PRELIMINARY OBSERVATIONS OF PIG MEAT QUALITY PROBLEMS IN A VICTORIAN ABATTOIR

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SUMMARY

The pH and opacity of the *M.longissimus dorsi* were measured at 45 min. (pHi, FOPi) and 24 h post-slaughter (pHu, FOPu) in 303 pig carcasses at a Victorian abattoir. Carcasses were then cut at 24-30 h post-slaughter and after a 30 min. bloom, meat colour measurements (Hunter L, a*, b*) and subjective appearance scores (1 = PSE, 3 = normal, 5 = DFD) were made. Sex, fat depth and pre-slaughter history information was also recorded. The overall incidences of PSE (pHi < 6.0) and DFD (pHu ⟩ 6.0) carcasses were 10 and 15% respectively and ranged from 0 to 28% and 0 to 67% for PSE and DFD respectively over the 14 consignments of pigs. There was no obvious relationship between the occurrence of meat quality problems in a consignment of pigs and the lairage period or transport distance. Both pHu and FOPu were correlated with objective meat colour measurements but only pHu was correlated to appearance score. FOPi and pHi were poor indicators of final meat quality. Sex had low but significant correlations with pHi, FOPi and pHu suggesting a possible advantage in treating sexes differently after they leave the farm.

INTRODUCTION

The general aetiologies of DFD and PSE in pig meat are generally well documented, but there is little information on the incidence or specific aetiology of these pig meat quality problems under Australian conditions. There is also a need to improve our ability to detect these problems as near to the time of slaughter as practical so that carcasses can be processed accordingly.

This study was undertaken to compare two techniques for the measurement of meat quality at approximately 45 minutes and 24 hours post-slaughter and to assess the incidence of pig meat quality problems in a large pig abattoir with the capacity to slaughter approximately 1000 pigs per day.

MATERIALS AND METHODS

The right side of 303 pig carcasses from 14 consignments within one day's kill at the abattoir were used to compare techniques for assessing PSE and DFD in pig meat. At approximately 45 minutes after slaughter, the pH (pHi) and opacity (FOPi) of the *M.longissimus dorsi* were measured. At 24 hours post-slaughter, pH measurements were repeated on all carcasses (pHu) and opacity measurements repeated on 97 carcasses (FOPu). Carcasses with a pHi < 6.0 were classified as PSE (Chadwick and Kempster 1983; Jones et al. 1984) while those with a pHu ⟩ 6.0 were considered as being DFD (derived from Lewis et al. 1987). The sex, fat depth (P_2 site) and consignment identification were also recorded at 45 minutes post-slaughter. After the 24 h measurements had been made, 129 sides likely to have a range of meat quality from PSE through normal to DFD were selected on the basis of these measurements and pHi, and cut at the second sacral vertebra. Objective and subjective assessments of the cut surface on the *M.longissimus dorsi* were made after the muscle had been allowed to bloom for a minimum of 30 minutes at 4-6°C.

Techniques

Both pH measurements were made in the region between the 9 th and 13 th rib through an incision between the ribs with a portable pH meter fitted with a temperature compensation probe and a spear electrode calibrated with pH 4.00 and 7.00 buffer solutions.

The opacity of muscle was measured with a fibre optic probe (Fibre Optic Lighting Pty.Ltd.) by inserting the probe into the muscle near the pH measurement site and ensuring a good contact between the meat and the probe. The FOP was calibrated with perspex blocks of standard opacity.

Objective meat colour was measured using a Minolta CR-100 Chromameter to give L, a*, b* readings (L = lightness, a* = redness/greenness and b* = yellowness/blueness) in the Hunter colour space (Hunter 1958). The instrument was calibrated by using a standard white tile. Subjective assessment of meat appearance was made by the authors scoring (by agreement) the meat on a scale of 1-5 with 1 = PSE, 3 = normal meat and 5 = DFD.

RESULTS

Incidence of PSE and DFD meat

The overall incidences of PSE and DFD carcasses were 10 and 15% respectively and ranged from 0 to 28% and 0 to 67% for PSE and DFD respectively over the 14 consignments of pigs (Table 1).

Based on the location of the source, estimates of the distance travelled by consignments ranged from 50 to 900 km and the time spent in lairage ranged from 6 to 24 hours. Consignments 2-4 were pigs from 3 separate farms which were mixed during transport and lairage. Consignments 5-9 were combined in the table because they travelled a similar distance and were small in sample size (Table 1).

