Preliminary investigation into the use of Raman Spectroscopy to discriminate between lamb fat depots

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Classification of lamb carcases based on production system has largely not been assessed, as currently markets assess carcases on weight and fat and not on production system. With changing consumer preferences and increased pressure from international markets to identify product history, there is a need to develop a tool for assessing lamb carcases, to be ready for these demands. A potential tool is Raman Spectroscopy which has previously shown success in assessing beef carcases. Subcutaneous fat in animals provides crucial information about the diet and the location of the fat in the carcase has been shown to alter fatty acid composition with differences seen in the inguinal area in particular in C18:1 (Bas and Morand-Fehr 2000).

A total of 67 crossbred lambs were fed for five weeks in a feedlot with two per pen, each pen was fed one of four diets of differing cottonseed pellets in combination with a standard grain ration of barley and lupins. The diets included the control with the grain ration, a cottonseed protein meal pellet, a cottonseed barley blend pellet and a mixed cottonseed and grain ration. Each carcase was sampled at three locations, the loin, brisket and rump, with the subcutaneous fat from each depot excised and scanned, using the Metrohm Mira Handheld Raman device in three positions with an integration time of 3 s and 5 repetitions, at 48 h post-mortem. A separation of samples was obtained through a Principal Components Analysis with standard normal variate and mean centering pre-processing of the spectra and cross validated with leave one out cross validation.

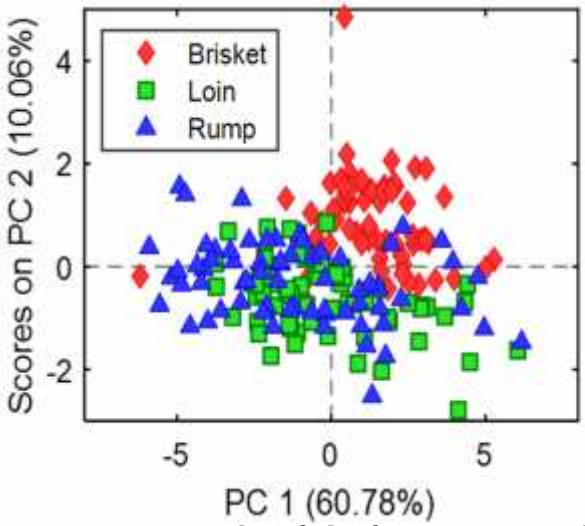

Figure 1. Scatter plot of the first two principal components of Raman spectra collected from the loin, brisket and rump fat from 67 lamb carcases.

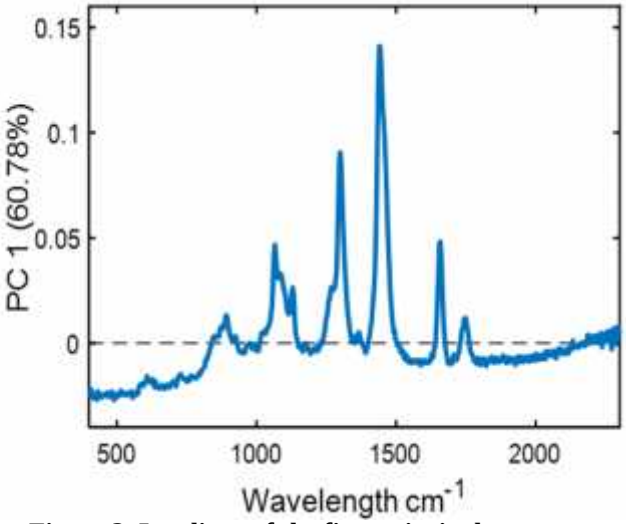

Figure 2. Loadings of the first principal component collected from 48 h post mortem subcutaneous loin, brisket and rump fat of 67 lamb carcases.

Samples from the brisket (Figure 1), show separation from the loin and rump spectra which were unable to be clearly separated. The first principal component responsible for separating the brisket samples shows key spectral features such as the peak at 1301 cm^{-1} and 1658 cm^{-1} (Figure 2). These key peaks have previously been identified as identifiers of fatty acid differences. The 1301 cm^{-1} peak is a key indicator there is a difference in the saturated fatty acids (Lakshmi et al. 2002).) It is hypothesised the fat accumulated on the brisket is higher in unsaturated fatty acids than the loin and rump, due to the brisket responding quicker to changes in unsaturated fatty acid ingested. Raman spectroscopic measurements taken from the brisket cannot be compared to measurements from the loin and rump as the depot is different however research on evaluating the effectiveness of each site to distinguish feed groups is underway.

References

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Lakshmi, R. J., Kartha, V. B., Krishna, C. M., Solomon, J. G. R., Ullas, G., and Devi, P. U. (2002). *Radiation Research* **157**, 175-182, 8.

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