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‡DEPARTMENT OF ANIMAL SCIENCES AND AQUATIC ECOLOGY - LABORATORY FOR ANIMAL NUTRITION AND ANIMAL PRODUCT QUALITY

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TIBETAN SHEEP ARE BETTER ABLE TO COPE WITH LOW ENERGY INTAKE THAN SMALL-TAILED HAN SHEEP DUE TO LOWER MAINTENANCE ENERGY REQUIREMENTS AND HIGHER NUTRIENT DIGESTIBILITIES

INTRODUCTION

Tibetan sheep (Fig.1) are indigenous to the Qinghai Tibetan Plateau (QTP) and are well-adapted to and even thrive under the harsh alpine conditions. Moreover, they play a vital role in the livelihoods of Tibetan pastoralists and in the QTP ecosystem. Small-tailed Han sheep (Fig.2) were introduced to the plateau because of their high prolificacy and are maintained mainly in feedlots. However, under traditional management, Tibetan sheep graze on rangeland all year round and are largely dependent on the native grassland to survive, suffer the seasonal nutritional stress, especially during the long cold season (Fig. 3 and 4). As a result, their energy intake is at a low level for long periods of the year. Because of their different background, we hypothesised that Tibetan and Small-tailed Han sheep differ in their utilization of energy intake and predicted that Tibetan sheep cope better with low energy intake than Small-tailed Han sheep.

