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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

3 adipose tissues (AT)

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



- 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



⇒ To allow industries to guide early carcasses to the most appropriate marketing channels based on their FA composition, particularly their ω3 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<sup>-1</sup> of tissue) by GLC
- ASD Labspec 4 (350-2500 nm) portable spectrometer
- Spectra pretreatments (smoothing, derivation)
- PLS treatment and cross-validation

### Calibration evaluation

- R<sup>2</sup><sub>cv</sub>
- 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<sup>2</sup><sub>cv</sub> < 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<sup>2</sup><sub>cv</sub> > 0.78)
- Polyunsaturated FA (PUFA) were poorly predicted by portable NIRS (R<sup>2</sup><sub>cv</sub> < 0.53).
- Better prediction performances were obtained on the In muscle.

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

R <sup>2</sup> <sub>cv</sub>	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

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

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

R <sup>2</sup> <sub>cv</sub>	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

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<sup>2</sup><sub>cv</sub> < 0.80)

## 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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