The influence of blooming on the near-infrared spectra of beef

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Introduction The use of near infrared reflectance (NIR) for the prediction of meat quality has been reviewed recently (Prieto *et al*. 2009). Factors which may affect the NIR spectra and the prediction developed, include both time of measurement after slaughter, and whether the meat was allowed to bloom (Moss *et al* 2009a ,2009b) and method of carcase suspension prior to rigor (Ooltra *et al* 2009). The effect of blooming on the visible spectral region (380 to 780nm) is well known, however, the effect on the NIR region (780 to 2500nm) is not well characterised. In order to use NIR on cut surfaces of beef it is important to know the time course of blooming and the relative changes at different wavelengths in the spectra to aid in selection of wavelengths for prediction equations, such that blooming would have little influence on the prediction model.

Method The NIR spectra were measured on 150 beef sirloins using a prototype beef reflectance probe (Analytical Spectral Devices, Colorado, USA) both immediately after cutting and after 1 hour. Selection of the carcases (50 bulls, 50 steers, 50 heifers) was as described by Moss *et al*. 2009a).
To determine the difference between freshly cut and bloomed surfaces three statistical approaches were used; paired t test, principal component analysis (PCA) and discriminant analysis (DA). The paired t test and PCA was undertaken at each wavelength over the region 380 to 2250 nm on all samples. The DA, however, was performed on a subset so that the freshly cut and bloomed samples were not from the same animals. The discriminant model was then validated on different set of unrelated spectra.

Results and discussion The paired t test showed that in the visible region (380 to 780nm) the wavelengths not statistically significant between freshly cut and bloomed were: 454, 508, 526,527, 552, 553, 573, 590nm. These wavelengths represent isobestic points for the various myoglobin pigments. Statistically significant differences were found in the NIR region at wavelength regions: 805 – 1193, 1416- 1533, 1710-1783, 1801- 2434nm. The PCA analysis undertaken on the reflectance data from 380 to 2250 nm, showed that 3 components explained 96% of the variation in the data. Separation between freshly cut and bloomed was mainly along PC2 (fig 1), with complete separation between freshly cut and bloomed when PC2 was plotted against PC3 (fig 2). High loading coefficients were found both in the visible region (380 to 780 nm) and in the NIR region between 780 and 1340.

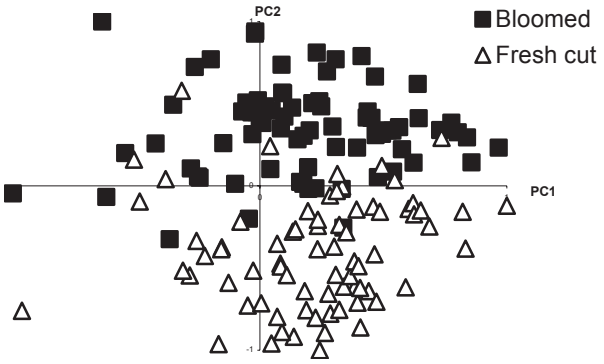

Figure 1 PCA plot for principal component 1 and 2

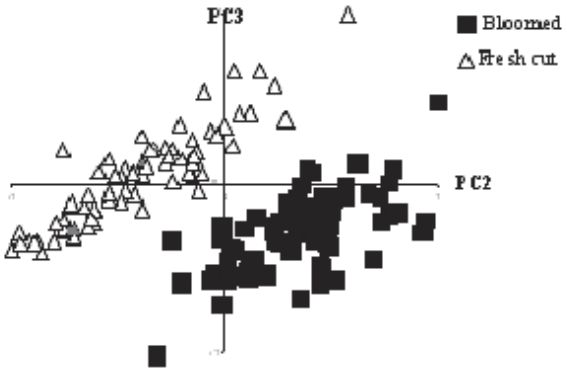

Figure 2 PCA plot for principal component 2 and 3

DA showed 100% discrimination between freshly cut and bloomed samples when performed on data in the visible and NIR regions (up to 1350nm). Above 1350nm it was not possible to obtain a statistically significant discriminant rule based on percentage reflectance data.

Conclusion The data shows that although major differences between freshly cut and bloomed spectra are greater in the visible region there are spectral differences in the NIR region. The results of the PCA and discriminant analysis indicate that above 1350nm blooming has less effect on the spectra. Thus prediction models based on wavelength regions between 1350nm and 2250nm will be less influenced by the time from cutting to measurement. Further work is required on the time course of blooming on NIR spectra.

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References

Prieto et al 2009, Meat Science
Moss, B.W, A Gordon, K Matthews, D Homer, P Hadley 2009a. Proceedings British Society of Animal Science 2009, 114.
Moss, B. W. A Grodon, 2009b. Proceedings of the British Society of Animal Science, 115.
Ooltra O., L Farmer, B W Moss, J Birnie 2009. Proceedings of the British Society of Animal Science, 144

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