DETERMINATION OF INTRAMUSCULAR FAT IN PIG MEAT FROM DIFFERENT MUSCLES AND COOKED HAM BY NEAR INFRARED TRANSMITTANCE

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Background

The use of Near Infrared Spectroscopy as by reflectance (NIR) as by transmittance (NIT) is suitable to determine main components in different kinds of foods. The determination of fat, protein and moisture is important to define the composition of meat and meat products. The chemical analysis of these components is time consuming and requires the use of solvents and acids which must be handle to avoid the release to the environment. Since, the possibility to determine the main components of meat and meat products by non chemical methods is interesting in terms of speed and safety. Several authors have reported the use of NIR for the analysis of moisture, fat and protein in meat and meat products (Ben-Gera and Norris, 1968; Kruggel et al. 1981; Lanza, 1983; Mitsumoto et al. 1991; Oh and Großklaus, 1995; Egelandsdal et al. 1996; Freudenreich and Wagner, 1996 ; Freudenreich, 1997; De Pedro et al. 1997). Fat is an important indicator of meat quality and the rapid determination of this parameter can reduce the analysis time spent in the evaluation of the quality of meat and meat products.

Objective

The objective was related with the application of NIT technique to the determination of intramuscular fat in pig fresh meat and cooked ham, by using two different sample devices.

Methods

The NIT instrument used was a Meat Analyzer Infratec 1265 (Tecator, Sweden). Meat and cooked ham samples were homogenized. Two sample device were used to analyze different amounts of sample: a) 200 g and b) 50 g. 15 (200 g) (NIT15) and 5 (50 g) (NIT5) subsamples were selected to measure the transmittance in the wavelength range of 900 -1100 nm. Homogeneity, Repeatability and liner regression analysis were performed by using the SAS software. Chemical analysis were performed by the Spanish Official Methods to determine fat and protein in meat and meat products (Ministerio de Agricultura, Pesca y Alimentación, 1986), in brief: fat was analyzed by acid digestion and Soxhlet extraction of fat which was determined by gravimmetry.

Results and Discussion

Table 1 shows the results obtained with the device for 50 g of sample (NIT5). Mean value was lower than the obtained with chemical analysis. A linear regression analysis was performed and the equation obtained was: $y=1.038 x + 0.239$ ($r= 0.97$). RMSEP and SEP presented the following values 0.294 and 0.170. NIT analysis using the device for standard procedure (NIT15) showed better results (table 2) in terms of mean difference but not in standard deviation value. Linear regression analysis showed similar results for the slope (1,11) and r (0.98), the results obtained for RMSEP and SEP (standard error of prediction) were 0.215 and 0.155. NIT5 and NIT15 showed similar results, but NIT15 allowed a more accurate analysis. The results obtained by NIT15 measurements were similar to the reported by Freudenreich (1992) and Freudenreich & Wagner (1996). Because the muscles used to obtain the previous data for NIT5 and NIT15 were different, a comparison between the three procedures (NIT15, NIT5 and chemical analysis) was carried out in *Longissimus dorsi* muscle. Tables 3 and 4 show the results obtained. NIT5 presented the lowest mean value but a similar standard deviation. This result agree with the results of the other two experiments (tables 1 and 2). The correlation was better for NIT15/NIT5 and NIT15/chemical analysis than for NIT5/chemical analysis, but the values obtained were similar for the three procedures. The determination of fat in cooked ham of extra quality was feasible using the calibration for cooked ham (Tecator, KP1). The standard deviation obtained for homogeneity and repeatability of 3 samples analyzed 10 times was below 3 and 1 % respectively. Linear regression showed a equation: $y= 1.004 x + 0.1475$ ($r=0.98$) and the values for Bias, RMSEP and SEP were - 0.169, 0.258 and 0.202.

Conclusion

NIT analysis with small sample amounts can be applied for the determination of intramuscular fat in the muscles *Longissimus dorsi*, *Semimembranosus* and *Gluteus medius*. However, it should be increased the number of subsamples taken for the measurements. The value of the slopes obtained was very close to 1 in all the experiments and the SEP values obtained were low.

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Table 1. Determination of intramuscular fat in pig meat (muscle: *Gluteus medius*) by NIT and chemical analysis. Sample size 50 g

Method	n	minimum	maximum	means	sd
Chemical	105	0.29	6.17	2.44	1.30
NIT	105	0.18	5.93	1.93	1.22

Table 2. Determination of intramuscular fat in pig meat (muscles: *Longissimus dorsi* and *Semimembranosus*) by NIT and chemical analysis. Sample size 200 g

Method	n	minimum	maximum	means	sd
Chemical	93	0.29	5.05	1.45	1.05
NIT	93	0.19	4.35	1.39	0.93

Table 3. Intramuscular fat determination by chemical and NIT analysis with 200 and 50 g of sample. Pig meat (muscle: *Longissimus dorsi*)

Method	n	minimum	maximum	means	sd
Chemical	30	0.29	2.77	1.18	0.66
NIT15	30	0.43	2.32	1.10	0.53
NIT5	30	0.13	2.29	0.88	0.57

Table 4. Correlation Coefficients (Pearson coefficient)

	Chemical	NIT15	NIT5
Chemical	1.00	0.93	0.89
NIT15	0.93	1.00	0.93
NIT5	0.89	0.93	1.00

NOTES