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Body temperatures of some wild East African ungulates

Introduction

Body temperatures are often a good indication of the general health and body condition of an animal; however, insufficient data are available for many of the wildlife species. Most of the intensive work performed has been on penned individuals of a few species (C. R. Taylor, unpublished data), and captive or paddocked individuals instrumented with radio-telemetric devices (Bligh and Harthoorn, 1965). The results of these intensive investigations and similar ones currently under way on thermostability and thermoregulation should provide data on normal deep-body temperature for an increasing number of wildlife species. Until such species-specific thermal patterns are available for field work, one must compare the temperatures of newly-captured animals, which have been stressed by one or more factors, with norms obtained from freshly-killed specimens.

Rectal temperatures obtained from drug-immobilized animals and freshly-shot ones (where available) are summarized in this paper for the following species: Coke's hartebeest (kongoni), *Alcelaphus buselaphus cokii* Günther; white-bearded wildebeest, *Connochaetes taurinus albojubatus* Thomas; Burchell's zebra, *Equus burchelli böhmi* Matschie; eland, *Taurotragus oryx pattersonianus* Lydekker, fringe-eared oryx, *Oryx beisa callotis* (Thomas); black rhinoceros, *Diceros bicornis* (L.); and African elephant, *Loxodonta africana africana* (Blumenbach).

Methods

Rectal temperatures were obtained with a standard clinical thermometer from animals immobilized for marking in a study of seasonal movements in Kajiado District, with the exception of the black rhinoceroses, which were captured on a translocation project in Tanzania (Denney, 1969). All the animals were immobilized after a short chase by helicopter or ground vehicle to get within Cap-Chur gun range for the drug injection. Rectal temperatures from freshly-killed specimens were taken within 10-20 min after death during a study of food-habits of kongoni, wildebeest and zebra in Kajiado District. Differences between means were tested for significance by a student's t test.

Results

Rectal temperature data have been summarized in Table 1 by species and sex, indicating the range and mean for each. Rectal temperatures of immobilized animals have been plotted individually for kongoni, wildebeest, zebra and eland in Figures 1-4, respectively.

Kongoni

A total of 61 adult kongoni (42 males and 19 females) was immobilized, and 21 (15 males and 6 females) were shot and killed. The 42 immobilized males had temperatures ranging from 38.9-43.3°C with a mean of 41.0°C, while the 15 shot males, arbitrarily assumed as the norm, ranged from 38.2-40.3°C, with an average of 39.2°C. The immobilized females ranged from 39.4-

TABLE 1

Rectal temperatures obtained from immobilized and freshly-killed East African wild ungulates

Species	Immobilized (alive) No. Sex	Range °C (°F)	Mean	Shot (dead) No. Sex	Range °C (°F)	Mean
Kongoni	42 M	38.9—43.3 (102.0—110.0)	41.0 (105.8)	15 M	38.2—40.3 (100.8—104.6)	39.2 (102.6)
	19 F	39.4—42.9 (103 0—109.2)	41.1 (106.2)	6 F	38.5—40.4 (101.4—104.7)	39.4 (103.0)
	—			—		
	61 All	38.9—43.3 (102.0—110.0)	41.1 (106.2)	21 All	38.2—40.4 (100.8—104.7)	39.3† (102.7)
Wildebeest	56 M	38.0—42.7 (100.5—109.0)	40.2 (104.4)	20 M	38.4—41.3 (101.1—106.3)	39.1 (102.5)
	22 F	37.4—42.2 (99.4—108.0)	40.1 (104.2)	14 F	38.3—40.3 (100.9—104.6)	39.2 (102.6)
	—			—		
	78 All	37.4—42.7 (99.4—108.0)	40.2 (104.3)	34 All	38.3—41.3 (100.9—106.3)	39.1† (102.5)
Zebra	44 M	38.3—42.3 (101.0—108.2)	40.7 (105.3)	7 M	38.4—41.8 (101.1—107.2)	39.4 (103.0)
	23 F	36.9—42.3 (98.4—108.2)	40.6 (105.1)	6 F	38.8—39.6 (101.9—103.3)	39.2 (102.6)
	—			—		
	67 All	36.9—42.3 (98.4—108.2)	40.7 (105.3)	13	38.4—41.8 (101.1—107.2)	39.3† (102.8)
Eland	6 M	38.0—42.2 (100.4—108.0)	40.8 (105.5)			
	7 F	39.4—41.9 (103.0—107.4)	41.0 (105.8)			
	—					
	13 All	38.0—42.2 (100.4—108.0)	40.9 (105.7)			
Rhinoceros	9 M	37.3—41.5 (99.3—106.7)	38.9 (102.1)			
	3 F	37.3—39.7 (99.1—103.5)	38.5 (101.3)			
	—					
	12 All	37.3—41.5 (99.1—106.7)	38.8 (101.9)			
Elephant	4 M	35.5—38.9 (96.0—102.0)	37.4 (99.4)		36.2—38.1* (97.2—100.6)	
Oryx	2 F	40.7—42.5 (105.3—108.5)	41.6 (106.9)			

