The effects of heat stress on sheep welfare during live export voyages from Australia to the Middle East

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Introduction

Australia, the second largest sheep population in the world, has one of the biggest live exports of sheep worldwide, approximately one to two million sheep annually, 98% of which go to the Middle East (DAFF, 2019) In 2018, of the 973,651 head of live sheep that were loaded 5 982 head died, or 0.61 % (DAFF, 2019)-Heat stress is a major cause of sheep mortality during live export (Caulfield et al., 2014), particularly in long distance travel between Australia and the Middle East when the shipment leaves Australia in the southern hemisphere winter-We analysed heat stress related data from fourteen ship voyages from Australia to Middle East, with the objective of determining more accurately critical thresholds for reduced welfare as a result of high temperatures, thereby facilitating improved control of the heat stress risk.

Results

Mortality increased mainly between 14 to 23 day and in July and August, with mean values of 0.14 % (+ 0.25 SD) and 0.070 % (+0.17 SD), respectively, compared with all other months (Figure 1.). The increase in mortality in the month of July was associated with a high heat stress score and the deck wet bulb temperature , and this occurred between day 15 and 20 of the voyage (Figure 2. and 3.).

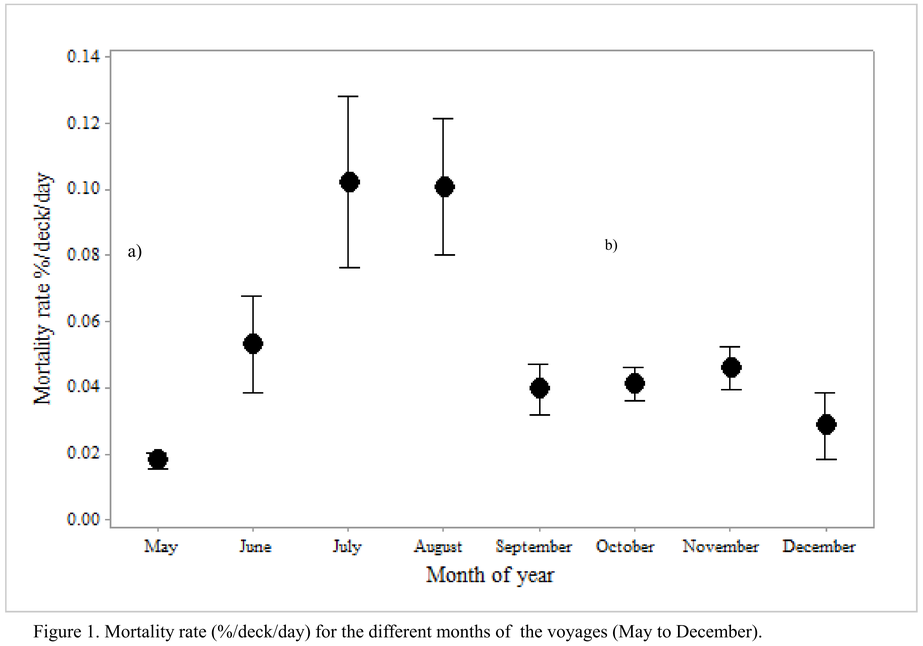

Figure 1. Mortality rate (%/deck/day) for the different months of the voyages (May to December).

Methods

Records of data obtained from 14 livestock voyages were provided by the Australian government, Department of Agriculture and Water Resources. The mean number of sheep/voyage was 46,501 (SD 25461), with a range of 4,466 to 77,988 head. These voyages took place between 2016 and 2018 from the ports of Fremantle and Adelaide in Australia, to the ports of Kuwait, Eilat, Aqaba, Doha, Muscat and Dubai in the Persian Gulf and Red Sea-Sheep mortalities on each deck and vessel cumulative mortalities were recorded by the ship veterinarian and reported to the captain daily. Daily wet bulb temperature (T_{WB} °C), dry bulb temperature (T_{DB}°C), and relative humidity (RH, in %) were measured on individual decks –Statistical analysis was performed using Minitab 18.0 (Minitab Version 18; Minitab Inc., State College PA, USA). A General Linear Model (GLM) with stepwise regression used to determine which environmental variables and relevant interactions.

