# Prediction of eating quality of lamb loin using Raman Spectroscopic technologies

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The eating quality of meat products is defined by a complex set of biophysical and biochemical interactions during processing and cooking which combine to create the flavour, juiciness and tenderness experienced by the consumer. Lambs within Australia are currently traded based on carcase weight and fat score, which is indicative of yield but not eating quality. Furthermore, the carcase grading system currently used for beef carcases is not suited to the assessment of lamb as carcases are not split prior to boning out. Thus, the lamb supply chain requires a rapid non-destructive method for carcase assessment which can be performed on entire carcases prior to further processing. Therefore, a preliminary investigation was undertaken to assess the potential of a hand-held Raman device to predict the eating quality of lamb loins.

The loins of 48 lambs were collected at 24 hours post-mortem and scanned with a Mira® hand-held Raman device in 3 positions perpendicular to the muscle fibres using an integration time of 3s and 5 repetitions. Loins were then sub-sectioned into 5 slices per loin and frozen prior to analysis by untrained consumers. Sensory analysis was completed using 60 untrained consumers in 3 panels as described by De Brito et al. (2016). Spectra and sensory scores for tenderness, juiciness, flavour and overall liking were averaged per carcase prior to analysis by partial least squares regression analysis.

Models demonstrated a high correlation between the predicted and measured tenderness scores ($R^2$ =0.99, RMSEP = 11.1, comp = 7) and a moderate correlation for the prediction of flavour ($R^2$ =0.78, RMSEP = 8.2, comp = 5). However, there was no correlation between predicted and measured juiciness and overall liking scores. Examining the PLS loadings of these models highlighted that variation in overall intensity as well as spectral signals at 413, 527, 639, 689, 992, 1345 and 1540cm$^{-1}$ contributed to the prediction tenderness (Fig 1).

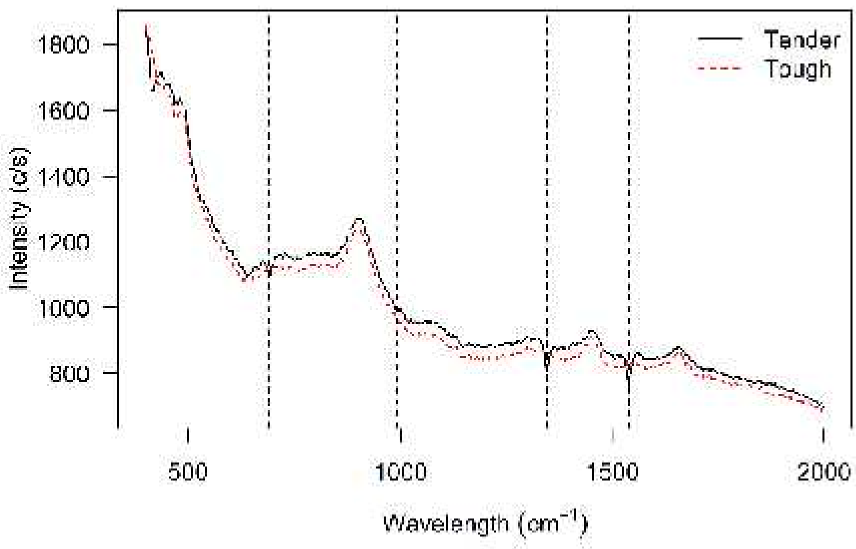


**Figure 1. Plot of the first two principle components for the prediction of sensory tenderness.**

Previous research conducted on the prediction of eating quality of beef using Raman spectroscopy has suggested these peaks characterise the myofibrillar structure and hydrophobicity of proteins (Fowler et al., 2018). These differences suggest loins which were scored as more tender by consumers had a greater ability to lose water in the myofibril when chewed, therefore enhancing the feel of tenderness and flavour during consumption. However, spectra collected from meat samples are complex and poorly understood.

Although this study demonstrated a strong correlation between predicted and measured tenderness and flavour sensory scores, the low numbers measured in this study limits application of the findings. Consequently, further research is required to determine how robust and repeatable this model is when applied to a larger population. Further research is also required to understand the characteristics of the meat which is being reflected in spectra.

**References**

De Brito G F, McGrath S R, Holman BWB, Friend MA, Fowler SM, van de Ven RJ and Hopkins D L (2016) *Meat Science.* **119**, 95-101.

Fowler SM, Schmidt H, van de Ven R and Hopkins D L (2018) *Meat Science.* **138**, 53-58.