H. J., Aluwong, T., Yaqub, L. S., Ahmad, M. S., Tauheed, M. and Buhari, H. U. (2014). Influence of sex, reproductive status and foetal number on erythrocyte osmotic fragility, haemàtological and physiologic parameters in goats during the hot-dry season. *Veterinarni Medicina*, 59(10): 479-490.

Ayo, J. O., Dzenda, T., Olaifa, F., Ake, S. A. and Sani, I. (2014). Diurnal and seasonal fluctuations in rectal temperature, respiratory and heart rate of pack donkeys in a tropical Savannah zone. *Journal of Equine Science*, 25 (1): 1-6.

Ayo, J. O., Dzenda, T. and Zakari, F. O. (2008). Individual and diurnal variations in rectal temperature, respiration and heart rate of pack donkeys during the early rainy season. *Journal of Equine Veterinary Science*, 28(5): 281-288.

Ayo, J. O.,Yaqub, L. S. and Dzenda, T. (2011). Effects of feed and water deprivation on diurnal variations in rectal temperature, respiration and heart rate of Yankasa sheep during the rainy season. Journal of Cell and Animal Biology, 5(15): 316-319.

Dzenda, T., Ayo, J. O., Lakpini, C. A. M and Adelaiye, A. B. (2011). Diurnal, seasonal and sex variations in rectal temperature of African Giant rats (Cricetomys gambianus, Waterhouse). Journal of Thermal Biology, 36: 255-263.

Fadare, A. O., Peters, S. O., Yakubu, A., Sonibare, A. O., Adeleke, M. A., Ozoje M. O. and Imumorin, T. G. (2012). Physiological and hematological indices suggest superior heat tolerance of white-coloured West African Dwarf sheep in the hot humid tropics.

Tropical Animal Health Production, 10.1007-1250.

Gur, S., Turk, G., Dermici, E., Yuce, A., Sonmez, M., Ozer, S. and Aksu, E. H. (2011). Effect of pregnancy and foetal number on diameter of corpus luteum, maternal progesterone concentration and oxidant/antioxidant balance in ewes. Reproduction in Domestic Animals, 46 (2): 289 – 295.

Table 1: Effect of L- carnosine on diurnal variation in rectal temperature of mid-gestation Yankasa ewes (n = 30).

Time of the day	Non-Pregnant	Pregnant	Pregnant+ carnosine
7:00	37.40±0.2^{a}	37.75±0.083^{a}	37.53±0.13^{a}
9:00	38.14±0.08^{b}	38.31±0.22^{b}	38.13±0.07^{b}
11:00	38.64±0.05^{c}	38.58±0.14^{c}	38.47±0.13^{c}
13:00	38.83±0.06^{c}	38.70±0.10^{c}	38.83±0.05^{c}
15:00	38.93±0.03^{c}	38.90±0.12^{c}	39.08±0.07^{c}
17:00	38.93±0.07^{c}	38.91±0.15^{c}	38.96±0.145^{c}
19:00	38.75±0.04^{c}	38.78±0.13^{c}	38.93±0.08^{c}

$^{a, b, c}$ values with different superscript letters within a column are significantly ($P < 0.001$)different

Table 2: Effect of L – carnosine on diurnal variation in respiratory rate of mid-gestation Yankasa ewes (n=30).

Time of the day	Non-Pregnant	Pregnant	Pregnant + carnosine
7:00	87.00±3.27^{c}	88.00±3.90^{c}	86.22±2.40^{c}
9:00	79.00±4.65^{c}	86.00±5.94^{c}	88.89±4.56^{c}
11:00	87.50±2.06^{c}	94.00±3.39^{c}	98.67±6.63^{c}
13:00	87.50±3.80^{c}	90.40±4.01^{c}	95.56±3.62^{c}
15:00	86.50±3.20^{c}	90.80±4.50^{c}	96.44±5.91^{c}
17:00	84.00±4.84^{c}	83.20±4.08^{c}	87.11±5.28^{c}
19:00	76.00±3.12^{c}	84.40±3.79^{c}	82.22±4.67^{c}

$^{a, b, c}$ values with different superscript letters within a column are significantly ($P < 0.05$) different

Table 3: Diurnal variation in heart rate of mid-gestation Yankasa ewes and effect of L-carnosine administration (n=30)

Time of the day	Non-Pregnant	Pregnant	Pregnant + carnosine
7:00	32.50±2.30^{a}	37.60±2.54^{a}	36.40±2.53^{a}
9:00	37.50±2.50^{b}	45.13±2.03^{b}	44.50±4.27^{b}
11:00	64.57±2.95^{c}	87.20±10.43^{c}	77.30±5.21^{c}
13:00	83.50±4.60^{c}	86.80±10.43^{c}	84.40±9.01^{c}
15:00	88.50±4.80^{c}	92.40±8.29^{c}	100.00±8.69^{c}
17:00	60.50±6.50^{c}	70.00±8.38^{c}	67.56±8.34^{c}
19:00	50.50±4.00^{c}	60.80±4.80^{c}	49.78±3.21^{c}

$^{a, b, c}$ values with different superscript letters within a column are significantly ($P < 0.001$)different

Table 4: Correlation coefficient between dry-bulb temperature and physiological parameters

Correlated parameters	Non- pregnant (r)	pregnant (r)	Pregnant+ carnosine (r)
DBT and RT	0.9103	0.8981	0.9209
DBT and RR	0.8982	0.8176	0.8463
DBT and HR	0.08267	0.1016	0.4272

*Significant correlation ($P < 0.05$) **Very significant ($P < 0.01$); DBT= dry-bulb