Abstract
Influence of the instrument setting parameters on the repeatability of near infrared spectra of intact pork loins analysed with a hand-held spectrometer

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Introduction

One of the main characteristics of NIR spectroscopy is that it is non-destructive, which allows spectral analysis with intact products. Nevertheless, to be able to perform this kind of analysis and, therefore, make more realistic the implementation of on-line analysis in the agro-food industry, it is necessary to study the sources of variability that affects the spectral measurements, and how it is possible to optimise the repeatability of the instrumental signal. In this study, different setting parameters of a hand-held instrument have been evaluated to analyse the signal repeatability on intact pork loins.

Materials and methods

Fifteen pork samples of M. *longissimus* and M. *spinalis* were tested. A hand-held micro-electro-mechanical (MEMS) digital transform spectrometer (Phazir 2400, Polychromix, Inc., Wilmington, MA, USA) working in reflectance mode (1600–2400 nm, spectral resolution 8 nm) was used. A quartz sampling head protection was used to measure the samples (Figure 1).

Three spectra were acquired for each sample. Two applications with different setting parameters were compared (Table 1).

Figure 1. Measurement of NIR spectra on intact pork muscles.

Data analysis was carried out in Matlab (version 7.0, the Mathworks, Natick, MA, USA). Spectral repeatability was evaluated with the statistic root mean square (*RMS*) of differences between spectra obtained for each sample of muscle type. First derivative (Savitzky-Golay algorithm with a window width of 15 nm and 2nd order polynomial) together with Multiplicative Scatter Correction (MSC) and mean-center were evaluated.

Results and discussion

Table 2 shows the *RMS* for each muscle type calculated as the mean of the *RMS* values calculated for each sample of the same muscle category.

In the case of M. *longissimus*, both applications were in the same range. However, with M. *spinalis* a slightly improvement of 0.81 in the instrument noise was noticed, comparing the mean *RMS* values, when the application "B" was used. First derivative shows the spectral heterogeneity of the same sample analysed with both applications (Figure 2).

Table 1. Setting characteristics of the collect applications evaluated.

Parameters	TBFS	Nº of ref. scans	Nº of sample scans	TBRM
Application A	15 seconds	5	5	15 mins
Application B	45 seconds	20	10	15 mins

TBFS: Time before first spectrum; TBRM: time between reference measurements.

Table 2. Statistical values for each collect application (L: M. *longissimus*; S: M. *spinalis*).

Collect application	Number of samples		Mean *RMS*		Mean *STD*	
	L	S	L	S	L	S
A	15	15	67935.06	67942.46	83066.38	83212.18
B	15	15	67231.73	55126.46	82341.72	67515.85

STD: Standard deviation of the *RMS* values.

Application "B" showed a slightly smoother tendency of the spectra than application "A". The large source of variation of some intact agro-food products, such as pork loins, and the new instruments that are appearing in the market requires further studies to optimise the spectral information collected.

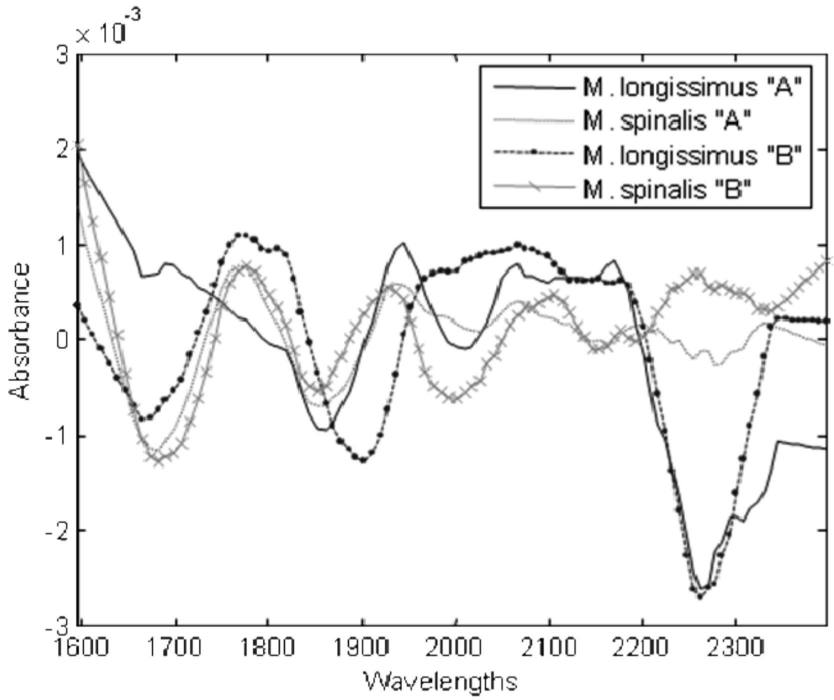

Figure 2. First derivative NIR spectra of a sample of each type of muscle collected with both applications.