

A YEAR IN THE THERMAL LIFE OF A HERD OF SPRINGBOK (*Antidorcas marsupialis*)

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The springbok, a small southern African antelope, maintains arterial blood temperature within narrow daily limits ($\sim 1^\circ\text{C}$), despite being subjected to high thermal loads in summer, often with concomitant water stress. The key to their homeothermy is thought to lie in thermoregulatory behaviour and the low radiant absorptance of their pelage. The pelage, however, also is thin with a high conductance and springbok are reported to be susceptible to hypothermia during cold winter months. As a consequence of technical limitations, there are no quantitative data on seasonal variations in body core temperature in springbok nor, indeed, in any other antelope. We used miniature data loggers to measure body core temperature in springbok, undisturbed in their natural habitat, for one year. We implanted data loggers (mass 30 g) into the abdomen of seven (2 male, 5 female) springbok (body mass 20-35 kg), during halothane (1-2%) general anaesthesia (duration 6 min). After surgery, springbok were released into a fenced 62 ha enclosure, where they ranged freely with other species of African ungulates. Body temperatures were recorded continuously, every 30 min, to an accuracy of 0.04°C , and hourly-measurements of microclimate data were obtained from a weather station at the study site. After 12-14 months, springbok were recaptured (using nets) and loggers were removed under anaesthesia. Over the year, the animals were subjected to air temperatures that fluctuated between -6°C and $+34^\circ\text{C}$, and a nycthemeral range of globe temperature that exceeded 40°C . Daily body temperature exhibited a small amplitude nycthemeral rhythm (mean $1.2 \pm 0.2^\circ\text{C}$) varying, on average, between 38.8°C and 40.0°C , with a temperature peak at 18:30 and a trough in the early morning between 05:00 and 07:30. In all seven animals, mean daily body temperature was linearly correlated with mean daily air temperature ($P < 0.0001$) so that, on average, body temperature increased 0.02°C per 1°C increase of air temperature. There also was a positive linear relationship between minimum daily body temperature and minimum air temperature, but the relationship between peak body temperature and maximum air temperature was less robust, particularly in the male springbok. Analysis of seasonal patterns also revealed that mean daily body temperature was significantly higher in summer months (Oct to Jan) than in mid-winter (June to July), by $\sim 0.3^\circ\text{C}$. Both the minimum and peak body temperature were significantly lower in winter months, so that the nycthemeral amplitude of body temperature, on average, was the same during all months. Thus, during hotter summer months, there was no demonstration of adaptive heterothermy, a thermal adaptation thought to be characteristic of antelope in arid or semi-arid regions. Also, although body temperature patterns were correlated with environmental thermal loads, the circadian and circannual variation of body temperature was small, a finding that we believe supports the idea of the importance of behavioural modifications in maintaining the stability of internal temperature.

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