Prediction of nitrogen and fat content in minced meat by near infrared spectroscopy

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Near Infrared Reflectance Spectroscopy (NIR) is routinely used for rapid and economical prediction of the macro nutrient content of grain and foods. The technique relies on the development of multiple regression equations between nutrient concentration and the reflectance at a number of wavelengths using samples of known composition. These regressions are then used to predict the nutrient concentration in unknown samples based on their reflectance characteristics. This study sought to develop an NIR calibration for prediction of the protein and fat contents of freeze–dried mince from lamb carcases.

Sides from 83 lamb carcases ranging in weight from 17-3 1 kg HCW and 45-76 % fat were minced in a commercial hogger, sub-sampled (1 kg) and freeze dried. A sample of freeze-dried mince (50g) was then homogenised in a stainless steel blender and frozen before chemical analysis of water, protein, fat and ash concentration. The chemical composition of all samples was entered into a Bran and Luebbe Model 400 InfraAlyser. All samples were packed and scanned three times. Data from 53 samples were used to develop calibration equations using six wavelengths (filters). The composition of the remaining 30 samples was then predicted from these equations to validate their precision (Table 1).

Useful prediction equations were unable to be developed for the content of water (r = 0.65) or ash (r = 0.76). This failure was attributed to the low water content in the freeze–dried samples (1–8% DM) and to the heterogeneity of bone fragment distribution in samples. Prediction of nitrogen and fat contents were excellent, with the SEP being 0.3 and 2.3% units respectively While precision of estimates cannot exceed that of the chemical analysis used to provide the calibration data, this study indicates little precision will be lost in estimating the composition of mince by using NIR in place of traditional laboratory means.

Table 1 Definition of data used to develop NIR calibrations for lamb carcase composition (n = 53), fitted models and estimates of precision based on validation study (n = 30). S.D. and Standard Error of Prediction (SEP) units are expressed as % constituent.

Variable	Range	Mean	Correlation (R)	Pooled S.D.	SEP
Nitrogen %	3.3 - 7.5	5.0 (0.76)	0.94	0.10	0.30
Fat %	44.6 - 75.6	62.7 (0.54)	0.93	0.62	2.27

Prediction Equations:

$$\%N = 3.65 + 97.1^* F_9 - 94.8^* F_{14} - 50.9 F_{15} + 18.3^* F_{16} - 30.3^* F_{19} + 57.6^* F_{20}$$

$$\% Fat = 80.0 - 66.8^* F_4 + 735^* F_6 - 742^* F_8 - 156^* F_{17} + 319^* F_{18} - 100^* F_{20}$$

#: Where F_n = log{1/reflectance at wavelength n}. Wavelengths (nm) for n = 9, 14, 15, 16, 19, 20, 4, 6, 17, 18 are: 2139, 2100, 1759, 1940, 1445, 1680, 2310, 2230, 2190, 1734, 1722, respectively.