* R. V. Short, in Bligh and Harthoorn (1965)
† Significantly lower than the immobilized animals ($P<0.001$)
M male, F female

42.9°C, averaging 41.1°C, and the freshly-killed females ranged from 38.5-40.4°C with a mean of 39.4°C. Overall range for the immobilized kongoni was 38.9-43.3°C, with a mean of 41.1°C, compared to an overall range of 38.2-40.4°C, averaging 39.3°C. for the freshly-killed animals.

Figure 1 reveals the scatter of individual rectal temperatures throughout the day, the solid line depicting the hourly means. The hourly means show an increase from a low of 38.9°C to a post-midday high of 42.3°C and a decrease to 40.9°C in the early evening.

From Table 1 it can be seen that the rectal temperatures varied much more in the immobilized animals than in the shot ones (4.4 and 2.2°C), and the species mean for immobilized kongoni was 1.8°C higher than in the freshly-killed ones. Rectal temperatures of immobilized kongoni were significantly higher ($P<0.001$) than those of shot kongoni.

Wildebeest

The range in rectal temperatures for 56 males out of a total of 78 immobilized wildebeest was 38.0-42.7°C, averaging 40.2°C, compared to a range of 38.4-41.3°C with a mean

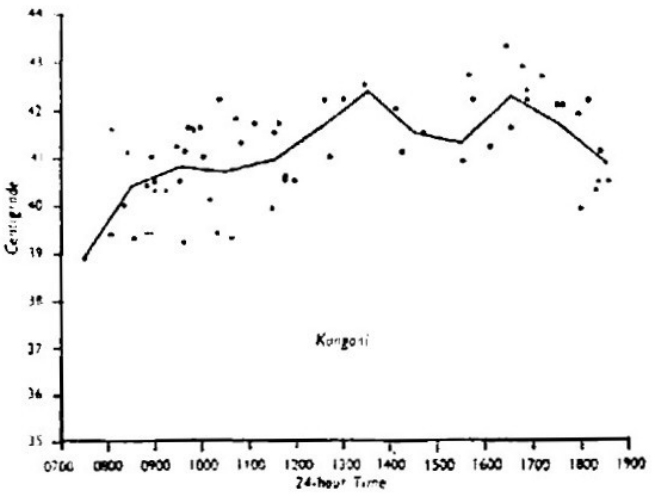

Figure 1

Individual rectal temperatures of 61 immobilized kongoni plotted against time, with the mean temperatures by hourly periods connected by the solid line.

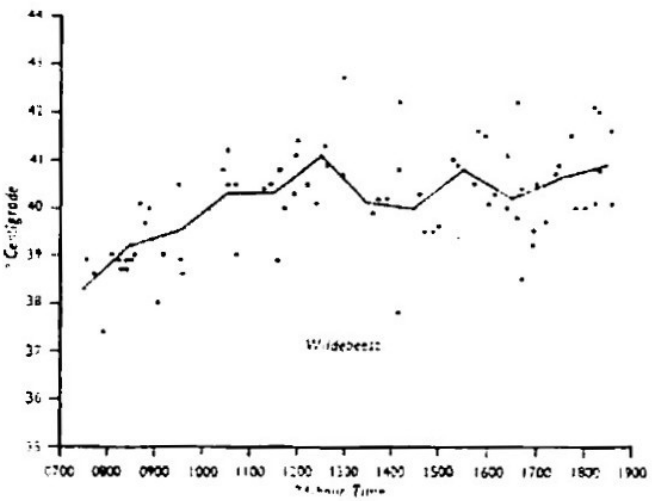

Figure 2

Rectal temperatures of 78 immobilized wildebeest plotted against time, with the solid line connecting the hourly means.

