VARIABILITY IN EATING QUALITY ATTRIBUTES OF AUSTRALIAN PORK

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Background

Previous research on pork quality has identified production and processing factors influencing the development of pale, soft and exudative (PSE) and dark, firm and dry (DFD) pork. These quality defects are assessed using measurements of pH, colour and drip loss. However, few studies have been conducted in Australia to determine the impact of production, pre-slaughter handling, processing and post-slaughter carcass management on sensory attributes of pork. Hofmeyr (1998) identified considerable variation in tenderness of pork purchased at the retail level, with 54% of pork loins found to have Warner-Bratzler shear force values of greater than 5 kg. In a study conducted by AMLC (1994), only 34% of consumers considered pork to be delicious to eat and was considered to be tougher, drier and less healthy compared with beef, lamb, chicken and fish. Bennett (1997) also stated that Australian consumers considered pork to be tough, dry and poor in flavour. A major research program currently funded by the Pig Research and Development Corporation is aiming to identify means and opportunities to ensure supply of consistently high eating quality pork to Australian consumers (Taverner 1999).

Objectives

This study was conducted to obtain an estimate of the current variability that presently exists in eating quality attributes of Australian fresh pork loins produced using current production and processing systems.

Methods

This study involved the co-operation of five major Australian pig abattoirs. On the slaughter floor at each abattoir, entire male (n=150) and female (n=150) carcasses from a total of 50 different properties, with a hot carcass weight of 60-75 kg and fat depth of 8-13 mm at the P2 site, were selected. At 24 h post-slaughter, whole loins (*M. longissimus thoracis et lumborum*) from the right side of each carcass were deboned and derinded (n=300 loins). All loins were vacuum packaged and aged for 2 days post-slaughter. Six steaks of 2 cm thickness were cut from the caudal end of each pork loin. Two packs per loin, each containing three steaks, were coded and vacuum packaged prior to freezing. The three steaks from each pack were cooked together at 190°C for five minutes (to a internal temperature of 75°C) on a double-sided Silex® grill to minimise any possibilities of contamination with flavour components from steaks from other animals. All steaks were rested for two minutes and each pork steak was cut in half width ways before being placed on presentation plates for evaluation by consumers.

Each loin was assessed by 12 consumers for tenderness, juiciness, flavour and overall quality, with two consumers assessing each individual steak. Each consumer evaluated a total of five half steaks within a taste panel session. Each consumer was used only once. Consumers were asked to use a line scale to assess quality of pork loin steaks. The scores used were: 0 = dislike extremely to 100 = like extremely. Each pack of three steaks from the same animal was assessed by two different consumer panels. A total of 720 consumers were involved in this study.

Muscle samples for assessment of intramuscular fat were obtained from the loin, adjacent to the 7th and 8th thoracic rib. A 50 g sample was trimmed from the centre of the loin muscle and freeze dried for 7 days. Following freeze drying, all samples were ground, fat was extracted using diethyl ether and intramuscular fat content calculated (Atkinson *et al.* 1972).

A sample of adipose tissue was rendered by microwave followed by an extraction of the molten sample by a simple solvent for determination of androstenone and skatole concentration. The solvent was analysed using reverse phase HPLC using fluorescence detection (Dehnhard et al. 1993; Hansen-Møller 1994).

Data were analysed using the Restricted Estimated Maximum Likelihood Program (REML) (Genstat 5.4, Payne *et al.* 1989) with abattoir, vendor, sex of the pig, animal and pack (within animal) included in the model. The analysis was blocked on pack.

Results and Discussion

Tenderness of pork differed between abattoirs, with pork from abattoirs A and E found to be more tender ($P<0.05$, higher acceptability scores) compared with pork from abattoirs B, C and D (Table 1). Juiciness, flavour and overall quality of pork from abattoirs A and E were also more acceptable ($P<0.05$) compared with pork from abattoirs B, C and D. No effect ($P>0.05$) due to abattoir was found for odour.

