PREDICTION OF DRIP LOSS AND ULTIMATE PH IN PORK SEMIMEMBRANOSUS BY THE NITFOM

A. Vautier[1*], T. Pieper[2], T. Lhommeau[1], H. Petersen[2] and M. Christensen[2]

[1]IFIP – Institut du Porc, La Motte au Vicomte, BP 35104, 35651 Le Rheu Cedex, France.

[2]FRONTMATEC, Hassellunden 9, 2765 Smørum, Denmark.

*Corresponding author email: antoine.vautier@ifip.asso.fr

Abstract – Most of the NIR spectrometers available are not suited for on line measurements in slaughterhouses. The aim of the study was to test the ability of a device dedicated to industrial measurement (NitFom, Frontmatec) for prediction of drip loss and ultimate pH. A calibration model fitting was satisfactory (drip loss, R^2=0.59 and pHu, R^2=0.70) and the prediction accuracy levels for drip loss were similar to calibration results found with the Labspec4, a laboratory Vis-NIR spectrometer (NitFom, rmsecv=1.5% and Labspec4, 1.7%). This study revealed that prediction of drip loss by NIRS could be a good alternative to measurement of ultimate pH for drip loss sorting.

Key Words – NIR spectroscopy, on line prediction, water holding capacity.

I. INTRODUCTION

A majority of studies dealing with near infrared spectroscopy (NIRS) prediction of meat quality are focusing on its chemical composition, but the ability of NIRS to predict technological quality of meat has been the subject of many recent publications. This technology gives a quick access to spectral pattern that is specific to the meat chemical composition, and can also be linked to the water holding capacity of meat. However, very few NIRS devices are suitable for industrial implementation. In this study, a feasibility test was carried out to evaluate the possibility of predicting drip loss and ultimate pH in pork *Semimembranosus* using the NitFom, a NIRS-based handheld invasive probe suitable for rapid on line measurements in pork carcasses immediately after slaughter.

II. MATERIALS AND METHODS

Two populations of bone-in hams were randomly selected among standard industrial pork batches (population 1 (n=222); Duroc sire and population 2 (n=145); Piétrain sire). At 24h post mortem, ultimate pH and NIR spectra (950-2200nm) using the NitFom were obtained in *Semimembranosus* muscles. To obtain a uniform pH distribution ranging from low pH (pH <5.5) to high pH (pH >6.2), a sub-population consisting of 41 and 45 hams, respectively, were selected based on ultimate pH value. The hams were uniformly distributed into six pH classes, and deboned. Vis-NIR spectra were measured with a Labspec4 spectrometer (350-2500nm, ASDI) on the internal surface of *Semimembranosus* followed by drip loss sampling for the EZ method [1] (n=86). Samples were stored 48h at 6°C. Spectral data were treated with Matlab software (version 2010a) and Eigenvector toolbox (version 8.0.1). Spectra were pre-processed using GLS filtering, normalization to water peak and auto-scaling for NitFom, and auto-scaling for Labspec4. Spectral prediction of the ultimate pH and drip loss were investigated with the PLS procedure.

III. RESULTS AND DISCUSSION

The overall level of drip loss in the selected hams is low, but the standard deviation is high due to the targeted ultimate pH distribution (table 1).

Table 1: Reference calibration data set

	Population 1			Population 2			Population 1+2		
	n	avg	s.d.	n	avg	s.d.	n	avg	s.d.
Drip loss (%)	41	2.0	1.4	45	3.3	2.6	86	2.7	2.2
Ultimate pH	222	5.7	0.12	145	5.8	0.23	367	5.8	0.19

NitFom prediction of drip loss was satisfactory (R^2cv=0.53) showing a cross-validation prediction error notably lower than the standard deviation of the reference data (table 1 and 2). These results are similar to the average prediction accuracy reported in comparable works (R^2c=0.4-0.8; rmsecv=0.6-2.4; [3][4][5]). Labspec4 prediction of drip loss reveals comparable prediction accuracy to NitFom considering the standard deviation difference between data sets. The prediction of ultimate pH with both devices show a high fitting level (Table 2) but it remains to be elucidated if the prediction errors obtained would be acceptable for use by the slaughterhouses. An important finding from this study is revealed in figure 1 where it is clearly shown that sorting of hams based on pH measurements performed 24h after slaughter to avoid hams with high drip loss is population dependent. Our findings are in agreement with Huff-Lonergan *et al.* [2], who reported that drip loss is poorly correlated to ultimate pH at values below 5.8.

Table 2: Calibration results for the prediction of drip loss and ultimate pH with NitFom and Labspec4

		Population	Pre-processing	#PC	R^2c	R^2cv	rmsecv
NitFom	Drip loss (%)	1+2 (n=86)	GLS/auto-scaling	2	0.59	0.53	1.48
	Ultimate pH	1+2 (n=367)	GLS/auto-scaling	2	0.70	0.64	0.11
Labspec4	Drip loss (%)	2 (n=45)	auto-scaling	3	0.61	0.54	1.71
	Ultimate pH	2 (n=45)	auto-scaling	5	0.74	0.61	0.17

Figure 1: Relationship between drip loss and ultimate pH

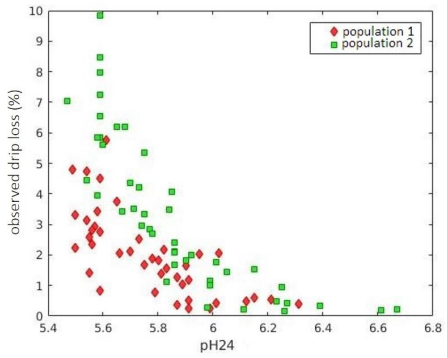
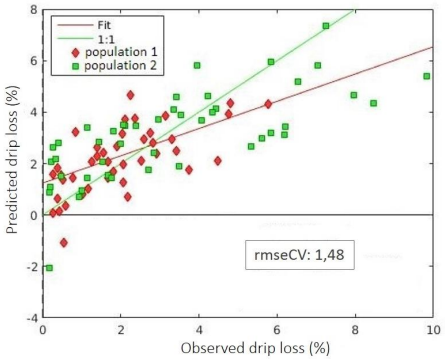


Figure 2: Prediction of drip loss with NitFom



IV. CONCLUSION

This study confirmed the ability to predict ultimate pH and drip loss by NIRS in *Semimembranosus* from pork. Prediction of drip loss appeared to be more accurate than measurement of ultimate pH for the sorting of hams according to drip loss level. NitFom is already installed in several slaughterhouses and used for backfat quality sorting. The present study demonstrates that NitFom may be used for prediction of the technological quality of meat in the future. However, to develop a robust generic model, more samples must be added to the data set taking into consideration different genetics, pre-slaughter handling etc.

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