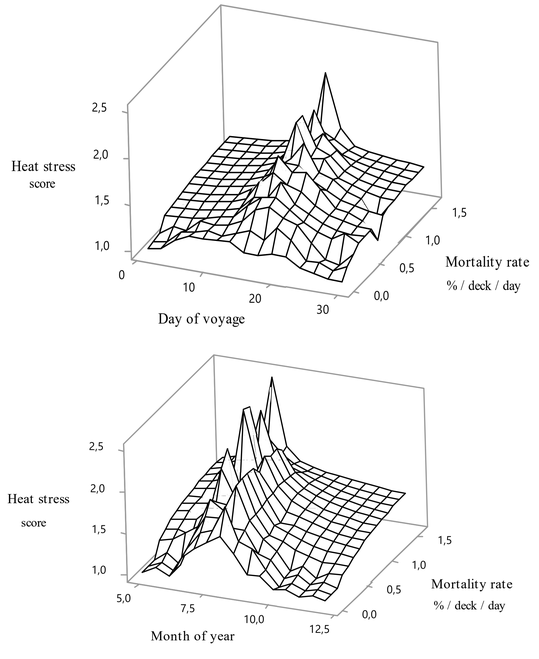

Figure 2. Relationships between heat stress score (1 = normal, 2 = moderate and 3 = severe), mortality and both month (a) and day (b) of the voyage.

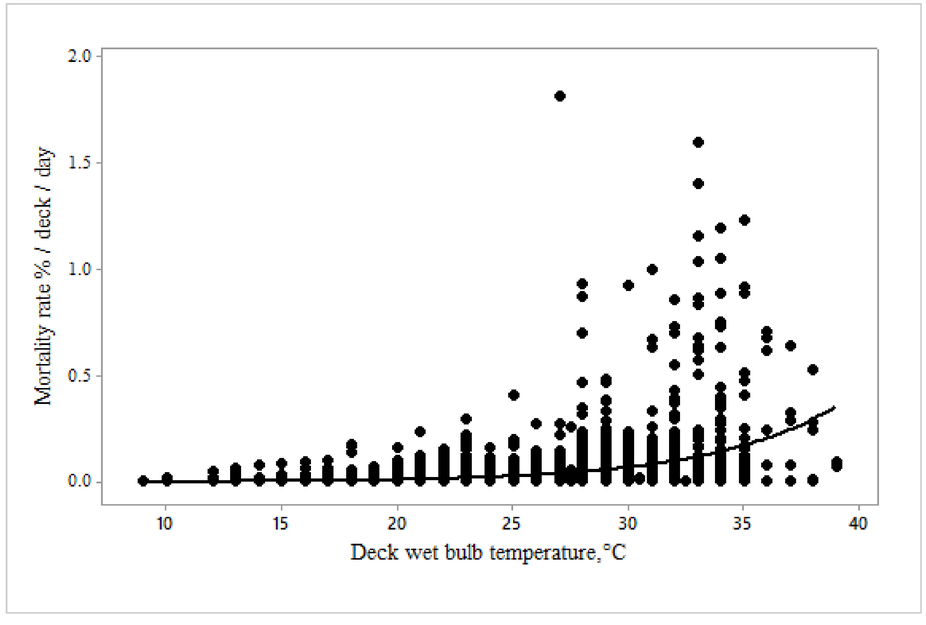

Figure 3.Mortality rate changes in deck wet bulb temperature °C. The relationship between mortality rate %/day and deck TWB was described by the equation: Mortality rate %/deck/day= 0.0003(+0.000009) * exp 0.18(+0.0095) Deck TWB, F=8.85, P<0.0001

Conclusion

The study shows, that absolutely, mortality is higher in the winter seasons of the southern hemisphere, this should suggest a change and an increase in travel during autumn period that shows a lower mortality rate.

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