

ENHANCING PORK PRODUCT QUALITY AND CONSISTENCY: A PATHWAY APPROACH

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Abstract— A total of 60 pigs were used in this commercial study to investigate the effect of eating quality pathways developed for a supermarket (Select Pork) and food service (Linley Valley Fresh Pork) brand in Western Australia on the eating quality of the *M. Longissimus thoracis*. Linley Valley Fresh pork had the lowest ($P<0.001$) a* (redness) values compared to generic and Select Pork. Select Pork and Linley Valley Fresh pork had lower ($P=0.007$) b* (yellowness) values compared to Generic pork. Linley Valley Fresh pork had lower ($P=0.006$) cook loss % and tended to have lower ($P=0.065$) shear force values compared to generic and Select Pork. The consumer taste panel results (Table 3) indicate that steaks from Select Pork were considered to have the better aroma ($P=0.002$) compared to steaks from generic and Linley Valley Fresh pork. Pork from Linley Valley Fresh was considered to have the best ($P<0.001$) flavour, juiciness, tenderness, overall acceptability scores, quality grades and the lowest consumer fail rates followed by Select Pork and then generic pork. The results from this benchmarking study indicate that the implementation of an eating quality approach for branded pork from Select Pork and Linley Valley Fresh improved both the quality and consistency of pork compared to generic pork.

Keywords - Eating quality pathway, pork, finisher diet and castration.

I. INTRODUCTION

The Australian pork industry in keeping with consumer demands has implemented significant changes to its production systems to produce leaner and 'healthier' pork. This has seen the introduction of leaner genetic lines, improved feed formulations and use of entire male pigs instead of castrated male pigs which are fatter. This shift to 'leaner and healthier' pork has in many ways been to the detriment of pork eating quality. Hofmeyr [1] identified considerable variation in tenderness of

pork sampled from the retail level, with 54% of pork loins purchased found to be unacceptable to consumers. Channon *et al.* [2] similarly reported considerable variation in pork eating quality – based on a total of 3528 pork steaks sensory tested by 1572 consumers, 49% of pork loins obtained average scores for sensory overall liking of 60 or higher which was required for consumers to have a positive intention to re-purchase pork. Other industries such as beef and sheep meat have developed eating quality standards, Meat Standards Australia (MSA), to enhance and consistently deliver a high quality product to consumers [3]. A similar approach is needed for pork to both improve the quality and consistency of pork products.

The aim of this study was to develop an eating quality pathway for a supermarket (Select Pork) and food service (Linley Valley Fresh Pork) brand in Western Australia and compare the eating quality of branded pork with non-branded 'generic' pork.

II. MATERIALS AND METHODS

Eating quality pathway

The eating quality pathway used by the Select Pork supermarket brand involved quality interventions at the production level and included genetics, sex, and dietary magnesium supplementation. The eating quality pathway for the Linley Valley Fresh food service brand involved quality interventions at the production and processing level and included genetics, breed, sex, dietary magnesium supplementation and moisture infusion. No quality interventions were adopted for 'generic' pork. The quality interventions for the various eating quality pathways are summarized in Table 1.

Table 1. Summary of quality interventions for the generic, Select Pork and Linley Valley Fresh eating quality pathways.

EQ Pathway	Generic	Select Pork	Linley Valley Fresh
Genetics	PIC	PIC	PIC
Sex	Entire	Castrate*	Castrate*
Magnesium supplementation**	No	Yes	Yes
Moisture infusion***	No	No	Yes

*Castration – boar taint vaccine Improvac®

**5kg Magnesium bioplex/tonne feed for 5 days pre-slaughter (Alltech Inc, Kentucky, USA)

***10% wet weight (Tenderboost®, Venturetech, Perth Australia)

Pork Samples

A total of 60 crossbred (Large White x Landrace x Duroc) pigs were randomly selected from the Select Pork, Linley Valley Fresh and 'generic' pig supply chain consignments for this study. The *M. Longissimus thoracis* from the right side of each carcass was boned out at 24 h post-slaughter, vacuum packaged and stored in a chiller for 72 h.

