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THE POSSIBILITY FOR AFFECTING ULTIMATE pH THROUGH VARIOUS TREATMENTS OF LIVE PIGS

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Background
The ultimate pH of meat is affected by the glycogen reserves in the muscles as well as by the glycolytic processes. Recent Danish research on fasting and lairage period showed that with fasting and lairage overnight it was possible to increase the pH_u-level in loin and ham by approx. 0.07 units as compared to no fasting and 30 minutes lairage (Maribo, 1994). There were, however, differences from one producer to the other with respect to the effect of treatment, which indicates that a larger pH-effect could be provoked by the treatment. New experiments were therefore initiated.

Objective
The objective of the experiment was to find out whether fasting combined with a relatively long lairage period would affect the ultimate pH to a larger extent than had been possible in previous experiments. Beyond that the objectives were to get an evaluation of the impact of the treatment on the drip loss as well as to clarify any difference at the slaughterhouses with respect to the effect of the treatment. The pigs used for the experiment were therefore slaughtered at two different abattoirs.

Methods
Four big herds were involved in this experiment. Crossbred combinations utilised were D(LY) (approx. 55%) and DH(LY) (approx. 45%). The producers delivered pigs to the two abattoirs simultaneously. The pigs had fasted for approx. 12 hours before transport to the abattoir. For each abattoir the pigs were divided into two groups. One group was slaughtered after a lairage period of 1 hour, while the other group was lairaged overnight. The pigs lairaged at the abattoir for approx. 24 hours had access to water and bedding (wood shavings).

On the day after slaughter the water holding capacity was measured with the MQM equipment in biceps femoris, semimembranosus and longissimus dorsi (Borggaard et al., 1989). pH_u was measured in biceps femoris, semimembranosus, longissimus dorsi and semispinalis capitis 30 hours after sticking. Samples for drip loss determination were taken from the loins by random sampling, yet so that the loins for the experiment represented the four producers evenly. Two loin chops 12-14 mm thick were cut from the carcasses in the chill room. Each chop was weighed and immediately placed on a netting in a white plastic tray which was sealed in order to limit the vaporization. The trays were placed at approx. 4°C. The following day and the day after the samples were weighed again.

The experiment comprised in total 1259 pigs. pH- and MQM-measurements were made on all pigs, whereas drip loss was measured on loins from 461 pigs.

Data from the two abattoirs have been analysed separately, since differences were found between the abattoirs with respect to the pH effect of the treatment. An analysis of variance has been utilised for the evaluation of pH and drip loss. In this analysis variance components have been included. Differences between groups with respect to the pH distribution as well as the presence of DFD and PSE have been analysed in a Chi^2-test.

Results and Discussion
The treatment affected the *pH_u-level* to a limited extent. pH_u in loin increased by 0.08 and 0.03 respectively with a lairage period of 24 hours at both abattoirs (Table 1). The pH_u-level is generally higher at abattoir No. 2 (1 hour lairage). The effect of the treatment on the pH_u-level is biggest at abattoir No. 1, where fasting combined with a long lairage period has resulted in a significant increase of the pH_u in all muscles measured. For abattoir No. 2 there is a tendency only for a higher pH_u in loin and ham with a long lairage period while the pH_u-level in the semispinalis capitis differs significantly between the two groups.

A number of published results from research have proved that the longer the lairage and fasting period the higher the pH_u. Based on results of older Danish research (Nielsen, 1979) it was expected that the pH-effect of the treatment used would be larger than was actually seen at the two abattoirs. In a more recent Swedish research it was found, however, that pH_u was not affected by the length of the lairage (2 or 24 hours). The glycolytic potential was relatively high and not significantly different from one group to the other. Lack of pH-effect from lairage was thus partially attributed the feeding state of the animals (Fernandez et al., 1992). The most recent results including a previous experiment at abattoir No. 1 mentioned under Background indicate that Danish pigs when compared to the experiment from 1979 have become more resistent to treatment which may possibly be attributed a higher glycogen level/bigger glycolytical potential of the muscles.

