Dual energy x-ray absorptiometry predicts whole body and carcass composition in sheep

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Dual energy X-ray absorptiometry (DXA) has been used increasingly for measuring body composition in humans (1) and has shown considerable potential for predicting fat and lean in domestic animals such as the pig (2). The aim of this study was to examine the potential of DXA for predicting whole body and carcass composition in sheep.

Twenty eight sheep (15 second cross lambs, 17-50 kg liveweight and 13 mature ewes, 44-71 kg liveweight) were fed a maintenance diet with access to water for 3 days before being shorn, anaesthetised and then scanned on day 4. On day 5, all sheep were slaughtered commercially and all body components, including gastrointestinal tract contents, weighed and stored. On day 6, the chilled carcass was scanned. All non-carcass and carcass tissues and gut contents were chemically analysed for fat, moisture and ash. Chemically determined values (including composition of gut contents) were then compared to DXA measurements of lean, fat and bone mineral (BM) using regression equations based on y = ax + b.

	Component	Regression equation	r	R^2
Whole body:	Fat (kg)	Chemical fat = 1.08DXA – 0.42	0.99	98.5
	Lean (kg)	Chemical lean = 1.00DXA lean + 0.46	0.99	98.4
	BM (kg)	Chemical ash = 1.05DXA BM + 0.29	0.99	97.4
Carcass:	Fat (kg)	Chemical fat = 0.97DXA fat - 0.42	0.99	98.2
	Lean (kg)	Chemical lean = 1.36DXA lean - 2.02	0.99	97.6
	BM (kg)	Chemical ash = 0.89DXA BM + 0.21	0.99	91.7

The DXA measurements of fat, lean and BM were highly correlated ($P<0.001$) with chemically determined fat, lean and ash for both the whole body and carcass. When gut contents were excluded from the chemical measurements there was still a very high correlation with DXA for whole body predictions (R^2 for fat and lean were 98.5 and 96.1, respectively). For whole body, DXA overestimated chemical fat and ash whereas lean was quantitatively estimated by DXA. In contrast, for the carcass, DXA underestimated chemical fat and overestimated both chemical lean, particularly at heavier weights, and ash content. Differences between ash and BM measurements could be explained by the inorganic content of soft tissue, which is not included in the DXA BM measurement. Further work is required to examine the influence of wool and animal orientation during scanning on DXA predictions. These data clearly demonstrate the potential of DXA to measure composition of the live animal and carcass of the sheep.

1. Pritchard JE, Nowson CA, Struass BJ, Carlson JS, Kaymakci B, Wark JD. Evaluation of dual energy x-ray absorptiometry as a method of measurement of body fat. Eur J Clin Nutr 1993;47:216-28.
2. Mitchell AD, Conway JM, Potts, WJE. Body composition analysis of pigs by dual-energy x-ray absorptiometry. J Anim Sci 1996;74:2663-671.