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Effects of cold conditions on the oxygen consumption of shorn goats

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ABSTRACT

Four pairs of shorn Cashmere-type goats, fed at 1.5 x maintenance, were exposed to air temperatures between 5° and 27°C, either with or without a wind. Oxygen consumption was measured during each 24-hour exposure to each set of conditions.

For three pairs of goats, oxygen consumption at 5° to 7°C was 40 to 50% higher than at 27°C. The corresponding increase was only 25% in the fourth pair.

For three pairs of goats, exposure to wind caused an increase of 19% in oxygen consumption at 10°C. The corresponding increase was only 9% in the fourth pair.

Estimated values for lower critical temperature (with no wind) were between 15° and 20°C for three pairs of goats and between 11° and 15°C for the fourth pair.

Exposure to wind increased these values for lower critical temperature by 3° to 5°C.

Keywords Shorn goats; cold; wind; oxygen consumption; critical temperature

INTRODUCTION

The number of goats farmed for fibre production has increased rapidly from 30 000 in 1982 to the present estimate of 1 million (Familton, 1988). Associated with these developments, there have been reports of high mortality rates in goats after shearing in late winter or early spring: for example, Buddle *et al.* (1987) examined 70 goat flocks and found that hypothermia was responsible for 39 of the 322 deaths studied.

The present paper presents some initial results from an ongoing study of the effects of cold conditions on shorn goats, a subject about which there appears to be no published data.

MATERIALS AND METHODS

Eight two-year old Cashmere-type female goats were used, with individual live weights ranging from 14 kg to 22 kg. They were provided from the flock maintained at DSIR's hill country research station Ballantrae, near Woodville.

During the measurements they were fed on chopped lucerne hay (20% crude protein and 9.5 MJME/kg DM) at a level calculated to provide 1.25 times the metabolisable energy required for maintenance (see Holmes and Moore, 1981).

The goats were shorn before being moved into the open-circuit calorimeter chambers used for the measurement of oxygen consumption (Holmes and McLean, 1974). Post shearing fleece depths (mid-side) were 4, 5, 4, and 8 mm for pairs 1 to 4 respectively. Two goats were housed in each chamber during the measurements,
and each measurement period was of 24 hours duration.

The first series of measurements was made with no wind (0.7 km/hr) at nominal air temperatures of 5°, 10°, 16°, 22° and 27°C. Oxygen consumption was measured on two days at each temperature except for 27°C, with 6 to 8 measurement days.

In the second series, a fan was used to increase the wind speed to 6 km/hr and measurements were made at 10° and 15°C, either with or without increased wind speed. Oxygen consumption was measured on 2 days at each combination of temperature and wind speed.

RESULTS AND DISCUSSION

Values for oxygen consumption measured in the

first series at 0.7 km/hr and expressed as litres O_2 per $kg^{0.75}$ daily, are shown in Figure 1 for the four pairs of goats. In all cases, oxygen consumption was increased by exposure to the lowest air temperature (5° to 7°C) when compared with 27°C. These increases were 40 to 50% in Pairs 1, 2 and 3, but only 25% in Pair 4.

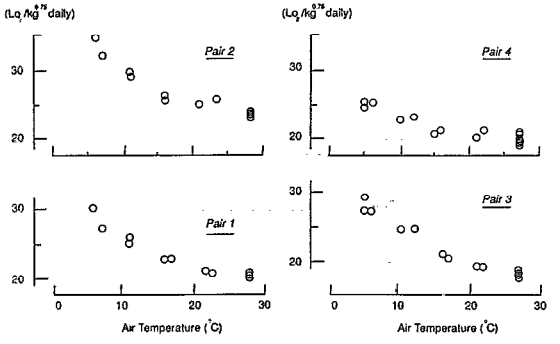

FIG. 1 Individual values for daily oxygen consumption of the four pairs of goats at each air temperature (wind speed 0.7 km/hr; each point represents one 24 hour measurement).

Examination of the values for oxygen consumption indicates that the values for lower critical temperature (TCL; the lowest temperature to which the animal can be exposed without being forced to increase its oxygen consumption) range from about 15° to 22°C in Pairs 1, 2 and 3. Pair 4 showed no differences in oxygen consumption between 15°, 22° and 27°C, indicating that TCL was between 11° and 15°C for this pair of goats. The greater resistance to cold conditions exhibited by Pair 4 was probably related to the deeper post-shearing fleeces remaining on these goats, with one animal having a particularly dense stubble compared with the other seven goats.

Measurements in the second series showed that exposure to a wind of 6 km/hr caused mean increases in oxygen consumption of 18 to 20% at 10°C and 15°C for Pairs 1, 2 and 3. The corresponding increases for Pair 4 were only 7 to 10%. From these it could be calculated that exposure to 6 km/hr wind caused increases in TCL of between 3 to 5° in these goats.

The effects of lower temperature and of increased wind speed are similar to those recorded in sheep (e.g. Alexander, 1974). However, the absolute values for TCL estimated in the present study (15° to 20°C with no wind) are lower than the corresponding values for shorn sheep at a maintenance level of feeding (25°C with no wind, Graham *et al.*, 1959).

It must be noted that in the present study goats were kept in pairs, whereas all of the studies with sheep have used animals kept individually. TCL would have been reduced by the huddling together of the goats in the colder conditions in the same way as has been reported for pigs (Holmes and Close, 1977).

Two measurements made at 16°C after a 4-hour period of artificial rain (from a water sprinkler inside each calorimeter), showed large increases in oxygen consumption in two goats (+ 90%).

These preliminary data show that during winter and early spring, climatic conditions will frequently be sufficiently cold (combinations of low air temperatures, wind or rain) to cause large increases in heat production by shorn goats. The measurements must be extended to include Mohair-type goats, goats fed on higher levels and goats shorn by different techniques.

ACKNOWLEDGEMENTS

The authors thank CAPRONZ and MOPANZ for financial assistance with this project.

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