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PREDICTION OF BEEF FATTY ACID COMPOSITION USING NEAR INFRARED SPECTROSCOPY: EFFECTS OF TISSUE AND SAMPLE PREPARATIONS

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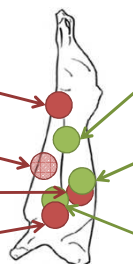
► **Objectives :** Use a portable Near Infrared Spectroscopy (NIRS) equipment to evaluate

1

Performance of prediction of fatty acid (FA) composition on 7 different cattle tissues grinded in liquid nitrogen

4 muscles

- Rectus abdominis (RA)
- Diaphragma (Di)
- Longissimus thoracis (LT)
- Infraspinatus (In)



3 adipose tissues (AT)

- intercostal subcutaneous adipose tissue (ISAT)
- intermuscular fat of the 5th rib (IMF)
- shoulder subcutaneous adipose tissue (SSAT)

2

Effect of 5 different sample preparation methods on the performance of prediction of the FA composition on RA muscle



On carcass (G0)



Without grinding (G0)



minced (G1)



Knife mill grinding (G2)



Grinding in liquid nitrogen (G3)

⇒ To allow industries to guide early carcasses to the most appropriate marketing channels based on their FA composition, particularly their $\omega 3$ content.

► **Materials and Methods**

78 carcasses of cattle

- Milk or meat genetic type
- Young bulls, cows, oxen
- Diets based on grass or corn silage +/- extruded linseed supplementation

Calibration development

- Fatty acids profile (g.100g⁻¹ of tissue) by GLC
- ASD Labspec 4 (350-2500 nm) portable spectrometer
- Spectra pretreatments (smoothing, derivation)
- PLS treatment and cross-validation

Calibration evaluation

R^2_{cv}

- Insuffisant : < 0.66
- Average : 0.66 – 0.81
- Good : 0.82 – 0.91
- Excellent : > 0.92

► **Results**

1

► For all AT, FA were not correctly predicted by NIRS ($R^2_{cv} < 0.59$)

► For muscles, predictions were quite satisfactory for major FA (C16:0, C18:0, C18:1 9c), total saturated (SFA) and monounsaturated FA (MUFA) ($R^2_{cv} > 0.78$)

► Polyunsaturated FA (PUFA) were poorly predicted by portable NIRS ($R^2_{cv} < 0.53$).

► Better prediction performances were obtained on the In muscle.

► However, in practice, to perform measurements on RA muscle seems preferable, as it is easily accessible in slaughterhouse.

2

► Performance of FA predictions increased with the fineness of sample grinding, regardless the FA considered

► Predictions on C0, G0 and G1 samples were similar and unsatisfactory for most FA

► G2 and G3 grinding modes gave better results of prediction ($R^2_{cv} < 0.80$)

Prediction models of FA (g/100g of tissue) by NIRS for the 7 ground tissues in liquid nitrogen (G3)

R^2_{cv}	Di	LT	RA	In	SSAT	ISAT	IMF
Total lipids	0.85	0.81	0.93	0.92	0.59	0.001	0.16
C16:0	0.78	0.80	0.90	0.91	0.51	0.13	0.001
C18:1 9c	0.79	0.81	0.87	0.94	0.41	0.20	0.12
SFA	0.80	0.80	0.89	0.90	0.55	0.19	0.12
MUFA	0.80	0.82	0.89	0.93	0.48	0.27	0.14
PUFA n-6	0.001	0.28	0.43	0.25	0.26	0.22	0.01
PUFA n-3	0.09	0.02	0.32	0.19	0.31	0.001	0.07
PUFA	0.03	0.26	0.53	0.21	0.32	0.09	0.05

Prediction models of FA (g/100g of tissue) by NIRS on RA muscle depending on the grinding mode

R^2_{cv}	C0	G0	G1	G2	G3
Total lipids	0.65	0.64	0.61	0.86	0.93
C16:0	0.53	0.68	0.57	0.81	0.90
C18:1 9c	0.60	0.58	0.49	0.80	0.87
SFA	0.59	0.66	0.56	0.82	0.89
MUFA	0.64	0.60	0.53	0.84	0.89
PUFA n-6	0.45	0.37	0.09	0.47	0.43
PUFA n-3	0.22	0.47	0.47	0.26	0.32
PUFA	0.38	0.51	0.34	0.45	0.53

► **Conclusions**

The portable NIRS has a significant potential for use to classify and orient carcasses on the basis of their FA composition. **The most appropriate tissue for the determination of the major FA is the RA muscle in its ground form** (knife mill type or grind in liquid nitrogen).

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