Table 1. Distance travelled, time spent in lairage, sample size and the incidence of PSE and DFD amongst the 14 consignments of pigs.

Consignment	Estimated Time in lairage(h)	Estimated distance travelled (km)	Sample size	Incidence % PSE	Incidence % DFD
1.	6	70	39	28.2	2.6
2.	6	350	21	23.8	14.3
3.	6	600	24	12.5	37.5
4.	6	800	3	0	67.0
5-9.	12	50-160	23	0	0
10.	12	160	17	5.9	11.8
11.	12	200	21	0	19.0
12.	12	200+	36	2.8	11.1
13.	12-18	900	93	6.5	12.9
14.	24	160	24	12.5	29.2

Relationship between meat quality and carcass parameters

The pHu of muscle was correlated to the three objective colour parameters (L value, r = -0.65; a* value, r = -0.37; b* value, r = -0.56), to appearance score (r = -0.47) and to FOPu (r = -0.48) ($P < 0.001$ in all cases). While only 41% of carcasses classed as DFD by pHu ⟩ 6.0 were also subjectively scored as either slightly DFD or DFD, most carcasses (93%) scored as either slightly DFD or DFD also had a pHu ⟩ 6.0. The FOPu was correlated to the 3 colour parameters (L value, r = -0.46, $P < 0.05$; a* value, r = -0.57, $P < 0.01$ and b* value, r = -0.67, $P < 0.001$) but not to appearance score.

There was a low but significant correlation between pHi and FOPi (r = -0.15; $P < 0.05$). Neither pHi nor FOP_i were related to any other measures. Only 27% of those carcasses classed as PSE (pHi < 6.0) were subjectively scored as either PSE or slightly PSE, and only 14% of those carcasses scored subjectively PSE were classed PSE on the basis of pHi.

Sex (0 = entire male, 1 = female) had a low but significant ($P < 0.001$) correlation with pHi (r = 0.25), FOP_i (r = -0.22) and pHu (r = -0.20) and also with Hunter L-value (r = -0.22; $P < 0.01$). Carcass fat depth was not significantly correlated with any other measures.

DISCUSSION

It is widely accepted that pork with a high pHu is likely to be DFD, however, the pHu used to identify DFD meat can vary from ⟩ 5.8 (Lewis et al. 1987) to ⟩ 6.5 (Chadwick and Kempster 1983). Although PSE meat is more difficult to identify objectively, many workers use a pHi of between 5.8 and 6.0 as the upper limit for PSE meat (Chadwick and Kempster 1983; Jones et al. 1984 and Seidler et al. 1984). In our study, the lack of correlation between pHi and FOPi readings and subjective appearance scores would suggest that, under our conditions, neither method can reliably detect meat quality problems soon after slaughter and confirms results of Martin et al. (1981). In contrast, the good relationships between pHu, objective meat colour and appearance and FOPu, pHu and objective meat colour indicate that pHu and FOPu are useful indicators of meat colour and quality. Although there were significant correlations between FOPu and the objective colour readings, the lack of correlation between FOPu and subjective scoring of meat appearance can not be explained.

Using the criteria accepted to identify PSE (pHi < 6.0) and DFD (pHu ⟩ 6.0), our results indicate a wide variation in the incidence of both PSE and DFD between consignments of pigs (Table 1). When lairage time is extended to at least 12 hours, the incidence of PSE tends to be less than the observed mean (10%). In addition, female pigs seemed to be more likely to produce a PSE carcass and less likely to produce a DFD carcass as indicated by regressions of sex on pHi and pHu. This suggests there may be an advantage in treating the sexes differently after they leave the farm.

In relation to the incidence of PSE and DFD, the data from this very limited sample (PSE 10%; DFD 15%) suggest similarities with the situation in the UK (13% and 12% respectively; Chadwick and Kempster 1983). It is generally believed that the presence of the PSS or halothane gene is relatively low in the Australian pig herd thus the variation in the incidence of these meat quality problems probably reflects the differences in on-farm, transport, pre-slaughter and post-slaughter management practices.

It is concluded from this preliminary study that the incidence of PSE and DFD pig meat in Australia may be sufficiently high to be of considerable concern. Techniques to detect DFD pork on the intact or sectioned carcass are available but there is a need for a reliable system for detecting PSE pork so that carcasses can be processed according to their quality.

ACKNOWLEDGEMENTS

The assistance of Spencer Field in collecting data and Chris Winfield in commenting on reports is gratefully acknowledged.

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