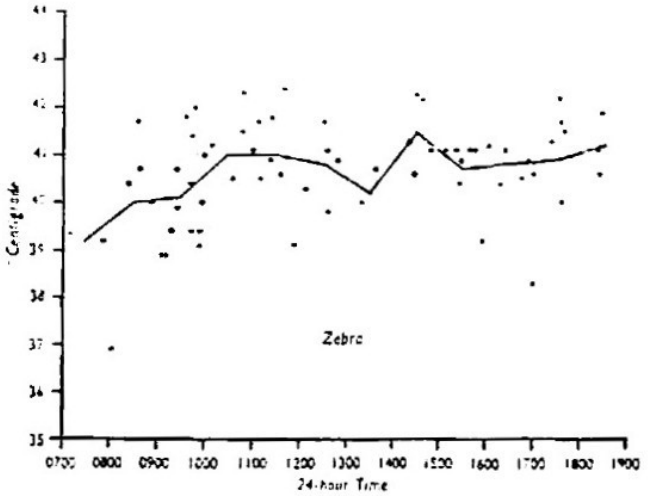

Figure 3

Rectal temperatures of 67 immobilized zebra, with the solid line connecting the hourly means.

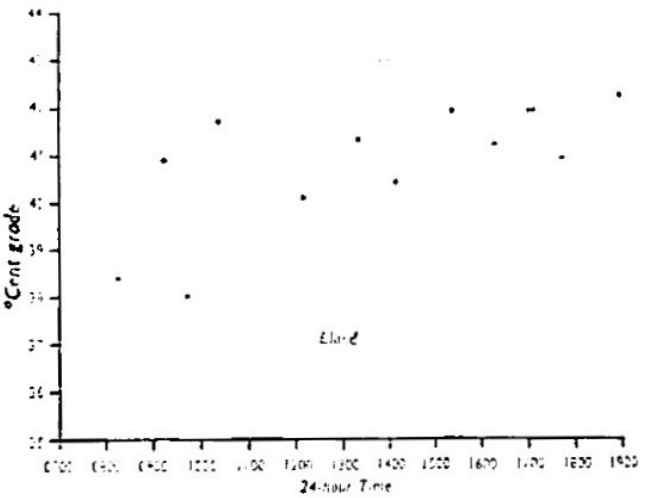

Figure 4

Rectal temperatures of 13 immobilized eland.

of 39.1°C for 20 males shot and killed out of a total of 34 wildebeest. Females ranged from 37.4-42.2°C, averaging 40.1°C in 22 immobilized ones, while 14 newly-dead females ranged from 38.3-40.3°C with a mean of 39.2°C. The overall range of immobilized wildebeest was 37.4-42.7°C, averaging 40.2°C, and the range for all shot animals was 38.3-41.3°C with a mean of 39.1°C.

The rectal temperatures of 78 immobilized individuals are plotted with hourly means in Figure 2, revealing a trend in hourly means from 38.3°C in the early morning to a high of 41.1°C at mid-day with a relatively constant average of 40.9°C into the early evening hours.

As with kongoni, the immobilized wildebeest temperatures (Table 1) were more variable (5.3°C) than those of the killed animals (3.0°C), and the average of the former was 1.1°C higher than that of the latter. Immobilized animals' rectal temperatures were significantly higher ($P<0.001$) than those of the freshly-killed ones.

Zebra

Rectal temperatures of 44 males out of a total of 67 immobilized zebra ranged from 38.3-41.3°C, with an average of 40.7°C. Seven freshly-killed males exhibited temperatures of 38.4-41.8°C, with a mean of 39.4°C. The range was 36.9-42.3°C, with an average

of 40.6°C. for 23 immobilized females, compared to a range of 38.8-39.6°C, averaging 39.2°C, for six shot ones. Overall, immobilized zebra displayed a range of 36.9-42.3°C with a mean of 40.7°C, compared to an overall range for shot zebra of 38.4-41.8°C, averaging 39.3°C.

Figure 3 shows the scatter of individual rectal temperatures throughout the day, with the hourly means connected with the solid line. The general trend is upward from 39.2°C in the early morning to 41.2°C at 1830 h.

Zebra display the most variable rectal temperatures of any of the species in Table 1: the range is 60% wider in immobilized animals and the overall mean is significantly (1.4°C) higher than in freshly-shot zebra ($P<0.001$).

Eland

Six immobilized male eland ranged in rectal temperatures from 38.0-42.2°C with a mean of 40.8°C. Seven females were between 39.4 and 41.9°C, averaging 41.0°C. Overall eland rectal temperatures ranged from 38.0-42.2°C, with an average of 40.9°C Rectal temperature data from the 13 immobilized eland are plotted at the times of their reading (Figure 4). An insufficient number of samples precludes drawing in the hourly means, but the general trend is upward from c. 38.0°C in the morning to c. 42.0°C in the early evening.

Rhinoceros

Temperatures of nine male rhinoceroses ranged between 37.3 and 41.5°C, with an average of 38.9°C. Three females spanned 37.3-39.7°C, with a mean of 38.5°C. The overall range of rectal temperatures for immobilized rhinoceroses was from 37.3-41.5°C, averaging 38.8°C.

