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DRIP LOSS DEPENDENT ON STRESS DURING LAIRAGE AND STUNNING

Susanne Støier and Eli V. Olsen, Danish Meat Research Institute, DK-4000 Roskilde, Denmark

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Background

In spite of a considerable effort to ensure pork with a good WHC - and thus the low incidence of PSE in Danish pigs - drip loss in pork from Danish slaughterhouses still varies. A number of factors could cause high drip losses. The halothane-gene influences the level of drip loss. This is of minor importance in Denmark, where the frequency of halothane-gene carriers among slaughter pigs is low. Use of the Hampshire breed results in a lower ultimate pH and a higher drip loss. This is related to the RN^--gene (Lundström *et al*, 1996). The slaughter and chilling processes influence the temperature drop in the carcass and thus the pH-fall in the muscles which is important for the meat quality. It has been found that the temperature level is important already on the slaughterline (Maribo *et al*, 1998). Danish experience also indicates that stress immediately prior to slaughter has an influence on the meat quality of halothane-gene free pigs. A newly developed stunning unit based on group driving and stunning will minimise the stress just prior to slaughter. A comparative examination of conventional and group stunning with CO_2 has therefore been carried out. Hampshire crosses might influence the quality influence of the group process and have therefore been included in the investigation.

Objective

It was the objective of the investigation to establish whether the use of small lairage pens and group driving and stunning led to a reduced drip loss compared to the conventional system. The hypothesis was that a reduced pre-slaughter stress would result in a delayed pH decrease and thus a lower drip loss.

Methods

225 pigs from four large herds were used in the experiment. Two of the herds used DL×LW crosses and two mainly used Hampshire crosses. After arrival, the pigs were stored for approx. two hours - half in small pens where pigs from different herds were separated and half in conventional large pens where pigs from different herds were mixed. The pigs were then driven to the old or to the new stunning unit.

Temperature and pH were measured at a depth of 4 cm in the *longissimus dorsi* muscle (LD) between the 2nd and 4th lumbar vertebra and in the *biceps femoris* muscle (BF). Temperature was measured in LD 4-5 min., 40 min., 6 hrs and 24 hrs *post mortem* (pm) and in BF 24 hrs pm. pH was measured in LD and BF 40 min., 6 hrs and 24 hrs pm. pH in LD was also measured 4-5 min. pm. A Knick pH meter (no. 751) with an Ingold electrode was used for pH measurements. Temperature was measured with a Testoterm thermometer with a Ni-Cr-Ni probe. Internal reflection values were determined in LD and BF with MQM equipment (Borggaard *et al*, 1989). Meat samples were removed for determination of drip loss in LD between the 2nd and 4th lumbar vertebra and from the centre of BF (Rasmussen & Andersson, 1996). Colour was measured on slices of LD after blooming for 1 hr using a Minolta (L*,a*,b*) unit.

Meat quality registrations were analysed with the following model:

x = stunning unit + herd +day of slaughter*herd + stunning unit*herd + day of slaughter*stunning unit + day of slaughter + rest

It was tested whether carcass weight and meat content were the same for each batch. An analysis of variance showed this to be the case.

Results and discussion

The carcass *temperature* was measured to investigate if a more stressing treatment led to a measurable temperature increase in the muscles. If this was the case, it could be used as a measure of the level of pre-slaughter stress. The measurements in LD did not exhibit a clear effect of lairage and stunning unit on temperature. In BF the temperature 40 min. pm was approx. 1°C lower for group stunning. 6 hrs pm there were no batch differences. The results for BF indicate an influence of treatment on carcass temperature, but as the temperature measurements depend on herd and week, no precise conclusion could be made.

