

Productivity and physiological responses of sheep exposed to heat stress

D.B.V. RAMANA*, P.K. PANKAJ, M. NIKHILA, RITA RANI and D. SUDHEER

Central Research Institute for Dryland Agriculture Santoshnagar, Hyderabad-500 059, Andhra Pradesh

*Email: damarla97@gmail.com

ABSTRACT

A study was conducted to evaluate the effects of solar radiation on some physiological parameters (body temperature, respiration rate, pulse rate and panting score), blood metabolites and average daily gain in two breeds of sheep (Deccani and Nellore). The experiment was conducted at Hayathnagar Research Farm of Central Research Institute for Dryland Agriculture (17°27'N latitude and 78°35'E longitude and about 515m above sea level) during May to July months in the year 2012 and involved 18 ram lambs divided into 2 groups with similar age (152±6.1d) and body weight (15.1±0.26kg). The ram lambs were exposed to solar radiation from 0900 to 1500hrs during the study period. Heat load index (HLI) was maximum ($P<0.05$) in May (93.9 ± 0.85) compared to July (88.7 ± 0.37) month. Significantly ($P<0.05$) higher body temperature, pulse and respiration rate, panting score was observed in both the breeds as HLI was highest in May, however impact was more pronounced in Deccani than Nellore breed. Exposure of sheep to heat stress evoked a series of radical changes in the biological functions, which include a decrease in feed intake, efficiency and utilization, disturbances in protein, energy and mineral balances, hormonal and blood metabolite levels. Heat stress severely affected body weight gain and resulted in lower average daily gain in ram lambs and a significant ($P<0.01$) difference was observed among two breeds. The present study confirms breed differences in susceptibility to heat stress as manifested by physiological alterations and subsequent effect on productivity.

Key words : Solar radiation, heat load index, ram lambs, panting score, productivity, blood metabolites

In the developing world, livestock are the key to productivity for many smallholder farmers (Owen *et al.*, 2005) and are often used as indicators of wealth. Sheep constitutes the world's largest livestock sector, second only to cattle. Sheep contribute meat, fiber and other functions that are significant to the productivity, stability and sustenance of farming systems in arid and semiarid areas. One of the major problems the sheep faces in these regions is the heat stress and high ambient temperature that remains above the thermo-neutral zone for 4-5 months in a year. The thermal environment is a major factor that can negatively affect sheep productivity in the tropical belt and arid areas (Silaniková, 2002). Solar radiation in the tropics considerably increases the thermal load on the animal grazing during the day. The physiological responses of livestock to heat stress have been described (Ominski *et al.*, 2002 and Beatty *et al.*, 2006), which include increased body temperature (Bernabucci *et al.*, 2006), increased respiratory rate (Collier *et al.*, 2006), decreased feed intake (West *et al.*, 1999) and increased water consumption (Mader *et al.*, 2006). These responses have detrimental effects on production, reproduction, and health in ruminants. In general, sheep productivity is also affected adversely by extreme climatic conditions (Marai *et al.*, 2007) as it adversely affects the biological functions, which are reflected in the impairment of their production and reproduction traits. This may result in a tremendous economic loss for the sheep farming in the country. The information related to the effect

of heat stress on thermoregulatory system of sheep, more particularly the two important breeds of southern India is very limited. Hence, an attempt was made to study the effect of heat stress on productivity and to gain better understanding of the thermoregulatory system under heat stress conditions in Nellore and Deccani sheep breeds.

MATERIALS AND METHODS

Experimental site

The experiment was conducted for 90 days (May-July, 2012) at the Hayathnagar Research Farm (HRF), Central Research Institute for Dryland Agriculture (17°27'N latitude and 78°35'E longitude and about 515 m above sea level), Hyderabad, in India. The climate is semi-arid with hot summers and mild winters. The mean maximum air temperature during summer (March, April and May) ranges from 35.6 to 38.6°C, whereas in winter (December, January and February) it ranges from 13.5 to 16.8°C. The annual long-term rainfall for the site is 746.2 mm, falling predominantly from June to October.

Experimental animals and feeding

Nine each Deccani and Nellore ram lambs were selected from the herd maintained at Hayathnagar Research Farm, Central Research Institute for Dryland Agriculture. Prior to the study, all the ram lambs were drenched for internal