

The effect of ageing on the eating quality of normal pork loins

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SUMMARY: Some experiments have shown that ageing pork loins was of little benefit while other experiments, especially Danish work, have shown that ageing improved tenderness. The Danish work dates back to 1971, where the experimental material consisted of Danish Landrace only. Today the majority of Danish slaughter pigs are crossbred with a higher intramuscular fat content. The aim of this work was, therefore, to repeat the previous Danish ageing experiment, but with crossbred pigs. In addition, the experiment included the effect of time of cutting from the carcass in relation to slaughter, as there is commercial interest in fast turnover times in the industry.

20 pigs with normal meat quality i.e. not PSE or DFD and with intermediate levels of intramuscular fat were selected. One side was cut up 8 to 9 hours after slaughter while the other side was first cut up the day after slaughter. The loins from both sides were cut into four pieces and aged respectively 1, 2, 3 and 6 days at 4°C. The eating quality was assessed by a nine-member experienced sensory panel.

The results showed that increased ageing time improved the tenderness. Ageing for 3 and 6 days improved the tenderness significantly compared with ageing for 1 or 2 days. The greatest effect was obtained from 2 to 3 days of ageing. The effect of time of cutting the loin from the carcass had no significant effect on tenderness.

This experiment confirmed the importance of ageing pork loins before they are sold to the consumer.

INTRODUCTION: The literature on the benefits of ageing pork has shown conflicting results, especially with respect to tenderness. Some experiments have shown that ageing pork loins was of little benefit (Harrison et al., 1970 and Bennett et al., 1973), while other experiments, especially Danish work, have shown that ageing improved tenderness (Gould et al., 1965 and Buchter and Zeuthen, 1971). The Danish work dates back to 1971, where the experimental material consisted of Danish Landrace only. Today the majority of Danish slaughter pigs are crossbred with a higher intramuscular fat content.

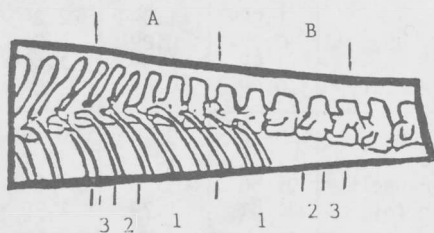
The aim of this work was therefore to repeat the previous Danish ageing experiment, but with crossbred pigs in order to find out if the same positive effect of ageing was obtained with pigs having a higher level of intramuscular fat. In addition, the experiment included the effect of time of cutting muscle from the carcass in relation to slaughter, because some information seems to show that cutting from the carcass early in the post mortem process could lead to tougher meat.

MATERIALS AND METHODS: The preliminary selection of pigs was carried out on the slaughter line. About 50 carcasses were selected which fulfilled the following requirement: weight: 67.0-73.9 kg, total lean content: 62.0-68.0%, pH₁, longissimus dorsi: > 6.3, pH₁, semispinalis capitis: < 6.3. Only relaxed carcasses (slow development of rigor mortis) were selected. Carcasses were rapidly chilled in a chilling tunnel for 70 mins. at about -20°C with air speed about 2.5 m/s. They were then placed in a cool room to equalize. About 9 hours after slaughter one side of each carcass, left and right alternately, was cut up and the other side the day after slaughter (24 hours).

The criteria for the final selection of carcasses was based on probe measurements using the MQM-equipment (Barton-Gade & Olsen, 1984) and ultimate pH₂-value in longissimus dorsi (Radiometer pHM 64 with combination

electrode GK 2401C): probe level: < 80, ultimate pH: < 5.8. Thus all carcasses were not PSE and had normal ultimate pH-values in longissimus dorsi. Each pork loin was divided for sensory evaluation, shear force measurements and analysis of water holding capacity (WHC) and % intramuscular fat content (IMF) as shown below.

A = thoracic portion
B = lumbar portion



1 = sensory evaluation
2 = shear force measurement
3 = WHC and IMF

The samples for analysis were trimmed of external fat and minced twice for the estimation of WHC (soluble sarcoplasmic and myofibrillar proteins) and intramuscular fat (SBR-method, Nordisk Metodik-Komitè for levnedsmidler, 1974). The samples were then frozen until analyses could be carried out.

The rest of each loin was divided into two cuts for sensory evaluation and shear force. All the cuts were vacuum-packed and aged 1, 2, 3 and 6 days respectively as shown below:

	I	II	II	I	I	II	II	I	
Thoracic portion--->	1	2	1	2	3	6	3	6	L = Left side of the pig
Ageing time at 4°C,									R = Right side of the pig
number of days	3	6	3	6	1	2	1	2	
Lumbar portion----->									
Number of loins:	L	R	L	R	L	R	L	R	
	5	5	5	5	5	5	5	5	

I = cut from the carcass 9 hours after slaughter, II = cut from the carcass 24 hours after slaughter.

When ageing was finished all the loin cuts for sensory evaluation and shear force were frozen to below -20°C until required.

