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The Effects of Season, Ambient Temperature and Sex on Rectal Temperature, Pulse and Respiratory Rates for the Adult One Humped Camel (*Camelus dromedarius*) in Shika-Zaria, Nigeria

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Abstract: A three year study on the effects of season, ambient temperature and sex on rectal temperature, pulse and respiratory rates (adaptive physiological parameters) of adult one humped camel (*Camelus dromedarius*) was conducted in Shika-Zaria a sub-humid zone of Nigeria. The average rectal Temperature (T), Pulse (P) and Respiratory (R) rates commonly referred to as 'TPR' were 37.0°C, 48.6 beats min^{-1} and 15.5 breaths min^{-1} respectively while the ranges were 35.0-40.0°C, 30-57 beats min^{-1} and 8-23 breaths min^{-1} respectively. Average TPR values were significantly lower ($p<0.05$) in the cold season than in the dry season and no significant difference ($p>0.05$) between the sexes. The ambient temperature significantly ($p<0.01$) influenced the TPR readings with lower values during morning hours than the afternoon hours.

Key words: *Camelus dromedarius*, temperature, pulse, respiration, Nigeria

INTRODUCTION

Physiologically, the camel is peculiar among other domestic animals in that it is homeothermic since it can maintain a constant body temperature independent of large variations in the temperature of its environment through a balance of heat gain and loss (Schmidt-Nielsen, 1985). Temperature, pulse and respiratory rates in farm animals have been used as indicators of environmental stress (Hafez, 1968). The environment surrounding animals influences the amount of heat exchange between them. If the environment is not within the zone of comfort, the animal is said to be under environmental stress, which is reflected in its growth rate, performance and health status since active animal life is limited to a narrow range of temperatures (Mount, 1974).

The body temperature of most domestic animals does not vary much unlike that of the camel. The camel's ability to allow its body temperature to rise and fall is exceptional with extremes outside the range of comfort for most mammals while still maintaining its normal homeokinesis (Kamal, 1972). The variations in camel's temperature were formerly thought to be an indication of poor thermoregulation, but it is now believed that the temperature fluctuations indicate a sophisticated control mechanism (Wilson, 1984). The ability of the camel to raise its temperature has the advantage of reducing heat gain. This is because the raised temperature reduces the heat gradient between the body and the air and heat flow is proportional to the gradient. The energy gained during the day can be dissipated at night when ambient temperatures are lower (Bengoumi *et al.* 1999, 2003; Yagil, 1985).

Temperature, therefore when used as an indicator of the state of health of camels must be with caution because average 'normal' values are not absolute. Pulse and respiratory rates also vary considerably in the healthy camel in response to heat load and the need to conserve or lose water (Schmidt-Nielsen, 1985).

Three distinct seasons exist in the area of study. They are the harmattan (cold) (November to February), hot (March to May) and rainy (June to October) seasons (Ayo *et al.*, 1998).

The present study was conducted to estimate average values of temperature, pulse and respiratory rates in normal adult one humped dromedary camels in a sub-humid savanna zone of Nigeria.

MATERIALS AND METHODS

Study area: This study was carried out at the National Animal Production Research Institute, Ahmadu Bello University, Shika-Zaria, Nigeria located on latitude 11°2'N, longitude 7°33'E and on altitude of 610 m above sea level. Shika is within the northern guinea savanna zone and has a sub-humid tropical climate.

Animals: The study involved eleven adult camels (6 males and 5 females) aged between 5 and 7 years

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Table 1: Mean weather conditions during the study period*

Season	Ambient temperature °C		Relative humidity %		Sunshine (hr)	Wind velocity (m s^{-1})	Rainfall (mm)
	Minimum	Maximum	AM	PM			
Harmattan (cold)	13.8±0.42	27.9±0.85	11.03±0.21	7.2±0.82	8.8±0.74	243±9.5	0.0
Hot	20.8±0.74	35.8±0.83	36.1±5.34	26.1±2.6	9.6±1.3	108.7±9.8	0.0
Rainy	19.8±0.72	28.1±0.42	75.1±5.64	67.2±63	5.8±1.48	109±8.4	2.6±0.05

AM-morning PM-afternoon, *Data collated from Meteorological Unit, IAR/ABU Samaru Zaria (Anon 2003)

Table 2: Mean (±SD) and ranges of rectal temperatures, pulse and respiratory rates for the adult dromedary camels in Shika-Zaria, Nigeria

Parameter	Mean of all camels (n = 7)	Males (n = 4)	Females (n = 3)	Range
Temperature (°C)	37.13±0.15	37.09±0.59	37.15±0.52	35.1-40.0
Pulse (beats min^{-1})	48.58±3.60	48.62±3.78	48.68±3.41	30-57
Respiration (breaths min^{-1})	15.47±3.08	15.42±3.21	15.33±3.09	8-23

monitored for 36 months. The camels were managed under a semi-intensive system involving grazing and browsing on improved pastures and the natural range for 6 to 8 h daily. They were fed 3 kg per head of concentrate supplementation and 0.7 kg/head of *kanwa* (local mineral lick) twice a week and water was available *ad libitum* in the grazing paddocks. They were screened for blood and helminth parasites and other diseases and appropriate treatments carried out before the experiment was started. Each camel was routinely dewormed with Albenda bolus and sprayed with acaricide solution.

