Microwave technology is a potential tool for the genetic selection of carcase composition in lamb

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Selection for the breeding objective trait of lean meat yield percentage in lamb is currently achieved using correlated live animal measures (e.g. weights and ultrasound scans) and carcase measures (hot carcase weight, C-site fat depth and GR tissue depth) (Mortimer et al. 2017). The collection of the carcase composition traits is currently a labour intensive and expensive process. Microwave technology is being investigated as an alternative tool to measure the carcase traits more easily in a commercial processing environment (Marimuthu et al. 2020). This study explores the potential to select for carcase composition using microwave predictions of C-site fat depth.

Microwave predictions for carcase C-site fat depth were derived using a Partial Least Square regression model, trained on C-site fat depth of 107 commercial lambs (ranging from 0.63 to 8.33 cm). This algorithm was used to predict C-site fat for 676 lambs from the 2017 drop of the Meat and Livestock Australia Resource Flock.

To understand the relationships between microwave-predicted C-site fat depth, abattoir-measured C-site fat depth (using callipers), GR-tissue depth and hot standard carcase weight, these traits were analysed simultaneously using a multivariate animal model. Significant fixed effects included contemporary group (defined by sex & kill group), dam breed, sire breed and age at measurement. Hot carcase weight was also included as a fixed effect for the fat and tissue depth traits. A random additive genetic effect was estimated using a pedigree, with 141 sires represented by an average of 5 progeny per sire.

The heritability estimate for microwave-predicted C-site fat was 0.58 ± 0.14 (± SE), demonstrating proportionally more genetic variation than abattoir-measured C-site fat (h^2 = 0.31 ± 0.13). However, the phenotypic variation for microwave-predicted C-site fat (1.55 ± 0.10) was lower than abattoir measured C-site fat (7.72 ± 1.29). This reflects the smaller range in microwave-predicted C-site fat (0.43 to 9.32 cm) compared to abattoir measured C-site fat (1 to 13 cm). Therefore the ability to distinguish between animals was lower using microwave technology.

The phenotypic correlations between microwave-predicted C-site fat depth and abattoir measured C-site fat depth, GR-tissue depth and hot standard carcase weight were moderately strong and positive (Table 1). Genetic correlations for these same comparisons were also positive but stronger. This suggests that selection for reduced C-site fat depth using microwave technology will influence carcase fat depth at this site, as well as GR-tissue depth and hot standard carcase weight.

Table 1. Phenotypic (above diagonal) and genetic (below diagonal) correlations between carcase traits

	C-site fat	Microwave-predicted C-site fat	GR-tissue depth	Hot carcase weight
C-site fat		0.43 ± 0.05	0.43 ± 0.05	0.23 ± 0.07
Microwave-predicted C-site fat	0.85 ± 0.11		0.56 ± 0.03	0.33 ± 0.07
GR-tissue depth	0.98 ± 0.07	0.89 ± 0.08		0.50 ± 0.10
Hot carcase weight	0.65 ± 0.19	0.66 ± 0.18	0.78 ± 0.13	

There is potential to better capture phenotypic variance by training microwave predictions on carcases with a wider range of C-site fat. Lean meat yield data are also required to better understand how microwave-predicted C-site fat can contribute to the breeding objective. Nevertheless, this preliminary study suggests that there is potential to select for carcase composition using microwave technology, which is less labour intensive and easier to use than current measurement techniques. Further analyses are also required to estimate the genetic correlation between microwave-predicted fatness and eating quality traits due to the unfavourable relationship between carcase composition and eating quality traits (Swan et al. 2015).

References

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The Advanced Livestock Measurement Technologies project is supported by funding from the Australian Government Department of Agriculture, Water and the Environment as part of its Rural R&D for Profit programme, in partnership with Research and Development Corporations, commercial companies, state departments and universities.