Evaporative Heat Losses in Different Coloured Brazilian Hair Sheep

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1. INTRODUCTION

In the year 2030, it is estimated that the planet is probably 1°C - 2°C warmer than today and these changes can have a significant impact on livestock production and on food supply to human population. Thermal comfort of animals in tropical regions depends largely on their ability to dissipate excess body heat by evaporative cooling (Silva 2008), being skin surface evaporation the main way for heat dissipation. Heat stress is one of the most important factors that affect sheep production in tropical regions. The searching of locally adapted genotypes is increasing in the last years, in Brazilian semiarid regions, with the aim to develop efficient livestock systems in these areas. The Morada Nova hair sheep is a native breed of Northeastern of Brazil, adapted to the high levels of solar radiation that occurs during all seasons. There are two official varieties, the Red Colored and the White Colored animals, both managed under extensive system conditions, exposed to high temperatures during the wet and the dry seasons. These animals are generally able to maintain satisfactory indexes of reproductive traits, as high fertility and maternal ability, compatible with a high meat production (Facó 2008). The red variety have maintained its census, however, white colored animals have been reducing the female amount over the last year, and now it became a threatened genetic resource. The goal of this study was to evaluate the evaporative heat losses in Red and White varieties of Morada Nova hair sheep, in a semiarid region, during the rainy season.

2. METHODS

The study was performed during the wet season in a semiarid region of Brazil, 40 white colored ewes and 80 red colored Morada Nova ewes were measured under environmental conditions of Morada Nova, Ceará, Brazil (5°06'24" South latitude, 38°22'21" west longitude) . The data were collected in the period from March and April 2014. Rectal temperature (RT, °C), and respiratory rate (RR, breath for minute). The cutaneous evaporation (CE; W/m²) of two body regions (neck and flank) was estimated with a ventilated capsule, at the same time of the other thermoregulatory traits. The device was fixed on body surface in order to obtain the amount of evaporated water. This variable was calculated using the following function:

$CE = X\lambda/AT,$

where CE is the cutaneous evaporation (W/m²); X is the water lost by sweating (g); λ is the latent heat of vaporization of water ($J.g^{-1}$); A is the capsule area (m^2) and T is the time of contact between the capsule and the body surface.

The surface temperature (°C) was measured by infra-red thermometer in the same area where cutaneous evaporation was measured. The time of sample was around 11am and 2pm, the animals were exposed to the sun. The environmental traits registered consisted in wind speed (WS, m/s), air temperature (AT, °C), wet bulb temperature (WBT,°C) and black globe temperature by sun (BGT, °C), utilized to estimate the radiant heat load (RHL, W/m²). The data were initially analyzed by the last-squares method, the model consider the effect the varieties (white and red) and the region of the body analyzed (neck and flank).

3. RESULTS AND DISCUSSION

We did not detect differences in Radiant Heat Load (RHL) between white (Mean RHL = 653.77 W/m^2) and red (Mean RHL = 650.12 W/m^2) varieties environment. However, significant differences were found in environmental relative humidity where red (RH = 89.0%) and white (78.0%) colored ewes were located.

There were differences between red and white coat color to cutaneous evaporation and surface temperature, where the average to red coat surface temperature (40.67°C) was greater than that of white coat (37.40°C), this increase was a result of the more absorbed radiant energy than in white coat. Light coats above pigmented skin have been considered most desirable ones for livestock in tropical areas as dark coated. About the cutaneous evaporation the white coat showed higher than red coat, so the white Morada Nova variety used more the heat loss by cutaneous evaporation in order to maintain the heat equilibrium although that presented less surface temperature than red Morada Nova. According to Silva and Starling *et al.* (2003) cutaneous evaporation is 63% of all evaporation in ovine, although respiratory evaporation was a suitable mechanism of rapid and short – term response to heat stress.

Among the regions that were analyzed, neck and flank, had no difference significant (P>0.01) for surface temperature and cutaneous evaporation (Table 2). Different result was found by McLean 1963. Costa et al., (2013), shows the flank region presented higher cutaneous evaporation than neck, because the flank showed more exposed to solar radiation with surface temperature hotter than neck region and suggest that sweat glands are activated by the direct exposure to solar radiation.

Therefore, red Morada Nova sheep was able to keep homoeothermic regardless of environmental conditions and ensure normal conditions of physiological process.

Table 1. Least-squares means of rectal temperature, respiratory rate, surface temperature and cutaneous evaporation according to variety the Morada Nova sheep

	Variety	
Traits	White	Red
Rectal Temperature (°C)	39.45^{a}±0.07	39.41^{a}±0.07
Respiratory Rate (respiratory per minute)	73.21^{a}±1.1	73.75^{a}±0.97
Surface Temperature (°C)	37.40^{b}±0.11	40.67^{a}±0.09
Cutaneous Evaporation ($W.m^{-1}$)	312.42^{a}±1.15	255.96^{b}±1.05

Means the same superscript do not differ statistically P>0.05

Table 2. Least-squares means of coat surface temperature and cutaneous evaporation in different body region (neck and flank) according to variety the Morada Nova sheep

		Variety	
Traits	Body region	white	Red
Surface Temperature(°C)	Neck	36.60^{b}±1.15	39.42^{a}±1.40
	Flank	37.65^{b}±1.65	41.94^{a}±1.80
Cutaneous Evaporation($W.m^{-1}$)	Neck	313.18^{a}±0.09	254.72^{b}±0.09
	Flank	311.67^{a}±0.07	258.16^{b}±0.08

Means the same superscript do not differ statistically P>0.05

4. CONCLUSION

We conclude that White Morada Nova used CE as a main way of heat loss and maintain homeothermic conditions.The red Morada Nova variety keep satisfactory performance under semiarid extensive systems.

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