Physiological parameters: The physiological parameters assessed were rectal temperature, pulse and respiratory rates. The physiological parameters were taken from each camel in a standard cattle crush to avoid unnecessary struggling that may affect readings.

Pulse rate was determined for each animal by placing the fingertips on the middle coccygeal artery, which is located in the mid-line of the ventral aspect of the tail near the root for one min using a stopwatch. Respiratory rate was determined by counting the number of flank movements per min while the rectal temperature was taken using a clinical thermometer calibrated in degrees centigrade. These physiological parameters were taken twice daily on each animal at 8:00 am and 2:00 pm twice a week.

Statistical analysis: The data was analyzed by least-squares method using the Harvey Computer Package (Harvey, 1990).

RESULTS

Prior to the commencement of study, data generated by the Meteorological Unit of the Institute for Agricultural Research, Ahmadu Bello University, Samaru-Zaria, on weather conditions were obtained (Table 1). The mean rectal temperature, pulse and respiratory rates are shown in Table 2. The average values were 37.0°C, 48.6 beats min^{-1} and 15.5 breaths min^{-1}, respectively.

Table 3: Average monthly values for rectal temperatures, pulse rate and respiratory rates for adult dromedary camels in Shika

Month	Temperature (°C)	Pulse rate (beats min^{-1})	Respiration (breaths min^{-1})
January	36.54±0.37	46.22±2.94	13.00±1.21
February	36.76±0.46	45.39±4.24	12.51±1.81
March	36.96±0.38	47.25±4.70	15.35±3.59
April	37.41±0.49	49.98±2.58	17.65±4.14
May	37.33±0.46	50.12±2.48	17.31±3.77
June	37.30±0.52	50.55±1.41	16.64±1.70
July	37.28±0.34	50.35±4.14	16.32±2.44
August	37.26±0.43	50.29±2.96	16.11±1.00
September	37.23±0.54	50.41±1.03	15.04±0.77
October	37.57±0.66	50.27±0.75	14.85±0.77
November	37.09±0.52	50.06±0.85	13.66±1.81
December	36.86±0.41	47.46±2.12	13.59±0.89

Table 4: Mean hot and cold season rectal temperature, pulse and respiratory rates for adult dromedary camels in Shika

Season	Temperature (°C)	Pulse rate (beats min^{-1})	Respiration rate (breaths min^{-1})
Hot	37.30±0.13	49.87±0.66	15.94±1.25
Cold (Harmattan)	36.78±1.15	46.58±0.83	13.61±1.07
Rainy	37.33±0.63	49.83±2.31	16.04±1.52

Table 5: Average morning-afternoon variations for rectal temperature, pulse rate and respiratory rates for adult dromedary camels in Shika

Time	Temperature (°C)	Pulse (beats min^{-1})	Respiration (breaths min^{-1})
8.00 h	36.96	47.04	13.61
14.00 h	38.07	49.05	14.52

Recorded ranges were T: 35.0-40.0°C, P: 30-57 beats min^{-1} and R: 8-23 breaths min^{-1} for all the year round (Table 3). TPR values were significantly lower ($p<0.05$) in the cold seasons (T=36.8°C, P = 46.6, R=13.6) than in the dry seasons (T = 37.3°C, P = 49.9, R = 15.9) (Table 4). The parameters were not significantly different ($p>0.05$) between males (T= 37.1°C, P = 48.6, R = 15.4) and females (T = 37.2°C, P = 48.7, R = 15.3) (Table 2). The time of measurement or sampling was significant ($p<0.01$) with lower values in the morning h (T = 36.9, P = 47.0, R = 13.6) than in afternoon h (T = 38.1 P = 49.1 R = 14.5) (Table 5).

DISCUSSION

The mean rectal temperature, pulse and respiratory rates obtained in this study were in agreement with earlier

studies (Higgins, 1985; Wilson, 1998). The values were significantly lower in the cold season than in the dry season even with the normal vital physiological fluctuations characteristic of camels in their natural habitat (Schmidt-Nielsen, 1985). There was however, no significant difference between the male and female values as reported by Wilson (1984, 1998).

The ambient temperature significantly lower values in the morning measurements than the afternoon measurements confirming the camel's ability to fluctuate its vital physiological parameters (Tefera, 2004; Wilson 1984). The result of this study also agrees with the previous reports (Higgins, 1985; Wilson, 1998) that the diurnal temperature variation in a hydrated camel (watered daily) is of the order of 2°C (36.96 and 38.07°C). However, range of respiratory rate 13.61 to 14.52 breaths per min obtained in this study does not tally with the results of Wilson (1984) which had 8 to16 breaths per min. The slight deviations obtained in this study from the normal arid zone reported values for vital physiological parameters might be due to environmental variations.

Respiratory rates increase very little with increase in ambient temperature in camels unlike in other domestic animals that respond to hot environment by resorting to an increased respiratory rate and, in some cases, by panting (Kelly, 1974). Pulse rate in this study exhibits wide variation rising gradually from 30 in the morning to 57 beats per min during the hottest part of the day.

The vital physiological parameters are used clinically as indicative of health or disease. Signs of pain, discomfort or distress and the presence of abnormal discharges and changes in faecal consistency are often significant in clinical examinations. However, in camel, use of body temperature as an indication of the state of health must be used with caution, because of the observed diurnal fluctuations in this study which is in conformity with the earlier report of Tefera (2004). This therefore indicates that morning high temperatures could indicate fever while afternoon highs may be hyperthermia.

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