

# Diurnal Fluctuations in Rectal Temperature of Pigeons during the Hot Dry Season of the Sahel Savannah Region

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## ABSTRACT

*Experiments were performed on 10 adult pigeons with the aim of determining their diurnal temperature fluctuations during the hot dry season. The rectal temperature (RT) was recorded with a standard clinical thermometer every hour from 06:00 to 19:00 hours. The RT increased from 40.9°C + 0.1°C at 6:00 hour to a peak value of 41.8°C + 0.2°C at 12:00 hour, thereafter the value began to decline until it reached 40.0°C + 0.1°C at 19:00 hour. The RT rose concurrently with increase in ambient temperature. The overall mean RT obtained between the pigeons was 40.9°C + 0.0°C. The overall diurnal fluctuation in the rectal temperature of the pigeons was 1.5°C + 0.2°C. There was no positive correlation between the minimum and maximum RT values obtained from individual animals. The correlation between minimum and maximum RT by hour was also not significant. The high diurnal range of 1.5°C + 0.2°C suggests that the hot dry season was thermally stressful to the pigeon during the hot dry season.*

**Keywords:** *Diurnal fluctuations, rectal temperature, pigeons, hot dry season*

## INTRODUCTION

Pigeon is an inclusive name for birds of the family (*Columbidae*), a cosmopolitan group with about 300 species. Generally, larger species are called pigeons and smaller ones are known as doves (<http://www.4to40.com/earth/geography/htm/birdsindex>). Being a homeotherm, the pigeon can carry out its usual activities under a wide range of external temperatures. In Poikileotherms, body temperature varies directly with that of the environmental temperature and is dependent on the external temperature. In the cold, they pass into a state of sleep-like activity, while in hot weather they may have to burrow into the mud to avoid disastrous over heating). Birds and mammals have evolved means of maintaining a deep body temperature that is relatively constant even in the face of considerable environmental temperature stress. They are temperature regulators and are called homeotherms (Zotterman, 1951). The rectal temperature which is a good indicator of the body temperature in animals is the measurement of the degree of coldness or hotness of the body. It represents the resultant of the heat gains and losses

of the body and is the best single criterion of heat tolerance in animals (Horvath and Foltz, 1950). Many conditions are capable of causing normal variations in the body temperature of homeotherms among which are age, sex, exercise, eating, digestion and drinking of water (Ayo *et al.*, 1998). Meteorological conditions, especially ambient temperature and relative humidity, can cause variations in physiological responses of animals. These could differ between breeds and species. Therefore, the assessment of acclimatization or adaptations of animals in the tropics involves their thermal response to Meteorological conditions (Igono, Molokwu, and Aliyu, 1982). To survive and maintain good production levels under unfavourable Meteorological conditions, provision of clean drinking water, adequate light stimulation especially for layers, protection from injury, disease and a balanced diet are required for pigeon. This study aims at measuring the rectal temperature of pigeon in order to assess its thermoregulatory capacity and the adaptation of the breed to hot dry weather conditions.

## MATERIALS AND METHOD

The experiment was performed at a backyard farm within the Maiduguri metropolis, located in the Sahelian zone of Nigeria. Measurements were taken in April, 2007 during the hot season. Meteorological data for the locality are given on table 1. The meteorological data during the study period (table 1) showed that the minimum ambient temperature ranged between 26°C and 27°C, while the maximum ambient temperature range was between 42°C and 43°C. The diurnal range in ambient temperature was thus between 1°C and 1°C. The mean wet and dry-bulb temperatures were 20.1°C ± 0.6°C and 34.3°C ± 0.2°C respectively. The relative humidity was 26.1 + 1.2 per cent. The Sahelian zone is characterized by long dry season from October to May. The hottest months are usually March to early June, when the daily maximum temperature can get to 44°C (Wakil, 1998).

