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► To cite this version:

Benoît-Pierre Mourot, Guillaume Mairesse, Emmanuelle Certenais, Guillaume Chesneau, Denys Durand, et al.. Prediction Of Beef Fatty Acid Composition Using Near Infrared Spectroscopy: Effects Of Tissue And Sample Preparations. 61st International Congress of Meat Science & Technology (ICOMST 2015), Aug 2015, Clermont-Ferrand, France. hal-01234335

HAL Id: hal-01234335

<https://hal.science/hal-01234335>

Submitted on 3 Dec 2015

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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

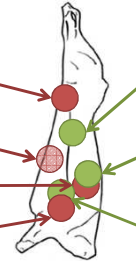
1

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

4 muscles

3 adipose tissues (AT)

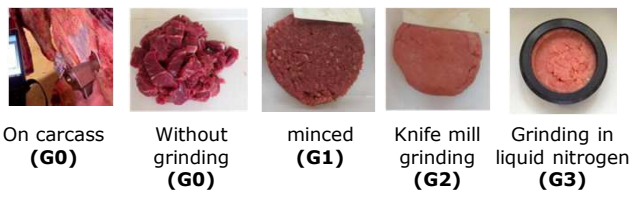
- Rectus abdominis (RA)
- Diaphragma (Di)
- Longissimus thoracis (LT)
- Infraspinatus (In)



- 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 $\omega 3$ 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

- R²_{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 (R²_{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) (R²_{cv} > 0.78)
- Polyunsaturated FA (PUFA) were poorly predicted by portable NIRS (R²_{cv} < 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 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

- 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 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

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 (R²_{cv} < 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).

This study was conducted with the financial support of the 14th FUI, of Bretagne and Pays de la Loire regions, the General Council of the Côtes d'Armor, Lannion-Trégor-Community and FEDER (SpecMeat Project).

