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Drinking Behaviour and Water Intake of Boer Goats and German Blackhead Mutton Sheep

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Introduction

Measurement of total body water in mammals by administration of deuterium water (D_2O) provides a convenient method for determining total body water and water intake in both laboratory and free living animals. This technique does not require killing of animals for estimating total body water (TBW), and allows animals to range freely within their normal habitat after initial capture and labeling with the isotope.

Materials and Methods

- 16 non-lactating females (8 German black head mutton ewes and 8 Boer goats)
- Animal were housed under controlled stable conditions (room temperature: 13.6 ± 0.4 ºC; light schedule: 10 h dark: 14 h light)
- Animals had access to hay (Ryegrass) and water *ad libitum*
- Individual food and water intake was directly measured by re-weighing buckets every 24 hour
- Deuterium oxide (D_2O) was administered at 0.3 g/kg body weight to estimate daily water turnover (Holleman, et al., 1982; Atti, 2000)
- Drinking behaviour was observed by using a time-lapse video recording system for 24 hours

Results and Discussion

Measured daily water intake differed significantly ($p = 0.01$) between the two species with higher amounts in sheep (4.7± 0.9 L) than in goats (2.3 ± 0.4 L). These significant differences were maintained when relating water intake to metabolic body weight in sheep (2.9 ± 0.5 L / kg $BW^{0.75}$) and goats (1.6 ± 0.3 L / kg $BW^{0.75}$), respectively (Fig. 1).

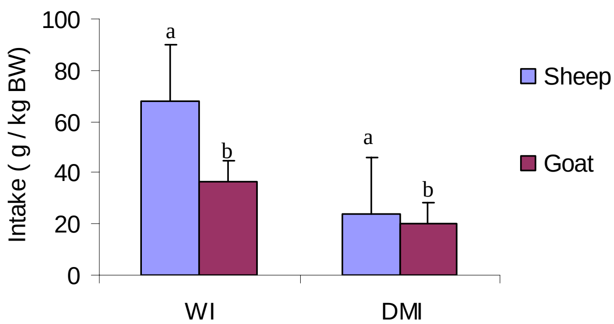

Figure 1. Average water intake (WI) and dry matter intake (DMI) in sheep and goats.

Water intake / DMI ratio in Boer goats (1.3 ± 0.3) was similar to those in desert goat breeds suggesting that Boar goats have a slower water turnover. This can be an adaptive mechanism of Boer goats which are adapted to arid habitats compared to German black head mutton sheep originating from temperate climates.

Total body water content estimated by D_2O dilution ranged between 58 to 61 % of body weight in sheep and goat, respectively (Table 1).

Table 1. Average water intake per day estimated by using the D_2O technique and measured by re-weighing buckets every 24 h in sheep and goat.

Species	Sheep	Goat
Total body water (% of BW)	58.3 ± 3.1	60.9 ±2.3
Metabolic water (g / kg BW)	10.9 ±1.3	9.3± 2.0
Performed water (g / kg BW)	4.0 ± 0.5	3.4 ± 0.7
Water drunk (g / kg BW)	68.0 ± 10.1[a]	36.7 ±6.5[b]
Measured TWI (g / kg BW)	82.9 ±11.6[a]	49.4 ±9.0[b]
Estimated TWI by D_2O (g / kg BW)	76.2 ± 7.3[a]	50.6 ±6.6[b]
Estimated TWI / Measured TWI	92.6 ± 4.9	103.7±7.7

TWI = (Metabolic water + Performed water + water drunk), preformed water from moisture content of hay (14.3%), $P<0.05$.

Total water intake estimated by D_2O dilution was 92.6 and 103.7 % of actual intake in sheep and goat, respectively (Table 1). This shows that the dilution technique could be a viable method to estimate water consumption in free ranging ruminants, e.g. in Bedouin goats and Awassi sheep production systems, where water availability is a crucial factor influencing the productivity.

The higher amount of water intake in sheep was also reflected by the drinking behaviour: Black head mutton sheep spent approximately 0.3 % per 24 h (3.8 ± 2.4 min / day) drinking, while Boer goats spent only 0.1% (1.2 ± 1.0 min / day).

Conclusion

The D_2O method gave accurate estimates of water intake in sheep and goat. Application of D_2O in studies of animal production systems seems to be a useful technique for understanding the reactions of domestic animal to their environment under natural conditions. It is suggested that the lower water intake in Boer goats seems to be an adaptive mechanism to arid climates.