Fig. 1 Tibetan sheep

Fig.2 Small-tailed Han sheep

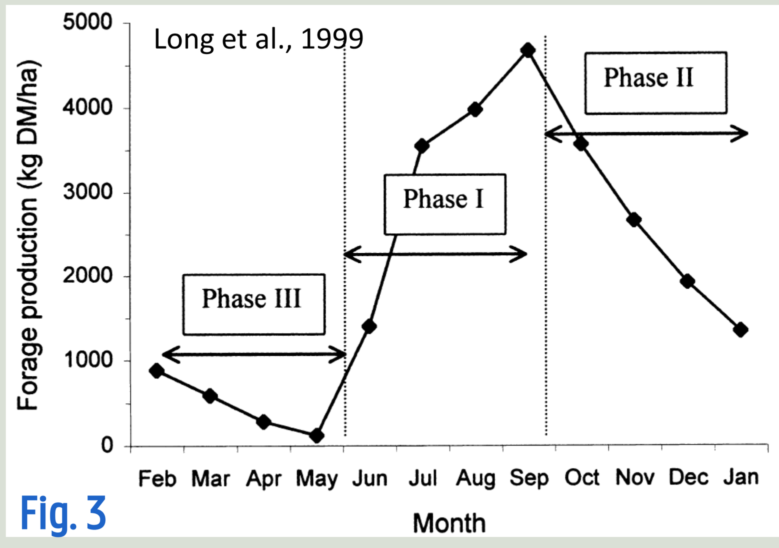


Fig. 3 Biomass of nature grass in Qinghai-Tibet Plateau

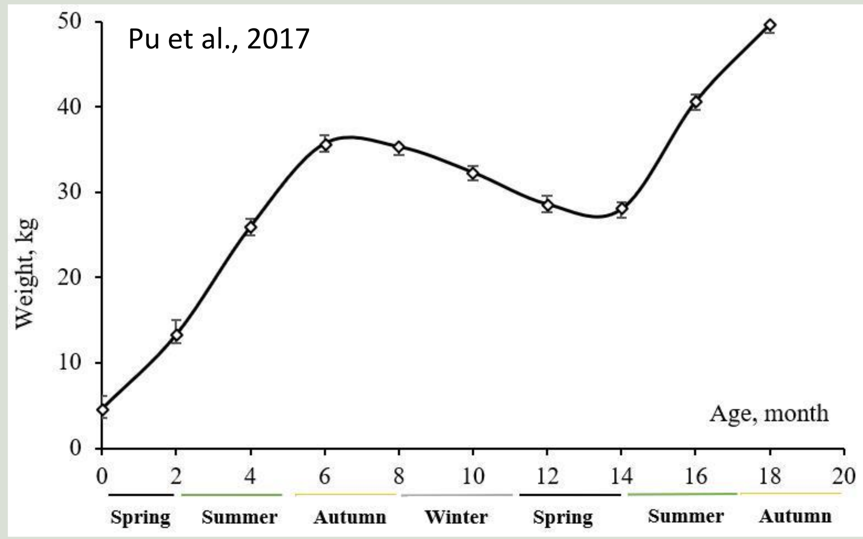


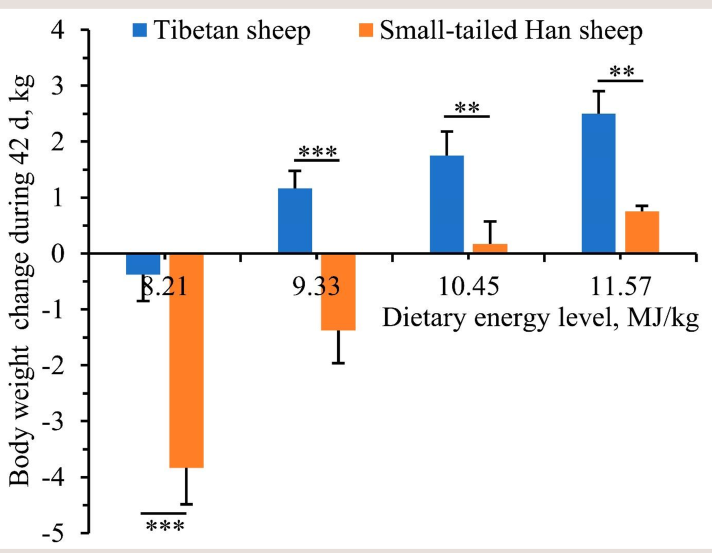
Fig.4 BW change of grazing Tibetan sheep

MATERIALS AND METHODS

Sheep of each breed (n = 24 of each, all wethers and 1.5 years of age, Tibetan sheep BW = 48.5±1.89 kg, Small-tailed Han sheep BW = 49.2±2.21 kg) were distributed randomly into one of four groups and offered ad libitum diets varying in digestible energy (DE) densities: 8.21, 9.33, 10.45 and 11.57 MJ DE/kg Dry matter (DM). Following 42 d of measuring feed intake, a 1-week digestion and metabolism experiment was done. The nutrient digestibilities, energy requirements for maintenance as well as blood concentrations of metabolites and hormones involved in energy metabolism were determined.

RESULTS

Fig. 5 BW change during 42 d experiment.