No differences ($P<0.05$) in intramuscular fat content were found due to abattoir or sex of the pig. In this study, 89% of pork loins had less than 1.5% intramuscular fat. In this study, the correlation between sensory tenderness and intramuscular fat content was low ($R=0.14$). Barton-Gade and Bejerholm (1985) suggested that the intramuscular fat content of pork had to be greater than 2% before any noticeable effects on sensory attributes of pork could be detected. Continuing efforts to improve leanness of Australian pigs may be influencing intramuscular fat content of pork loin and, as a consequence, its eating quality.

Table 1: Effect of abattoir on consumer sensory scores for tenderness, juiciness, flavour, odour and overall quality and intramuscular fat content (%) of pork loin

Abattoir	Consumer sensory scores†					Intramuscular fat content (%)
	Tenderness	Juiciness	Flavour	Odour	Overall Quality	
A	60.8	63.4	63.4	65.2	64.6	1.09
B	52.5	55.4	58.9	66.9	56.4	0.70
C	52.1	54.2	58.7	66.2	56.9	0.93
D	48.9	54.0	58.3	66.6	56.2	1.14
E	59.7	59.7	63.2	65.8	63.3	1.11
sed	3.15	3.15	0.90	1.10	1.55	0.26

† 0 = dislike extremely to 100 = like extremely

Tenderness of pork was variable (54.8 ± 12.1), with only 35% of pork loins (n=300) obtaining average consumer scores for tenderness of slightly acceptable or higher (ie. above 60) (Figure 1). Similarly, only 54% of pork loins had average scores for overall quality of greater than 60 (Figure 2), with an average consumer sensory score for overall liking of 59.5 ± 9.5. Further work is required to obtain a better understanding of those attributes driving consumer satisfaction of pork.

Figure 1: Distribution of consumer sensory scores for tenderness of pork

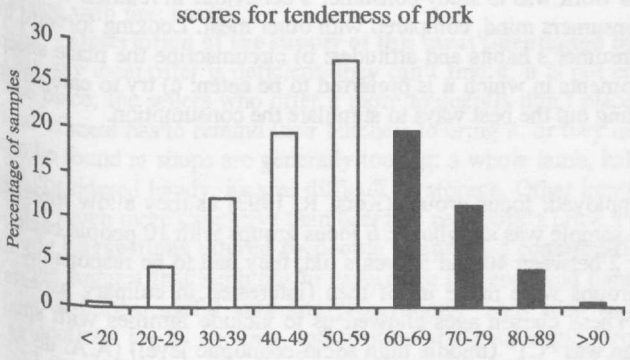
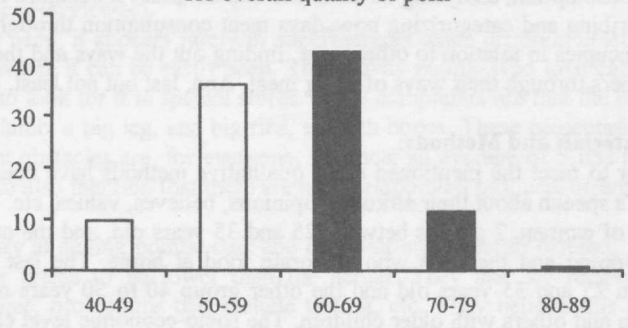


Figure 2: Distribution of consumer sensory scores for overall quality of pork



Skatole and androstenone are considered to be the major components contributing to boar taint in pork (Hennessy *et al.* 1997). Consumers sensitive to boar taint may detect this quality defect if the concentrations of both androstenone and skatole in subcutaneous fat exceed 1.0 µg/g and 0.2 µg/g, respectively. In this study, 14% of pigs had levels of androstenone in subcutaneous fat greater than 1.0 µg/g, whilst 10% of pigs had skatole concentrations greater than 0.2 µg/g. However, only 6% of entire males had concentrations of both androstenone and skatole present in subcutaneous fat higher than these threshold levels.

Conclusions

This study identified that Australian pork was inconsistent in tenderness and had relatively low levels of intramuscular fat. Eating quality attributes of pork were influenced by abattoir, with the amount of variation due to sex of the pig, vendor and day of sampling found to be small. Reasons for these differences in eating quality of pork between abattoirs may be due to the variation in pig supply together with differences in pre-slaughter handling and processing practices used at each abattoir.

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