Objective pork quality assessment

The pH of the *M. Longissimus thoracis* muscle between the 12th and 13th rib was determined at 72h post-slaughter using a portable pH/temperature meter (Jenco Electronic Ltd, Model 6009) fitted with a polypropylene spear-type gel electrode (Ionode IJ42S, Brisbane, QLD) and a temperature probe. Drip loss from the loin muscle was measured using the suspension method with samples removed at 24h post-slaughter being standardised to 20mm in thickness. Surface lightness (L^*) of the loin muscle was measured with a Minolta Chromameter CR-100, using D₆₅ lighting, a 2° standard observer and a measuring aperture of 8mm, standardised to a white tile.

Consumer taste panel assessment

Five steaks per *M. Longissimus thoracis* were used for sensory pork quality assessment, and were individually wrapped and frozen. The 300 individually wrapped and identified boneless loin

steaks were used for the consumer taste panel assessment [4]. Each steak was halved after cooking and tasted by two consumers. Thirty-two boar taint free loin steaks (20mm thickness) were used as “warm-up steaks” during the cooking of pork samples. The samples were thawed and cooked according to a standard protocol. The pork samples were cooked using a Silex flat-plate grill and were cooked to a standardized degree of doneness. The pork steaks were cooked to an internal temperature of 75°C, between a medium/well-done and well-done degree of doneness, using a Silex flat-plate grill set at 190°C for five minutes and rested for 2 minutes. The consumer group was balanced for gender, age and demographic group. Each consumer received one half-steak portion for assessment. Ten consumers tasted steaks from each pig from each experimental treatment. Consumers scored the steaks for odour, tenderness, juiciness, flavour and overall acceptability (1=dislike extremely, 100=like extremely). The consumers were also asked to grade the steaks with 1 = unacceptable; 2=below average; 3=average; 4=above average and 5=premium. The fail rate was calculated as the percentage of steaks that had a grade score <3.

Statistics

Analysis of variance (ANOVA) was used to analyse the eating quality pathway effects on the objective and sensory pork quality measurements using GENSTAT 11th Edition (VSN International Ltd, Hemel Hempstead, UK).

III. RESULTS & DISCUSSION

The *M. Longissimus thoracis* objective pork quality results are presented in Table 2. There were no significant differences ($P>0.05$) in muscle pH, surface lightness (L^*) and surface exudate between generic pork, Select Pork and Linley Valley Fresh pork. Linley Valley Fresh pork had the lowest ($P<0.001$) a* (redness) values compared to generic and Select Pork. Select Pork and Linley Valley Fresh pork had lower ($P=0.007$) b* (yellowness) values compared to Generic pork. Linley Valley Fresh pork had lower ($P=0.006$) cook loss % and

tended to have lower ($P=0.065$) shear force values compared to generic and Select Pork.

Table 2. The effect of generic, Select Pork and Linley Valley Fresh eating quality pathways on the objective pork quality of the *M. Longissimus thoracis*.

EQ Pathway	Generic Pork	Select Pork	Linley Valley Fresh	I.s.d
pH _(72h)	5.07	5.18	5.04	0.265
L*	51.2	53.2	49.7	7.69
a*	8.51 ^a	8.54 ^a	4.10 ^b	2.20
b*	4.18 ^a	2.30 ^b	2.03 ^b	1.90
Surface Exudate (mg)	39	48	49	23
Cook Loss %	34	33	29	3.02
Shear Force (kg)	5.5	5.0	3.2	1.77

The average pH of the loin muscle at 72h post-slaughter (Table 2) was low, however, no pale, soft, exudative (PSE) pork was observed. The objective pork quality parameters for Select Pork were similar to generic pork; however moisture infused pork (LVF pork) did have lower cook loss and tended to have lower shear force values. The lower cook loss and shear force values observed for moisture infused pork was expected due to the addition of 'brine solution' enhancing the water holding capacity of muscle [5].

Table 3. The effect of generic, Select Pork and Linley Valley Fresh eating quality pathways of the *M. Longissimus thoracis*.