The pigeons were housed in a cage and fed with corn chaff and water. The feed and water were withdrawn during the measurements. The pigeons were exposed to a period of pre-conditioning (one week) during which the rectal temperatures were measured to accustom them to the experimental procedures. Measurements of rectal temperature (RT) were taken every hour from 06.00 to 19.00 hours throughout the period of the experiment. Recordings were taken for three days, one day per week. Rectal temperature was recorded with a standard clinical thermometer inserted into the rectum and kept there for two minutes. All data obtained were subjected to students' t-test and correlation analysis. Data were expressed as mean ± standard error of the mean (Mean ± SEM). Values of P < 0.05 were considered significant.

## RESULTS AND DISCUSSION

The mean minimum rectal temperature (RT) of the pigeon was 40.0°C ± 0.2°C while the mean maximum RT was 41.5°C ± 0.2°C (p < 0.001). The mean diurnal range of individual minimum and maximum temperatures was (2.6°C ± 0.1°C (Table 2). The

recorded hourly rectal temperature (Table 3) was lowest at 19:00 hours with  $40.0^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$  value, and highest at 12:00 hours with  $41.8^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$ , ( $P < 0.01$ ). With an increase in ambient temperature, there was a concurrent increase in RT. The correlation coefficient between the minimum ambient temperature and the rectal temperature ( $r = 0.0091$ ,  $P = 0.9754$ ) was lower than between the maximum ambient temperature and the rectal temperature ( $r = 0.7088$ ,  $P = 0.00045$ ), and neither was statistically significant. The dry-bulb temperature was more related to the RT than the wet-bulb temperature, with correlation coefficient of 0.9722 ( $P < 0.0001$ ), the P value was extremely significant. The relationship between relative humidity and RT, was not significant ( $r = 0.1733$ ,  $P = 0.6320$  i.e.  $P > 0.05$ ). The maximum diurnal variation ( $1.5^{\circ}\text{C}$ ) was obtained between 06:00 and 12:00 hours. The overall mean hourly RT obtained during the entire period of investigation was  $40.9^{\circ}\text{C} \pm 0.0^{\circ}\text{C}$ . The maximum hourly RT ( $41.8^{\circ}\text{C}$ ) was recorded at 12:00 hours. Thereafter the maximum hourly RT began to decline until reached  $40.0^{\circ}\text{C}$  at 19:00 hours (Table 3).

Despite the overall pattern of the diurnal means, there were considerable differences between the mean recordings at the various hours of observation with three of the values falling within the standard error limit, i.e.,  $40.8^{\circ}\text{C}$  (Table 2). The minimum and maximum individual readings at each time of the day confirmed the diurnal pattern. The RT minima and maxima, together with the standard errors and ranges shown on table 3, described the extent of variation at each hour of observation. Table 2 shows the extent of variation recorded throughout the day in each animal. Although the pigeons showed a similar diurnal pattern, there were differences between them.

The result of this study indicated a diurnal rhythm in the Rectal Temperature (RT) of the pigeons. The rectal temperature increased from 06:00 hour's value of  $40.9^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$  and attained a peak value of  $41.8^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$  at 12:00 hours. Thereafter, the value began to decline until it reached  $40.0^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$  at 19:00 hours. This finding concurs with previous investigations into the rectal temperature of filial crosses and local Awassi sheep (Abisaab and Suleiman, 1995), Savannah Brown goat (Igono, Molokwu and Aliyu, 1982) and the West Africa Dwarf sheep (Orji and Umesiobi, 1985). Similar results were found in the Red Sokoto goat (Ayo *et al.*, 1998), Yankasa sheep (Igono, Molokwu and Aliyu, 1982) and the desert sheep (Ahmed and Abdullatif, 1995). The diurnal range of RT is an important indicator of the degree of stressfulness of the ambient temperature or weather conditions to the animals.