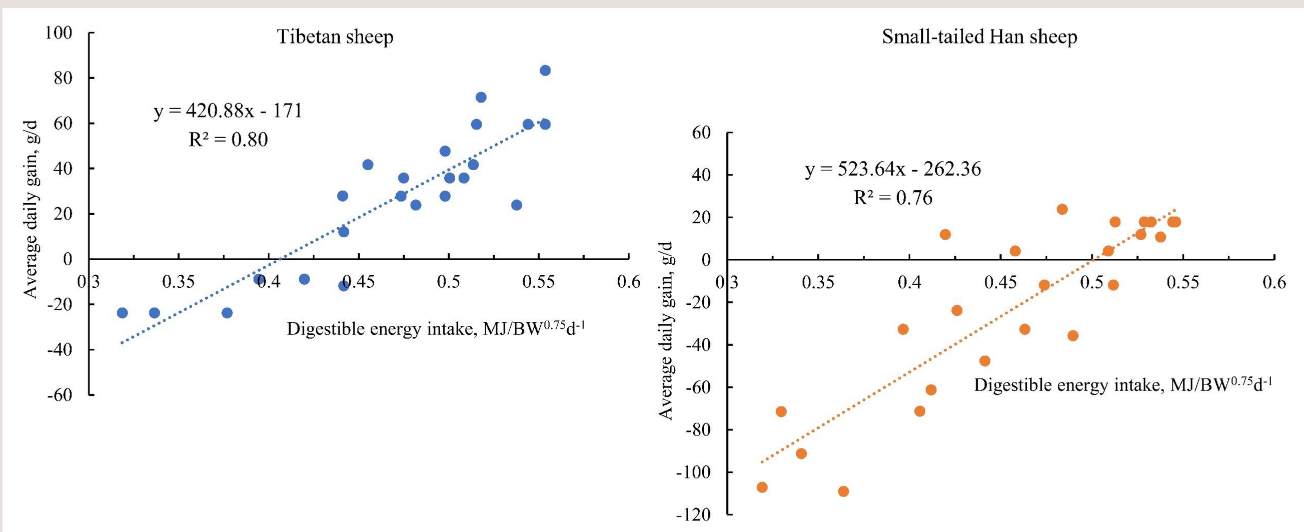


Items	*F*
breed	< 0.001
lin diet E	< 0.001
quad diet E	0.003
cubic diet E	0.582
lin diet E*breed	0.003
quad diet E*breed	0.208
cubic diet E*breed	0.527

** Means $P < 0.01$, *** Means $P < 0.001$.

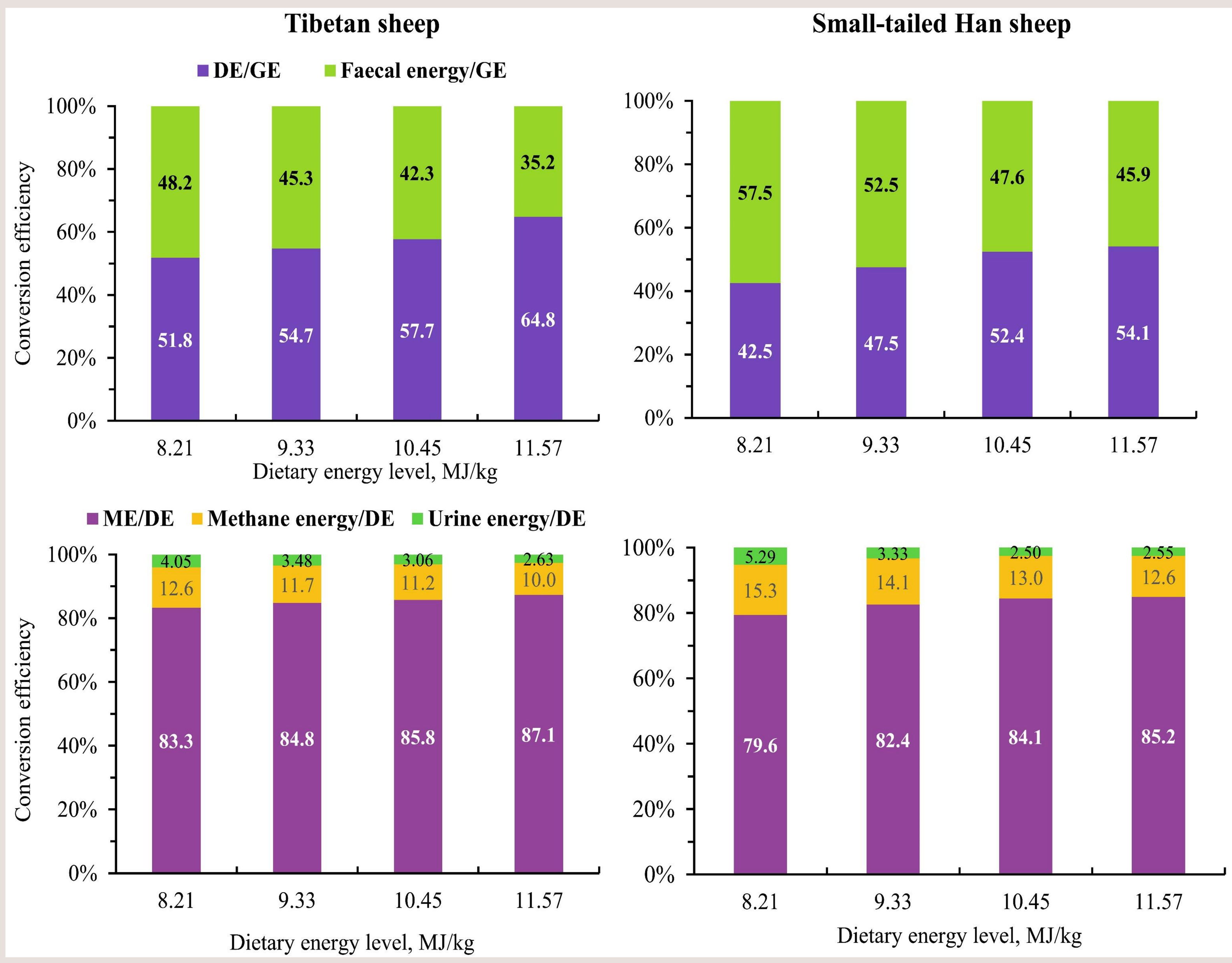
There was no differences between breeds or among diets in daily DM and CP intake.

