A comparison of surface and rectal temperatures between sheared and non-sheared alpacas (Lama pacos)

A.M. Heath*, C.B. Navarre, A. Simpkins, R.C. Purohit, D.G. Pugh
Department of Large Animal Surgery and Medicine, College of Veterinary Medicine, Auburn University, Auburn, AL 36849, USA
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Abstract

The objective of this research was to determine if whole-body shearing would effect gross thermoregulation in alpacas. Eight mature, intact male alpacas were randomly assigned to one of two groups and maintained in outdoor pastures with adequate artificial shade from June through August (summer climate) in east central Alabama, USA. Group one animals (N = 4) were sheared to remove all fiber to within 2 cm of their skin. Group 2 animals (N = 4) were left non-sheared. Sheared alpacas tended to have lower rectal temperatures during high ambient temperatures than did non-sheared alpacas (P < 0.06). Thermographic studies of the scrotum revealed cooler surface temperatures in sheared versus non-sheared alpacas (P = 0.05). Temperatures in the right medial thigh of sheared animals were 0.9°C cooler than the thigh region of non-sheared animals in the morning (P < 0.03). Right medial thigh temperatures were 1.6°C cooler in sheared alpacas in the afternoon (P < 0.01). Significant positive correlations were found in non-sheared animals between ambient temperature and rectal temperature in the morning (r = 0.612, P = 0.014). In sheared animals during the morning significant positive correlations were established between the Heat Stress Index (HSI) and the right medial thigh surface temperatures (r = 0.648, P = 0.003), the HSI and rectal temperature (r = 0.729, P = 0.0003), the ambient temperature and right medial thigh surface temperature (r = 0.485, P = 0.04), and the ambient temperature and the rectal temperature (r = 0.823, P < 0.0001). In the afternoon a significant positive correlation was found in the sheared alpacas between the HSI and the right medial thigh surface temperature, rectal temperature and surface scrotal temperature (r = 0.538, P = 0.02, r = 0.543, P = 0.019 and r = 0.522, P = 0.045), respectively. These data indicate that whole-body shearing of alpacas could have a beneficial effect on thermoregulation when used as a preventative measure against heat stress. Shearing may assist heat dissipation resulting in a cooler surface body temperature and rectal temperature in alpacas when challenged by the heat and humidity experienced in the summer months in the southeastern United States.

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1. Introduction

Although domesticated longer than practically any other animal in the world, South American camelids have remained relatively obscure animals in the United States until recent years. Progenitors of camelids are generally assumed to have originated in North America. However, present day camelids have adapted to the Andean Mountain habitat. High temperature and high humidity combinations found in the United States, and in particular the southeast, renders heat stress as one of the major causes of illness and death of South American camelids in North America (Johnson, 1993). Estimates of mortality from heat

*Corresponding author. Tel.: +1-334-844-4490; fax: +1-334-844-6715.
E-mail address: heatham@vetmed.auburn.edu (A.M. Heath).
stress during the summer of 1995 alone were as high as 1000 animals. This is a major cause, not only of death, but also reduced productivity, infertility in the male, and fetal wastage (Fowler, 1994). The male llama does not have as pendulous a scrotum as most other species and may be more susceptible to the deleterious effects of elevated body temperatures on spermatogenesis than most other animals. Scrotal edema is also a common sequel to heat stress in South American camelids. Hyperthermia is also associated with aberrations of the central nervous system, the respiratory system, the digestive system, the cardiovascular system, the hematopoietic system, the urinary system and the reproductive system. It has been suggested that shearing will aid in the prevention of heat stress, but no research has been reported demonstrating the effectiveness of shearing and to what extent it would act as a preventative measure in decreasing the occurrence of this syndrome (Fowler, 1998). It has also been suggested that body fiber insulates camelids against high temperatures. Therefore, the objective of this clinical trial was to determine if whole-body shearing would effect gross thermoregulation in alpacas.

2. Materials and methods

Eight mature, intact male alpacas were blocked according to weight and coat color. They were then assigned to one of two groups and maintained in outdoor pastures with adequate artificial shade from June through September (summer climates) in east central Alabama. Group one animals (N = 4) were sheared to remove all fiber to within 2 cm of their skin. Group 2 animals (N = 4) were left non-sheared. At 14 day intervals for a total period of 90 days, all animals were retrieved from the grazing paddock, moved to an indoor holding facility and allowed to acclimate for 30 min to room temperature (22°C) at approximately 8:00 a.m. (CST) and again at approximately 1:00 p.m. (CST). Following acclimation, the animal’s rectal temperature was measured using a digital thermometer. Subsequently, surface body temperature of the right medial thigh and scrotum was measured using a Thermovision 8701 real time imaging system with AGEMA Infrared Systems computer software. Each thermographic image along with the associated temperature scale was photographed and stored as 2” × 2” slides. The highest temperature readings from the thigh and scrotal regions were recorded. Changes in isotherm patterns were visually evaluated. Average ambient temperature, relative humidity and a livestock heat stress index was recorded for each measurement period. These values were collected from data recorded by the Agricultural Weather Information Service, Inc. The livestock heat stress index is calculated from the dry bulb temperature and the relative humidity. All descriptive data was analyzed using the repeated measures analysis of variance (ANOVA). All significant (P < 0.05) correlations (Fischer’s r to z) were determined by examining a matrix table containing all the recorded variables. Statistical calculations were made using a proprietary software program.