There is a tendency towards lower *drip loss* with long lairage periods. The differences between the groups are, however, not significant. A treatment resulting in a rise in the pH_u-level does not necessarily involve a reduction of the drip loss. Despite the fact that the increase of pH in the loin is biggest for Abattoir No. 1, the reduction of the drip loss is not more significant at this abattoir. It further appears from Table 1 that the drip loss at Abattoir No. 2 is at a higher level than at Abattoir No. 1.

Fasting combined with a long lairage period results in an increase of *DFD* in semispinalis capitis at Abattoir No. 1(Table 1). At Abattoir No. 2 there are no significant differences between the groups with respect to incidence of DFD. The *PSE* incidence has been determined by the MQM measurements. From Table 1 appears that the PSE incidence is relatively low. There is a tendency towards a decreasing PSE at Abattoir No. 1 with an increased lairage and fasting period. The difference is not significant for either of the two abattoirs.

Variances at Abattoirs

The meat quality experiments showed variances from one abattoir to the other. The drip loss of the loin is largest at Abattoir No. 2 though the PSE-frequency is lower and the pH_u-level is higher or identical to the level measured at Abattoir No. 1. It should be noted, however, that drip loss is determined based on random sampling among the pigs of this experiment and that the PSE incidence is generally low. Results show however, that the size of the drip loss is affected by other factors than the pH_u-level and PSE. A treatment resulting in an increase of the pH_u-level does not neccessarily improve the drip loss. Previous experiments have proved that drip loss is affected by both the pH-level as well the speed of the pH-drop (Barton Gade, 1994).

Treatment of the pigs before slaughter as well as the processing conditions at the factory affect the pH-drop in such a way that a more stressful treatment of the pigs plus a slower chilling of the carcass will result in a quicker pH-drop and consequently a larger drip loss. One hypothesis therefore may be that the treatment of the pigs as well as the processing conditions at Abattoir No. 2 have resulted in a quicker pH-drop and consequently a larger drip loss than at Abattoir No. 1.

Conclusion

The treatment affects the pH_u-level, but the effect is limited as pH_u in loins increases by 0.08 and 0.03 respective with a lairage period of 24 hours at both abattoirs. Based on older Danish results it was anticipated that the treatment would affect the pH-level to a larger extent than was actually seen. Recent results indicate however, that Danish pigs have become more resistent to the treatment which may result in the higher glycogen levels/larger glycolytic potential of the muscles.

There is a tendency towards lower drip loss with long lairage periods. The differences between the individual groups is however, not significant. A treatment resulting in a rise of the pH_u-level does not necessarily result in a reduction of the average drip loss.

Differences are found between the abattoirs with respect to meat quality and the effect of the treatment. First of all the pH_u-level is higher at Abattoir 2 (Group 1) but the effect of the experimental conditions on the pH-level is smaller. The drip loss is furthermore bigger at Abattoir No. 2 whereas the PSE incidence is higher at Abattoir No. 1. Treatment of the pigs as well as the processing conditions at the abattoirs have an effect on the rate of the pH-drop and thus the size of the drip loss which is presumed to be the explanation for the differences between the abattoirs.

Pertinent Literature

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Data

Table 1 - Average pH_u, drip loss, DFD Incidence and PSE Frequency per group

	Abattoir No. 1		Abattoir No. 2	
Lairage Period	1 hour	24 hours	1 hour	24 hours
pH_u in loin	5.49[a]	5.57[b]	5.53	5.56
pH_u in semispinalis capitis	6.02[a]	6.21[b]	6.07[a]	6.15[b]
Drip loss - 48 hours	2.2	2.0	3.0	2.6
DFD, $pH_u \geq 6.10$ in loin	1.0	1.3	0.4	0.8
DFD, $pH_u \geq 6.50$ in semispinalis capitis	7.7[a]	21.4[b]	9.5	12.2
PSE in loin, WHC <0.150	1.8	1.1	0.4	0.4
PSE in biceps femoris, WHC <0.150	1.5	0.5	0.7	0.4

Values marked with different letters vary significantly, p>0.05 per abattoir.