The samples for shear force were then thawed at 5°C, cooked to a final centre temperature of 72°C, cooled and then sheared once to 80% penetration with Volodkiewich shear attachment on a Karl Frank Testing Instrument.

After thawing at 4-5°C the samples for sensory evaluation were sliced into chops with a thickness of 2.0 cm and heated 7-8 minutes without additional fat on a griddle plate to a centre temperature of about 65°C, i.e. not well done, but with a light pink colour. Cooking losses were registered. Sensory evaluation was carried out by a 9-member experienced panel. The samples were scored for flavour, tenderness, juiciness and overall acceptability on an 11-point symmetric hedonic scale where 5 = ideal, 0 = neither good nor bad and -5 = poor (Bejerholm, 1984).

The results of the sensory evaluation and shear force measurements were investigated using an analysis of variance (SAS, 1988) for the influence of ageing treatments, time of cutting the loin from the carcass and position along the loin.

RESULTS: The effect of ageing treatment on eating quality is shown in Table 1.

Table 1: Effect of ageing time on sensory attributes and shear force value.

Scoring scale: +5 = ideal, 0 = neither good nor bad, -5 = poor. Shear force: values above 100 = more or less tough. Means with different superscripts are different (p < 0.05).

Description	Ageing time (number of days)			
	1	2	3	6
Number of loins	20	20	20	20
Flavour	1.9 ^{bc}	1.8 ^{bc}	2.2 ^{ab}	2.3 ^a
Tenderness	-0.2 ^b	0.0 ^b	1.0 ^a	1.6 ^a
Juiciness	1.4 ^b	1.3 ^b	1.8 ^{ab}	2.2 ^a
Overall acceptability	0.4 ^b	0.6 ^b	1.5 ^a	1.8 ^a
Shear force value	104.2 ^b	99.5 ^b	90.3 ^{ab}	79.1 ^a
Cooking loss, %	14.1	14.1	12.7	12.4
Water holding capacity	0.186	0.185	0.185	0.183
% intramuscular fat	1.81	1.79	1.79	1.74

Increasing ageing time improved eating quality, especially tenderness. Ageing for 3 and 6 days respectively improved the tenderness significantly compared with ageing for 1 or 2 days. The greatest effect was obtained from 2 to 3 days of ageing. The percent of very tender pork chops (score ≥ 2.0) increased from 5 to 29% from 2 to 3 days of ageing. The corresponding percentages for 1 and 6 days of ageing were 10 and 50% respectively. The results were confirmed by the shear force values which showed decreasing values with increasing ageing time.

As found in earlier Danish work (Barton et al., 1987) the thoracic portions of the loins were more tender than the lumbar portions, because of the higher intramuscular fat content. The greatest effect of increasing ageing time was obtained for the lumbar portions of the loins:

Tenderness score for	Ageing time (number of days)			
	1	2	3	6
the lumbar portion	-0.6 (1.58)*	-0.2 (1.62)	0.8 (1.79)	1.2 (1.64)
the thoracic portion	0.2 (2.01)	0.2 (1.94)	1.1 (1.77)	1.8 (1.83)

* The figures given in brackets are % intramuscular fat.

The effect of time of cutting the loins from the carcasses in relation to eating quality is shown in Table 2. Table 2. Effect of time of cutting the loins from the carcasses on sensory attributes and shear force value
Scoring scale: +5 = ideal, 0 = neither good nor bad, -5 = poor. Shear force: Values above 100 = more or less
 tough. Means with different superscripts are different ($p < 0.05$).

Description	Time of cutting from carcass	
	9 hours	24 hours
Number of loins	40	40
Flavour	2.0	2.1
Tenderness	0.4	0.8
Juiciness	1.9 ^a	1.5 ^b
Overall acceptability	1.0	1.1
Shear force value	98.2	88.3
Cooking loss	12.6 ^a	14.1 ^b
Water holding capacity	0.184	0.185
% intramuscular fat	1.85	1.71

Tenderness was not significantly influenced by the time of cutting from carcass, even if the average score was a little higher and the shear force values a little lower, when the loins were cut after 24 hours compared with 9 hours. On the other hand the pork chops were significantly more juicy and had less cooking losses when the loins were cut from the carcass after 9 hours compared with 24 hours. However the average amount of intramuscular fat was greatest in the group of loins cut from the carcass after 9 hours. The percent of tough pork chops (score < 0.0) was 30% and 4% respectively.

CONCLUSION: In general the results of this experiment have confirmed the tenderizing effect of ageing pork loins obtained in earlier Danish work. Ageing for 3 and 6 days improved tenderness significantly compared with 1 or 2 days of ageing. The greatest effect in this experiment was obtained from 2 to 3 days of ageing.

The effect of time of cutting the loin from the carcass had no significant effect on tenderness, so the loins could be cut from the carcass the day of slaughter without giving tough meat.

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