3. Results

The average values for ambient temperature, heat stress index, and relative humidity are listed in Table 1. Descriptive statistics for the animal temperatures are reported in Table 2. Sheared alpacas tended to have lower core body temperature (39.0°C versus 39.6°C) during the warmer afternoon testing periods than did non-sheared alpacas (P = 0.06). This difference was not apparent during the morning testing periods (P = 0.74). Thermographic studies of the scrotum revealed a tendency towards cooler surface temperatures in sheared versus non-sheared alpacas (P = 0.05 for the PM test period and P = 0.06 for the AM test period). Temperatures in the right medial thigh of sheared animals were 1°C cooler than non-sheared animals in the morning (P < 0.03) and right medial thigh temperatures were 1.6°C cooler in sheared alpacas in the afternoon (P < 0.01). Clinical heat stress was not evident in any animals during the study.

Calculated correlations between environmental variables and body temperatures are shown in Table 3. When data was looked at combining both

1 AGEMA Infrared Systems, Danderyd, Sweden.
2 Agricultural Weather Information Service Inc., Auburn Alabama.
3 Statview, Abacus Concepts, Berkeley, California.
treatment groups there was a significant correlation between rectal temperatures and medial thigh temperatures \((P = 0.05)\). The calculated \(p\) values for the correlations between scrotal temperatures and both rectal and thigh temperatures were all greater that 0.05.

### 4. Discussion

Thermography utilizes the measurement of infrared radiation to measure surface body temperatures. It can also be used as an indicator of the temperature of tissues deep to the skin as well as actual skin
temperature (Coulter et al., 1988). Specifically, testicular thermography has been used clinically to determine the severity and chronicity of testicular lesions (Purohit and Hudson, 1985). Increased scrotal surface temperature and abnormal scrotal surface temperature patterns had been associated with decreased fertility in bulls (Coulter and Lunstra, 1992). Thermography provides an excellent tool for measuring the skin temperature at different points on the body without altering the temperature in any manner. For this study it provided an ideal temperature-monitoring tool.

Published studies in pregnant sheep suggest that shorn ewes gain weight better and produce heavier litter sizes than non-shorn sheep. The non-shorn sheep were also reported to have an increased respiratory rate and a greater variation in respiratory rates (Hofman and Riegle, 1977). Rectal temperature, skin temperature, and respiratory rate was shown to increase with increasing wool length in Barki ewes under shaded conditions in Egypt. This same author also suggested that the presence of available shade may also play a role in the animal’s ability to thermoregulate and that in full sunlight, fleece may provide insulation from radiant heat (Khalil, 1990). Work by Acharya et al. (1995) showed hair length in goats under full sun conditions in the summer had a protective mechanism against heat stress. Hair color in this report had an interaction with coat length. Clipped Hereford cattle were shown to have a lower core body temperature and lower respiratory rates than non-clipped cattle in a study performed under tropical conditions while forcing the animals to continuously walk. During the hottest part of the day the non-clipped animals were removed from the trial due to clinical signs of heat stress (Yeates, 1977).

Shearing of alpacas under the conditions present in the summer of 1997 in the southeastern United States was shown in this study to lower core body temperature. This difference was found only in the afternoon testing periods corresponding to the hottest part of the day. These temperatures were taken after the alpacas had been in a room temperature environment for approximately 0.5 h. Surface body temperatures measured at the scrotum and at the medial thigh followed a similar pattern. There was consistently a greater discrepancy in the surface body temperatures between sheared and non-sheared alpacas during the afternoon hours than during the morning hours. This suggests that the beneficial effects of shearing are greater during more extreme temperatures. It was surprising to the authors that no significant correlations were found between the relative humidity and the surface body temperatures. Although the correlations did not prove to be significant, it was interesting to note that the correlations between humidity and animal temperatures were for the most part in a negative direction. This may be explained by the methodology of the experiment. The half-hour acclimation period in room temperature may be a confounding factor when explaining surface temperatures relative to humidity. Rectal temperatures tended to follow ambient temperatures more consistently in the sheared than in the non-sheared animals in both the morning and the afternoon testing periods. The correlations found between the HSI and ambient temperature compared to the surface temperatures and rectal temperatures indicate that sheared animals respond in a more predictable fashion to changes in the environmental variables studied in this trial. The lack of correlation between scrotal temperatures and environmental variables in the sheared alpacas combined with the significant correlation in the non-sheared alpacas and the decreased scrotal surface temperatures in the sheared alpacas suggest that shearing may have a protective mechanism for scrotal temperature.

Fowler (1998) has described thermoregulation in the llama. The ventral regions of the body, including the inner thigh and the perineal region of the llama are covered by a thinner hair coat than found on the dorsal surfaces of the body. This provides a thermal window for heat dissipation via evaporative cooling through sweating. Shearing of the areas of the llama that have a denser fiber may allow for better airflow in and around this thermal window. Heat dissipation via convection and evaporative cooling mechanisms may also be inhibited in the areas with a denser hair coat if the hair becomes matted, dirty or wet.

5. Conclusions

It was difficult to draw any valid clinically significant conclusions from the correlations between environmental factors and animal temperatures. The mechanisms involved in the differences in body temperature between the treatment groups were not
investigated in this clinical trial. Repeating a similar study in a more controlled environment, i.e. an environmental chamber, could help to answer some of the mechanistic questions. The data reported in this study did however indicate that whole-body shearing of alpacas could have a beneficial effect on thermoregulation when used as a preventative measure against heat stress. Shearing may assist heat dissipation resulting in a cooler surface body temperature and rectal temperature in alpacas when challenged by the heat and humidity experienced in the summer months in the Southeastern United States.

References


