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Real Time Prediction of Backfat Composition and Iodine Value by Portable Near Infrared Spectroscopy in a Diverse Population of Pigs

N. Prieto[1], M. E. R. Dugan[1], M. Juárez[1], Ó. López-Campos[1], R. T. Zijlstra[2], and J. L. Aalhus[1]*

[1]Lacombe Research Centre, Agriculture & Agri-Food Canada, Lacombe, Canada;
[2]Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Canada

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Objectives

The aim of this study was to test the potential of portable near infrared spectroscopy (NIRS) to predict the fatty acid (FA) composition and iodine value (IV) of backfat in real time at the abattoir using a large and variable population of pigs.

Materials and Methods

In total, 357 pigs from various genetic backgrounds (Duroc, Lacombe, Iberian crossbreds), genders, diets (commercial, high oleic acid, high α-linolenic acid), and slaughter weights (either 120 or 140 kg) were raised at the Lacombe Research and Development Centre (LaRDC-Agriculture and Agri-Food Canada, Canada). At slaughter, pigs were stunned, exsanguinated, dressed, pasteurized and eviscerated at the LaRDC federally-inspected abattoir. Following carcass splitting, at 45 min post mortem a clean cut surface of the inner layer of backfat from the left side was transversely scanned (350 to 2,500 nm) at the shoulder, using a hand-held ASD fiber-optics pro-reflectance probe attached to a portable LabSpec ^{4} Standard-Res spectrometer (Analytical Spectral Device-ASD Inc.). Following collection of NIR spectra, a representative 5-g sample of the inner backfat layer was collected from each pig and stored at -80°C until FA profiles were analyzed by gas chromatography (Turner et al., 2014). Partial least squares regression (PLSR) was used to estimate FA proportions, ratios and IV, using spectra as independent variables.

Results

NIRS successfully predicted the total polyunsaturated and n-3 FA proportions, polyunsaturated/saturated ratio and IV (R^2 > 0.90; ratio performance deviation, RPD > 3.0). This portable technology also met the requirements for a quick screening of the proportions of total saturated, monounsaturated and n-6 FA, n-6/n-3 ratio, and some individual FA such as C18:2n-6 and C18:3n-3 (0.80 < $R2$ < 0.89; 2.10 < RPD < 2.63). Conversely, unreliable estimations were observed for other individual FA such as C16:0, C18:0 and C18:1 ($R2$ = 0.60 to 0.77; RPD < 1.80), probably due to their low variability (coefficient of variation = 4 to 8%).

Conclusion

Portable NIR spectroscopy can be used as a fast, online tool to successfully predict fatty acid composition and iodine value of backfat from pig carcasses. The abattoir implementation of this technology, to collect spectra directly on the carcass, opens new possibilities for early sorting of carcasses based on fat composition or hardness for marketing purposes. Application of this technology may provide benefits including development of quality standards and payment grids for different fat qualities, use by specialty pork producers for product development and quality control, and use by pig breeding companies to assist in selection for desirable fat quality. Further testing of this technology on fast-moving abattoir processing lines is still required.