If the diurnal range is less than  $1^{\circ}\text{C}$ , there is less stress on the animal, but ranges over  $1^{\circ}\text{C}$  are stressful (Bianca, 1961). The wide diurnal range of  $1.9^{\circ}\text{C}$  obtained in this study indicated that the hot dry season is thermally stressful to the pigeons. This finding is however at variance with that done on Nigerian dwarf goats wherein, the diurnal range in RT was less than  $1^{\circ}\text{C}$  and consequently lowered thermal stressfulness (Mehrotra and Mullik, 1958). The high relative humidity ( $26.1 \pm 1.2\%$ ) obtained during the study period because of early appearance of rain may be accountable for the wide diurnal range in RT. Usually, the hot dry season is characterized by very low relative humidity in the Sahelian zone which makes the prevailing ambient temperature bearable.

**Table 1:** Meteorological data for the study period

Day	Ambient temperature (°C)				
	Maxium	Minimum	Wet-Bulb	Dry-Bulb	R.H (%)
1	42	27	21	33.1	27.9
2	43	26	22.1	34.6	28.5
3	42	27	19.9	34.3	24.6
Mean± SEM	42.3 ± 0.3	26.7 ± 0.3	20.1 ± 0.6	34.3 ± 0.2	26.1 ± 1.2

*Source:* Nigeria Meteorological Agency, Maiduguri, Borno State.

**Table 2:** Variation in rectal temperature between the pigeons (°C).

S/No	Rectal Temperature (°C)				Mean ± SEM
	Maximum	Minimum	Range		
1	40.1	41.4	1.3		40.8 ± 0.1
2	39.7	41.4	1.7		40.6 ± 0.2
3	39.7	41.4	1.7		40.7 ± 0.1
4	40.1	41.8	1.7		41.0 ± 0.1
5	40.1	41.7	1.6		40.8 ± 0.1
6	40.2	41.2	1.0		40.9 ± 0.1
7	39.8	41.8	2.0		40.8 ± 0.2
8	39.8	41.3	1.5		40.8 ± 0.1
9	40.1	41.4	1.3		40.8 ± 0.1
10	40.1	41.4	1.3		40.9 ± 0.1
Mean ± SEM	40.0 ± 0.2	41.5 ± 0.2	1.5 ± 0.2		40.8 ± 0.0

*Source:* Experimentation, 2013

**Table 3:** Diurnal variation in rectal temperature of pigeons (°C).

Hour	Rectal Temperature (°C)				Mean ± SEM
	Minimum	Maximum	Range		
06.00	40.0	42.0	2.0		40.9 ± 0.1
07.00	40.2	42.0	1.8		41.0 ± 0.1
08.00	40.3	41.7	1.4		41.0 ± 0.1
09.00	40.1	42.0	1.9		41.1 ± 0.1
10.00	40.0	42.9	2.9		41.4 ± 0.1
11.00	40.5	42.9	2.4		41.3 ± 0.1
12.00	40.1	42.8	2.7		41.8 ± 0.2
13.00	40.1	42.7	2.6		41.2 ± 0.2
14.00	40.2	41.4	0.9		40.70.1
15.00	40.0	41.3	1.3		40.6 ± 0.1
16.00	39.3	41.4	2.1		40.6 ± 0.1
17.00	39.2	41.0	1.8		40.3 ± 0.1
18.00	39.0	40.8	1.8		40.1 ± 0.1
19.00	39.0	40.5	1.5		40.0 ± 0.1
Mean± SEM	39.9 ± 0.5	41.8 ± 0.8	1.9 ± 0.0		40.9 ± 0.0

*Source:* Experimentation, 2013

### CONCLUDING REMARKS

The Rectal Temperature (RT) values obtained in this study were predominantly within the normal range for avians and they followed a pattern associated with the diurnal fluctuations in activity and ambient air temperature characteristic of most animals. The

RT of the pigeon during the hot dry season showed a wide diurnal variation with a range of 1.9°C, indicating that the hot dry season of the Sahel zone marked by early appearance of rain was thermally stressful to the pigeon.

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