There were no significant interactions between stunning method and the other factors in the statistical model for pH, drip loss and reflection value. The estimated *pH levels* are shown in table 1. The pH levels 4-5 min., 40 min. and 6 hrs pm were significantly higher (0.1 % level) for the group stunned batch. The day after slaughter the pH in LD was at the same level regardless of stunning method. The pH level in BF changed after 24 hrs, when it was highest in the batch slaughtered conventionally. The *drip loss* in LD was 0.5% lower and in BF 0.3% lower with group driving and stunning as shown in table 1. This difference was significant on the 1% level in LD and on the 5% level in BF. The *reflection value* which is a measure of the WHC expressed as the degree of protein denaturation, was significantly lower in LD for group stunning. There were no significant batch differences for BF (table 1). The effect of stunning unit on *meat colour* (redness and yellowness) depended on the herd. For one herd (DL×LW pigs) the a- and b-values were 0.9 and 0.7 units lower for group stunning. For the three other herds there were no batch differences for the a- and b-values. The L-value was 1 unit higher for pigs slaughtered in the conventional system. Group stunning thus gave a slightly darker meat colour.

The effect of stunning unit on pH development, drip loss, reflection figure and meat lightness was independent of the *herd*. The higher glycolytic potential in Hampshire crosses thus did not make the pigs more sensitive to stress just prior to slaughter.

There was a significant effect of *herd* on some of the measured meat quality traits. The following model was used for an analysis of the effect herd and cross differences had on the meat quality:

$$x = a_{\text{stunning unit}} + b_{\text{delivery}} + c_{\text{herd(cross)}} + d_{\text{cross}} + b_{\text{delivery}} * d_{\text{cross}} + b_{\text{delivery}} * c_{\text{herd(cross)}} + \text{rest}$$

The carcasses from the two Hampshire herds had a significantly lower pH level in LD and BF compared to the two DL×LW herds. The pH in loin and hind leg was approx. 0.1 unit lower for the Hampshire crosses. The analyses showed a significant herd effect for *drip loss*. The herd differences for drip loss could partly be explained by the cross differences. The mean drip loss for the two DL×LW herds was 1-2% lower in LD and 1% lower in BF compared to the Hampshire herds. There was also a significant difference in drip loss for both LD and BF between the two DL×LW herds. There were no herd differences in *reflection value* for LD, but for BF there was a significant herd effect. The DL×LW crosses had 6 units lower reflection value for BF.

DL×LW had a lower a-value and a lower level of lightness (0.9 units) than the Hampshire crosses.

The herd differences with respect to meat quality could not be explained solely by the cross combinations which were used. pH and drip loss in LD and BF were thus significantly different for the two DL×LW herds.

Conclusions

The hypothesis that a more gentle handling during lairage and stunning result in a later/slower pH decrease after slaughter and a lower drip loss has been confirmed. The drip loss was 0.5%-units lower in the loin and 0.3%-units lower in the *biceps femoris* muscle when using group driving and stunning. The reflection value in the loin was lower and the surface colour of a loin slice was darker with the group process. Small pens and group driving and stunning does not only improve animal welfare but also reduces the drip loss. The effect of the stunning method on pH development, drip loss, reflection value and meat lightness was independent of the herd.

Literature

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Table 1. pH, drip loss and reflection value (ls-means and se) for LD and BF

		pH								Drip loss, %		Reflection value	
		4-5 min. pm		40 min. pm		6 hrs pm		24 hrs pm					
		ls-means	se	ls-means	se	ls-means	se	ls-means	se	ls-means	se	ls-means	se
LD	conv. stunn.	6.7	0.02	6.5	0.02	6.0	0.02	5.61	0.01	3.7	0.15	47	0.7
	group stunn.	6.8	0.02	6.7	0.02	6.2	0.02	5.62	0.01	3.2	0.15	43	0.7
BF	conv. stunn.	-		6.6	0.02	5.9	0.02	5.64	0.01	1.9	0.09	75	0.8
	group stunn.	-	-	6.8	0.02	6.0	0.02	5.58	0.01	1.6	0.09	74	0.8