POTENTIAL OF VISIBLE AND NEAR INFRARED SPECTROSCOPY TO AUTHENTICATE BARLEY-FINISHED BEEF

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I. OBJECTIVES

Barley production is well suited to western Canada and provides feedstuffs (i.e., grain and silage) found in most beef finisher diets. At the same time, development of low heat unit hybrid corn has provided a practical alternative to barley. The ability to discriminate between beef fed different diets creates opportunities for targeted marketing. The objective of this study was to test whether visible and near infrared spectroscopy (vis-NIRS), combined with different discrimination approaches, could be used to rapidly classify beef based on grain source in finishing diets.

II. MATERIALS AND METHODS

A total of 85 in-bone ribeyes from barley ($n = 29$), corn ($n = 27$) and blended (50:50 barley and corn; $n = 29$) grain-fed steers [1] were collected and shipped refrigerated to the Lacombe Research and Development Centre (Agriculture and Agri-Food Canada, Canada). After 15 d of aging, two 2.5-cm steaks were fabricated from each ribeye for subsequent analyses. Sensory descriptive evaluation (9-member trained sensory panel) [2], fatty acids (FA) [3], and proximate analyses [2] were performed on the *longissimus thoracis* (LT), whereas color (Minolta L^*, a^*, b^*) was measured on both LT and subcutaneous fat. The vis-NIR spectra were collected on subcutaneous fat and intact and ground LT, using a portable ASD LabSpec®4 Standard-Res spectrometer from 350 to 2,500 nm. Meat quality, FA, and sensory data were analyzed using the MIXED model procedure of SAS version 9.4 (SAS Institute Inc., Cary, NC). Partial least squares discriminant analysis (PLS-DA) and support vector machine in linear (L-SMV) and radial (R-SVM) kernel were applied to the spectra for source of grain-fed discrimination, using the software R-Project (R Development Core Team 2009).

III. RESULTS

Dietary grain source did not affect ($P > 0.05$) meat quality but influenced ($P < 0.05$) FA profiles and sensory attributes. The LT from barley-fed steers had greater n-3 FA contents and were more tender and juicy compared to LT from corn and blended grain-fed steers. Using vis-NIRS coupled with PLS-DA and L/R-SVM kernel resulted in <70% overall accuracy when barley, corn, and blended grain were included in the same analysis for subcutaneous fat, and intact and ground LT. When only barley and corn samples were considered in the analyses, fat samples were correctly classified with >94% overall accuracy using PLS-DA and L/R-SVM. Additionally, for intact LT, PLS-DA and L-SVM successfully (~90% of accuracy) discriminated barley from corn. Spectral differences observed at 420, 540, 570, 1,200, and 1,720–1,760 nm,

related to the absorption of FA and meat pigments and carotenoids stored in fat, could have contributed to the successful classification of fat and intact LT samples based on cattle feeding regime. Ground LT samples were classified with <70% overall accuracy, probably due to the destruction of muscle integrity during grinding, which entails a loss of relevant information of muscle such as texture and juiciness.

IV. CONCLUSION

Vis-NIRS measurements on fat and intact loin can be used to accurately discriminate between corn- and barley-fed beef, but the ability to discriminate between diets was reduced when a blended grain diet was also considered.

References: [1] Johnson *et al.* (2019). Translational Animal Science 4(1):129–140. [2] Prieto *et al.* (2017). Meat and Muscle Biology 1:157–168. [3] Vahmani *et al.* (2017). Meat Sci. 131:9–17.

Keywords: barley, beef, near infrared spectroscopy, partial least squares discriminant analysis, support vector machine