

Chronic heat stress can negatively impact sheep physiology and growth performance

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The sheep meat and wool industries contribute considerably to the rural Australian economy and many sheep farms are in semi-arid environments. Sheep are affected by heat stress (HS) through; activation of the hypothalamo-adrenal axis (Indu *et al.* 2014), decreased feed intake (Chauhan *et al.* 2016), and compromised metabolic (Marai *et al.* 2007) and oxidative status (Chauhan *et al.* 2014). However, the duration of heat events that can trigger stress responses and thus compromise animal welfare, are unknown. The present study investigated the impact of chronic heat stress (HS) on sheep welfare and growth rates in climatic chambers.

Twenty-four Merino sheep were acclimatised to indoor housing and feeding for two weeks followed by relocation to climate-controlled chambers and individual housing in metabolic cages. Twelve sheep were maintained under thermoneutral conditions (TN: Temperature - 21-23°C and relative humidity (RH) = 40 - 50 %) and 12 sheep were exposed to cyclic HS (Temp- 28-40 C and RH = 30-40 %) for 4 weeks as two replicates. In the HS room, the temperatures were increased to 38°- 40°C between 0800 and 1700 h daily and maintained at 28°C for the rest of the time. Physiological variables (respiration rate (RR) and rectal temperature (RT)) were recorded manually three times daily at 0800, 1200, and 1600h. Both feed and water were provided *ad libitum* and intake measured daily. Liveweights were measured weekly and further growth rates were calculated. The data were analyzed using the REML variance component analysis procedure for Genstat (GenStat 16th Edition; VSN International Ltd., Hemel Hempstead, UK). Fixed model effects were temperature (HS vs TN), and time (hour, day or week depending on the parameter) and the random effects were lamb ID and replication.

Sheep exposed to HS exhibited an immediate increase (within 4 h) in RR (56 vs 172 breaths/min, $P < 0.01$) and RT (38.9 vs 40.2 °C $P < 0.01$). However, average values of both RR and RT decreased ($P < 0.01$) in heat stressed sheep after 7 days of HS before increasing again ($P < 0.05$) towards the 4th week. There was linear increase ($P < 0.01$) in the baseline temperature every week such that normal resting body temperature in sheep at 0800 am on day 1 was increased from 38.9 to 39.6 °C on day 21 of HS, indicating an accumulation of heat load on sheep after chronic heat exposure. The differences in average RR and RT between TN and HS sheep are depicted in Figure 1.

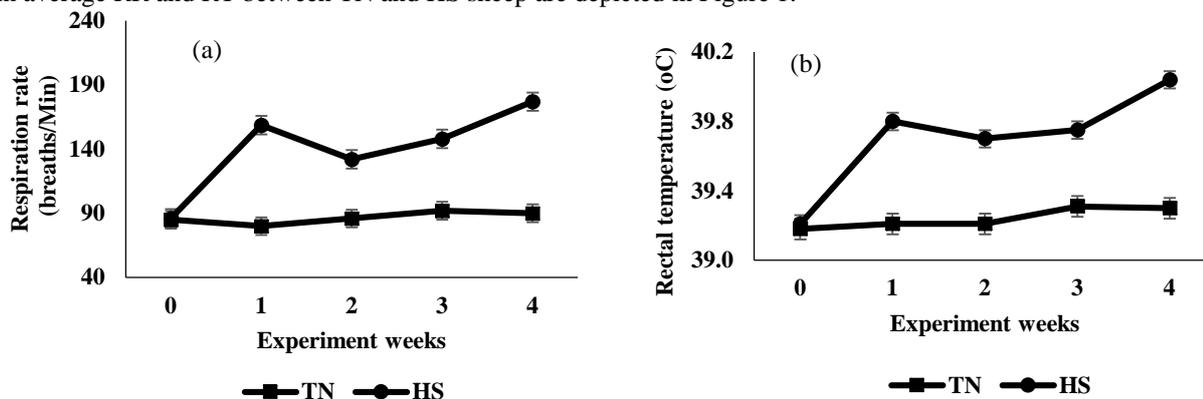


Figure 1. Mean± (s.e.d) (a) respiration rate and (b) rectal temperature subjected to either TN or HS conditions (n=12/treatment).

Feed intake reduced by 14% (1.6 vs 1.3 kg/day, $P < 0.001$) and water intake increased by 33% (4.7 vs 6.3 L/day, $P < 0.001$) after four weeks of HS in sheep. Sheep growth rates also reduced by 40% within a week, which further declined to 80%, 100% in week three and four, respectively. Sheep started losing body weight after 21 days of HS.

This study has provided further insights regarding the adaptability of Merino sheep subjected to chronic HS. The significantly lower RR and RT in the heat stressed group during 2nd week as compared to 1st week gives an indication of better acclimatisation ability of Merino sheep to heat waves extending over a week. However, an increasing trend towards the fourth week suggest their decrease in ability to dissipate accumulated heat during exposure to chronic and continuous period of HS. Further, HS significantly reduced feed intake and growth rates in Merino sheep indicating that production potential is compromised during prolonged HS exposure while trying to adapt to the harsh climatic condition.

References

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