Elephant

Four bull elephants were immobilized, yielding a rectal temperature range of 35.5-38.9°C, with an average of 37.4°C. Elephants displayed the lowest rectal temperatures of the species immobilized.

Oryx

Two female oryx were immobilized, and had rectal temperatures of 40.7 and 42.5°C, with an average of 41.6°C (Table 1).

Discussion

The wider variations and higher average rectal temperatures found in the immobilized animals compared to the freshly-killed ones are attributed to the stresses imposed on them by chasing with a vehicle or helicopter, as well as possibly to the effects of some of the components of the drug mixtures. Acetylpromazine was used as the neuroleptic in most of the immobilizations with morphine-like analgesics, and it is known to suppress the body-temperature control mechanisms. In addition, the energy expended in running, from the time of first being chased until becoming immobilized, would generate heat.

To compare rectal temperatures of immobilized animals with normal temperatures of unstressed animals, we have assumed that the temperatures obtained from shot animals more closely represent normal values and will fluctuate throughout the day. Talbot and Talbot (1963) found that rectal temperatures taken within the first minute of shooting followed a daily cycle, from a low value just before dawn to a maximum between 1500 and 1700 h, and then remained high until about 2000 h, when they dropped slowly. Fitting our data from immobilized wildebeest into the time schedule used by Talbot and Talbot, and using their data as the normal values, we have:

Time period	*Normal temperature*	*Immobilized temperature*
Before 0700	37.8°C	
0700—0855	38.5	39.5°C
0900—1155	38.5	40.1
1200—1455	38.9	40.5
1500—2000	39.2	40.6

The Talbots found an overall range of 37.7-39.8°C, with a mean of 38.8°C in rectal temperatures taken within 1 min of death on >100 wildebeest. Our data on 34 freshly-killed wildebeest ranged from 38.3-41.3°C, with an average of 39.1°C, and these temperatures, though higher than those recorded by Talbot and Talbot, were statistically significantly lower than those from immobilized animals.

Bligh and Harthoorn (1965) found good agreement between rectal temperatures and those deep-body temperatures taken simultaneously from probes placed in muscle tissue close to the spine behind the shoulder blade on a single eland; values varied between

38.3 and 39.8°C. Our immobilized eland data indicate a range from 38.0-42.2°C, with a mean of 40.9°C for 13 individuals. Again, it would appear that the temperatures of immobilized eland are higher than the normal body temperatures.

An immature male black rhinoceros, monitored by Bligh and Harthoorn (1965) during the last 10 h of daylight on 1 d, ranged in deep body temperature from 37.6-39.5°C, compared to a range of 37.3-41.5°C, with a mean of 38.8°C on our 12 immobilized rhinoceroses. It was observed that rhinoceroses showed profuse sweating after the exercise associated with immobilization. The rise in body temperature stimulated the sweat glands, which is obviously one of the heat-loss mechanisms of the rhinoceros, contrary to the statement of Guggisberg (1966, p. 56) that rhinoceroses have no sweat glands and depend on heat regulation by contact with an outside coolant. Microscopic examination of the skin shows well-developed groups of sweat glands (Prof. D. Robertshaw and Dr. B. Clausen, pers. comm.).

The only comparative data available on African elephants are from R. V. Short (Bligh and Harthoorn, 1965), indicating a range of 36.2-38.1°C for shot elephants, compared to our range on immobilized elephants of 35.5-38.9°C.

It appears, therefore, that the stresses involved in the drug immobilization of wild animals in the manner in which I have performed it may induce rectal temperatures which on the average may exceed mean normal temperatures by up to 2°C.

It is possible that additional data in the hourly periods depicted in Figures 1-3 would smooth out the mean curves, particularly if temporal patterns could be recorded continuously from several individuals simultaneously under the same conditions. However, it is more likely that fluctuations are more normal than a smooth curve, in view of the fact that several factors affect body temperatures. Ambient temperatures, direct sun and shade, rain, general health and body circulation, including the degreee of dehydration, are factors affecting body temperatures. Talbot and Talbot (1963) found that pregnant female wildebeest had slightly lower temperatures than other adults, and that animals< 1 y old appeared to have higher temperatures than adults. Bligh and Harthoorn (1965) found inexplicable fluctuations in continuous measurements of deep body temperatures on an instrumented eland and an oryx. C. R. Taylor (unpublished data) found that certain animals (eland, oryx, wildebeest, Grant's and Thomson's gazelles) exhibited a wider variation in rectal temperatures when dehydrated than when hydrated, and when subjected to a periodic heat load.

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