EQ Pathway	Generic	Select Pork	Linley Valley Fresh	I.s.d
Aroma ¹	55 ^a	63 ^b	57 ^a	6.54
Flavour ¹	54 ^a	66 ^b	76 ^c	6.11
Juiciness ¹	43 ^a	58 ^b	75 ^c	6.85
Tenderness ¹	41 ^a	59 ^b	75 ^c	7.40
Overall acceptability ¹	48 ^a	64 ^b	76 ^c	6.67
Grade ²	2.9 ^a	3.5 ^b	4.0 ^c	0.279
Fail rate (%) ³	30	15	3	-

¹Acceptability score (line scale); 0 = dislike extremely and 100 = like extremely; ²Grade score; 1 = unacceptable, 2=below average, 3=average, 4=above average and 5=premium; ³Fail rate; % of steaks/treatment graded <3.

The consumer taste panel results (Table 3) indicate that steaks from Select Pork were considered to have better aroma ($P=0.002$) compared to steaks from generic and Linley Valley Fresh pork. Pork from Linley Valley Fresh was

considered to have the best ($P<0.001$) flavour, juiciness, tenderness, and overall acceptability scores followed by Select Pork and then generic pork. The results from this benchmarking study indicate that Linley Valley Fresh pork was considered to have the best eating quality, followed by Select Pork and then generic pork. The results also indicate that branded pork from Linley Valley Fresh and Select Pork were considered by consumers to have significantly better eating quality compared to generic pork. The results also indicate that adoption of eating quality pathways improved both the overall quality as well as the consistency of pork.

Pork from Select Pork, after implementation of the Stage 1 eating quality interventions, were generally considered to have good eating quality, with the consumer taste panel scores being >60. As expected, Linley Valley Fresh pork was considered as having the best eating quality with consumers consistently scoring the flavour, juiciness, tenderness and overall acceptability attributes in the >70 with the only exception being odour. In-house observations indicate that cooked enhanced pork did have a slight 'metallic' odour from the 'brine' solution.

The MSA eating quality model allowed a change from a carcass-based grading system, to a cuts-based grading scheme. This improved the accuracy of the prediction of eating quality and also recognised the eating quality of a greater number of high value muscles than just the striploin, cuberoll, tenderloin and rump [3]. In contrast to cattle, where grading is conducted on an individual carcass, the sheep meat program recognised that it was unrealistic to classify individual carcasses. Thus the predicted consumer eating quality scores for sheep meat is based on a mob, rather than on an individual sheep/carcass basis [3]. The pork eating quality pathways implemented for Select Pork and Linley Valley Fresh was based on a similar concept.

There are numerous factors along the supply chain that impact eating quality, and not all are 'additive' in terms of impact on eating quality. An

eating quality pathway approach allows us to implement key intervention strategies to determine the most appropriate pathway to enhance eating quality and consistency of pork. The results from this commercial study has attempted to quantify the impact of key critical control interventions such as castration and moisture infusion that have an additive effect on the quality and consistency of branded pork products. An eating quality pathway approach also allows supply chain flexibility to deliver a high quality product consistently depending on customer requirements and in the most cost effective manner.

The eating quality pathways developed for Select Pork and Linley Valley Fresh also provide a platform for further refinement of the eating quality pathways depending on brand requirements. For example, whilst moisture infusion played a key role in improving quality and consistency of Linley Valley Fresh pork, it is likely that such an intervention may not be preferred for a retailer brand such as Select Pork. Revisions to the Select Pork eating quality pathways to include alternative interventions such as tender stretch (aitch bone hanging) or ageing can be considered as potential alternative approaches to enhance quality (consumer taste panel score >70) and consistency (fail rate <5%). In addition, further work is also required to enable such eating quality pathways to be cuts-based rather than just the *M. Longissimus thoracis*. The relationships between the various interventions and their impact on various muscle/cuts need to be investigated.

IV. CONCLUSIONS

The results from this benchmarking study indicate that the implementation of an eating quality approach for branded pork from Select Pork and Linley Valley Fresh improved both the eating quality and consistency of pork compared to generic pork. The improved eating quality and consistency of Select Pork compared to generic pork was largely due to the use of the boar taint vaccine, whilst the improved eating quality and consistency of the Linley Valley Fresh pork was due to the additive

effect of the boar taint vaccine and moisture infusion on eating quality and product consistency. The use of an eating quality pathway approach is an effective and cost-effective approach to improve the eating quality and consistency of branded pork.

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