Warm boning of pigs in relation to meat tenderness.

Susanne Støier
Danish Meat Institute, Roskilde, Denmark

Introduction

Warm boning of pigs is used by some Danish meat plants. The killing and dressing are carried out in the traditional way, and the carcasses are then chilled in blast chilling tunnels for about one hour. The carcasses then equalise one to four hours before cutting and boning takes place. The method can improve production economy, which is achieved as a result of lower chilling losses, faster throughput and higher productivity. The reason for the meat plants' interest in the warm boning process is primarily the wish and the need for a better utilization of the production potential.
Warm boning increases the risk of cold-shortening and this can affect the tenderness of pork cuts. The purpose of this work was to study if an extension of the equalisation time from one to four hours could avoid the problems with reduced tenderness of warm boned loins.

Materials and methods

The pigs (62-73 kg) were randomly selected on the slaughter line. The probe values were measured in biceps femoris and logissimus dorsi using the transportable equipment (Andersen, 1984), and 32 pigs which were all expected to develop a normal meat quality were used in the experiment. The carcasses were split in half, and the one side was warm boned, while the other half served as control side where the cutting and boning took place the day after slaughter. In this way the best standard of reference between warm and conventionel boning was obtained.
The half carcasses which were going to be warm boned were chilled in blast chilling tunnel for 40 minutes, while the control sides were chilled as normal for 80 minutes. After this chilling-process the carcasses were placed in a cold room to equalise. The experimental sides equalised for respectively one and four hours, while the control sides equalised until the day after slaughter.

The production process.

Number of sides		Equlisation time (hours)		Period from chilling to start of freezing (hours)	
Warm boned	control	Warm boned	control	Warm boned	control
16	16	1-1 1/2	24	5 1/2	30
16	16	3 1/2-4	24	8	30

The internal temperatures of the different muscles (loin, leg and shoulder) were determined after the blast chilling, after the equalisation and after the deboning.
The loins were packed in thermoformed packs made on deep-drawing machines. The packing process took place directly after boning and then the loins were placed in fibreboard cartons and frozen in blast tunnels. The temperature of the meat was registered throughout the freezing process, and the freezing time, the time until the centre temperature of the products has reached at least -10°C, was found to be 24 hours for the warm production and 20 hours for the control production.
The loins were stored at -25°C for 2 to 3 weeks after which they were thawed at 4°C. Samples of the loins were used for measurement of the shear force values, which were carried out on a Karl Frank 81559 test instrument with volodkiewich jaws to 80% penetration. The rest of the loins were sliced into chops with a thickness of 2.0 cm and the pork shops were fried and used for assessment of the eating quality using the Institute's standard procedure (Bejerholm, 1984).

Results and discussion

The results showed that there is a risk of thoughness of the pork loin when warm boned (Table 1).

Table 1. Effect of warm boning on taste characteristics and shear force values in pork chops. Mean values for right/left loins respectively warm and cold deboned

	Warm boned	Control	Difference	Warm boned	Control	Difference
Equalisation time (hours)	1-1 1/2	24		3 1/2-4	24	
Number of loins	16	16		16	16	
Taste panel scores:						
Fried colour	2.63	2.90	-0.27*	2.67	2.97	-0.30*
Flavour	1.08	1.92	-0.84***	1.51	2.08	-0.57**
Tenderness	-1.51	1.28	-2.79***	-1.19	1.88	-3.07***
Juiciness	2.37	2.53	-0.16NS	2.47	2.81	-0.34NS
Ovcerall acceptibility	-1.05	1.34	-2.39***	-0.95	1.79	-2.74***
Frying loss %	14.52	15.41	0.89NS	13.63	14.12	0.49NS
Shear force values (N)	116.8	95.5	21.3***	151.9	100.1	51.8***

NS = non significant, * :$p < 0.05$, ** :$p < 0.01$, *** :$p < 0.001$

Taste panel scores: < 0.0 : less satisfactory quality
0.0-1.9 : good quality
≥ 2.0 : very good quality

It can be seen that the shear force values of the warm boned loins were significantly higher than for the control loins, and they were such a magnitude that the level could not be considered as acceptable. Shear force values of 100-110 correspond to slightly tough meat and values of about 130 to extremely tough meat. It was thus expected that the eating quality in many cases would be less satisfactory, and this was confirmed by the organoleptic assessments. The overall acceptability of the warm boned loins was poorer than the corresponding control loins, mainly as a result of a greater degree of toughness. The tenderness and the overall acceptibility of the warm boned loins was thus not satisfactory.The results from this work,which have confirmed previous Danish investigations, showed no unquivocal relation between the equalisation time or the period between killing and freezing and the magnitude of the increased toughness. The shear force values were on average highest from the carcasses which have equalised for four hours, and the reason for this difference is inexplicable. The experimental conditions were, except for the equalisation time, identical for the two baches, and the probe values measured in longissimus dorsi were of equal magnitude. pH_1 values were unfortunately not measured in this experiment, and the difference between the two batches is perhaps due to a different rate of post mortem glycolysis. The greatest differences between the warm boned and the control sides regarding the shear force values and the organoleptic assessments were also found when the carcasses had equalised for four hours and not for one hour.
In table 2 below the temperature registrations are shown.

Table 2. Temperature registrations

Equaliation time (hours)	Internal temperature °C of the loins: After equalisation	After deboning
1 1 1/2	9.5 - 14.5	12.5 - 17.5
3 1/2 - 4	8.5 - 11.0	11.0 - 14.0
24	5.0 - 6.0	6.5 - 7.5

It can be seen that the temperature measured in the centre of the loins just before cutting was about 1 to 3,5°C lower when the equalisation time was extended from one to four hours. This temperature difference has not affected the risk of thoughness of the loins when warm boned. Furthermore the test results show that even though the internal temperatures before cutting and boning were not lower than 10°C the problems related to consistency still occurred.
Reagan and Honikel (1985) have carried out experiments in the light of which they conclude, that chilling to temperatures below 20°C within about four hours post mortem provides the optimum conditions for normal muscles regarding meat quality. Furthermore, ongoing chilling to temperatures not below 10°C at 5 hours post mortem avoids cold-shortening conditions.

This was not confirmed by our work where we observed increased toughness of the warm boned loins even though the internal temperatures were not below 10°C within 5 to 6 hours post mortem.

Conclusion

Warm boning increases the risk of thoughness in pork. The purpose of this work was to study if an extension of the equalisation time from one to four hours could affect the tenderness of the pork loins. It can be concluded that the problem regarding the consistency cannot be solved by extending the equalisation time alone within the period used in this experiment. Furthermore, the experimental results show that even though the internal temperatures before cutting and boning were not lower than 10°C the problems related to consistency still occurred.

References

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