Operating pork quality traits measurements and their relations to drip loss

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Keywords : pork meat, drip loss, pH, conductivity

Introduction:
Predicting water holding capacity of meat and reducing commercial losses due to drip loss are still some of the main challenges for fresh meat industry. A high drip loss meat has a low attractive appearance and shows after cooking a lowered level of tenderness and juiciness. It can be difficult to select a good predictor of drip loss that can be easily assessed on-line. Among the variety of quality parameters, the relation between drip loss and physiological parameters as pH and carcass temperature has been well documented (Schäfer, 2002). In addition conductivity is a parameter that can be assessed on line and has shown highly correlated with drip loss (Lee at al., 2000). The aim of this study is to compare the prediction quality of a number of inexpensive quality traits measurements on drip loss, at three different times post-mortem.

Materials and Methods:
One hundred and eighty pigs (NN and Nn) were slaughtered with a groupwise Backloader Co_2 stunning device. Measurements were performed at three different post mortem times: 30 min. (pH1SM, cond1SM), 5 hours (pH5LD, cond5LD, pH5SM, cond5SM) and 24 hours (pH24LD, cond24LD, pH24SM, cond24SM, L*LD). All measurements were taken on both *Longissimus dorsi* (LD) and *Semimembranosus* (SM) muscles except pH and conductivity at 30 min. (*Semimembranosus* only), and 24 hours L-value (*Longissimus dorsi* only).

- pH measurements were performed with a pH-meter (SYDEL, France) equipped with a Xerolytã electrode (LoT type, Mettler Toledo, Switzerland). The *Longissimus dorsi* pH measurement site is located at the last rib.
- L-value was determined with a Minolta Chromameter CR-300 (Japan) on freshly cut *Longissimus dorsi* (at the 6th rib).
- The LF-Starã (Matthaüs, Germany) was used to measure the conductivity at the same location than pH measurements.
- Drip loss was determined by removing at 24h post mortem a slice of 2cm thickness of *Longissimus dorsi* from the 6th rib. Slices were weighed after sampling, then put in commercial trays (without pad) for 48 hours. The change in weight percent over the subsequent 48 hours was taken as the drip loss.

Linear and logistic regressions were carried out using continuous drip loss or drip loss in class (5 class: class 1 £0.5%; 0.5% £class 2 £0.75%; 0.75% £class 3 £1.0%; 1.0% £class 4 £1.5%; class 5 ³ 1.5%) with the 8.02 SAS software version (SAS Institute, USA).

Results and Discussions:
The drip loss mean is particularly low in this experiment (m=1.12% ± 0.66, results not shown) compared to other studies (2.32% to 9.70%, Gueblez et al., 1990 ; Schäfer et al., 2000 ; Otto et al., 2004 ; Merour et al., 2007). A very low PSE meat frequency has been observed with only 1.1% of pH1SM under 6.1. This could be a consequence of the minimal stress handling and stunning of pigs due to the Co_2 groupwise stunning device. Stoier and Olsen (1999) already found less drip loss and higher pH1 when pigs were stunned in a group stunning device than in conventional one by one stunning device.

Table 1: Pearson correlation coefficients for *Longissimus dorsi* parameters (*: P<0.01)

	pH5LD	cond5LD	pH24LD	L*LD	cond24LD
drip loss	-0.40*	0.38*	-0.34*	0.33*	0.31*
pH5LD		-0.34*	0.33*	0.00	-0.33*
cond5LD			-0.07	0.15	0.60*
pH24LD				-0.19*	0.02
L*LD					0.07
cond24LD					

Table 2: Association of predicted probabilities and observed response for drip loss and *Longissimus dorsi* parameters (logistic regression)

Step	parameter	percent concordant	percent discordant
1	pH24LD	63.7	34.1
2	+ L*LD	68.2	30.8
3	+ pH5LD	71.7	27.1

The correlation between drip loss and pH and conductivity shows better relation for measurements at 5 and 24 hours post mortem than 30 min. post mortem (table 1, table 3). These results are in contrast to the results of Schäfer et al. (2002) and Otto et al. (2004) that indicate a critical influence of the pH in the first 2 hours for the determination on drip loss. On the other hand, the correlation level between pH24LD and drip loss (r=-0.34, table 1) agrees with previous studies (r= -0.35 to -0.48, Gueblez et al., 1990; Van Laack et al., 1994; Merour et al., 2007). Correlation between drip loss and 24 hours conductivity (r=0.31, table1) agrees with the result of Otto et al. (2004) despite of using a different drip loss determination method (r=0.42).

Table 3: Pearson correlation coefficients for *Semimembranosus* parameters (*: P<0.01)

	pH24SM	pH5SM	cond5SM	Cond24SM	pH1SM	cond1SM
drip loss	-0.33*	-0.29*	0.26*	0.24*	-0.12	-0.03
pH24SM		0.06	0.14	0.16	-0.04	0.08
pH5SM			-0.30*	-0.23*	0.64*	0.02
cond5SM				0.69*	-0.12	0.39*
Cond24SM					-0.13	0.27*
pH1SM						0.08
cond1SM						

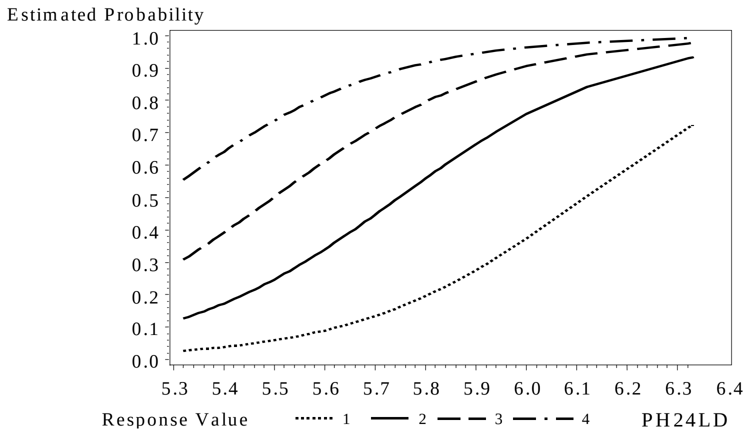

Figure 1: Drip loss prediction curves on pH24LD (class data)

The logistic regression analysis results (table 2) unravel the contribution of the different measurements to the variation in drip loss. pH24 of *Longissimus dorsi* (pH24LD) ranks first from all other measurements in the model. However, this dominant parameter produces only a 63.7% concordant prediction, that shows how difficult drip loss predicting is. The introduction of other significant parameters in the model (L*LD and pH5LD) only increases the predicting quality by 8%. The prediction curves (figure 1) estimate the risk percentage to get a high drip loss meat. At a 5.4 pH24LD value, the risk of getting a class 5 meat is about 0.36, but this risk falls to 0.08 at a 5.8 pH24LD value.

Conclusion:

These results on higher correlations at 5 and 24h post-mortem between quality parameters (pH, conductivity, L-value) and drip loss have been obtained in very low PSE-prone meats under lesser stressing handling and stunning conditions. Under such conditions, pH24 of *Longissimus dorsi* shows to be from all tested operating (on line) measurements the best (but perfectible) drip loss predictor.

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