Fig. 6 Linear relationship between digestible energy intake (DEI) and ADG



Tibetan sheep required 0.41 MJ DE/BW$^{0.75}$ per day for maintenance, which was significantly less than the 0.50 MJ DE/BW$^{0.75}$ per day required by Small-tailed Han sheep.

Fig. 7 Energy conversion efficiency



Enteric methane energy emission (MEE) was calculated following Patra et al. (2016)

Table 1 Apparent digestibilities

Items[1]	Breed	Dietary energy level, MJ/kg				SEM	*P*-value[2]			
		8.21	9.33	10.45	11.57		Breed	E-L	E-Q	E-C
DM	T	0.49	0.54	0.57	0.64	0.013	< 0.01	< 0.001	0.820	0.985
	H	0.45	0.50	0.56	0.59			0.558[x]	0.222 [x]	0.438 [x]
OM	T	0.53	0.58	0.60	0.67	0.012	< 0.01	< 0.001	0.526	0.136
	H	0.49	0.54	0.57	0.59			0.119 [x]	0.246 [x]	0.376 [x]
CP	T	0.39	0.41	0.43	0.47	0.011	< 0.001	< 0.001	0.151	0.695
	H	0.34	0.35	0.37	0.39			0.105 [x]	0.580 [x]	0.584 [x]
NDF	T	0.50[a]	0.47[a]	0.44[a]	0.47[a]	0.020	< 0.001	< 0.001	0.509	0.689
	H	0.41[b]	0.37[b]	0.34[b]	0.28[b]			0.018 [x]	0.177 [x]	0.406 [x]
ADF	T	0.48	0.47	0.41	0.44	0.019	< 0.001	< 0.001	0.180	0.943
	H	0.45	0.38	0.37	0.33			0.084 [x]	0.730 [x]	0.057 [x]
Ash	T	0.24	0.31[a]	0.23	0.36[a]	0.019	0.001	< 0.001	0.555	0.0403
	H	0.20	0.22[b]	0.27	0.25[b]			0.537 [x]	0.142 [x]	< 0.001 [x]

[2] E-L=Linear effect of dietary energy level; E-Q=Quadratic effect of dietary energy level; E-C=Cubic effect of dietary energy level. [x] P-value for interaction of dietary energy level × breed..

CONCLUSION

ADG and nutrient apparent digestibilities were higher and energy requirements for maintenance lower in Tibetan sheep compared with Small-tailed Han sheep. From these breed differences, we concluded that Tibetan sheep can cope better with low energy diets than Small-tailed Han sheep.

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