

Finisher Pig Diet and Sex Affect the Sensory Acceptability of Australian Pork for the Japanese Market

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Abstract— Fifty-six crossbred (Large White x Landrace) pigs were used to investigate the effect of finisher diet (maize-soybean and barley-lupin) and sex (entire male, immunological castrate male, surgical castrate male and female) on the sensory quality of pork using a Japanese consumer panel. Four pigs per treatment were randomly selected and 5 steaks per *M. Longissimus thoracis* were used. Pork steaks were cooked to 75°C internal temperature and rested on a flat-plate grill at 190°C for 5min. Analysis of variance (ANOVA) was used to analyse the main effects of diet (D) and Sex (S) on the objective and sensory pork quality measurements. The Japanese consumer taste panel preferred pork ($P<0.05$) from pigs fed the maize-soybean diet (better flavour, more tender, juicier and better overall acceptability) compared to pork from pigs fed a barley-lupin diet. There was a negative effect of sex ($P<0.05$) on aroma of pork with consumers rating pork from entire male pigs lower compared to pork from castrated male (ICM and SCM) and female pigs. These data indicate that finisher phase pig diets and the sex of the pig can affect on the sensory quality of the *M. Longissimus thoracis*. Furthermore, the Japanese consumer panel rated pork from immunological castrated male pigs similarly to pork from female and surgically castrated male pigs.

Keywords— Pigs, finisher diet and castration.

I. INTRODUCTION

Export of pork to Asia is a major business opportunity for most pork exporting countries. By global standards, Australia has a relatively small pork production base and its major pork exports markets include Singapore, South Korea, New Zealand, Philippines and Hong Kong. Japan remains a relatively small and highly specialised export market for Australian pork. Given its size, the Australian pork industry cannot compete with the larger pork producing and export countries in the EU and North America on price. The Australian pork industry is

hoping to change this by differentiating its pork in the Asian markets by producing High Integrity Australian Pork by developing pig productions systems that have minimal negative effect on the welfare of the pig, the environment and the consumer.

Pig diets in Asia are mainly based on maize and soybean meal as the primary ingredients, compared to barley and lupins as is the case in Western Australia. There is no reason to suspect that diets based on barley and lupins will be responsible for any undesirable eating quality effects, although there is little or no information reported in the scientific literature. An important characteristic of pork quality for Asian pork markets is the colour of the subcutaneous fat. Hard white fat is preferred over soft-yellow fat. The presence of boar taint in pork is also a major issue for Asian consumers. The Australian pork industry ceased castration of entire male pigs over 30 years ago in an effort to capture the production benefits associated with entire male pigs. More recently however, the uptake of the boar taint vaccine (Improvac®, Pfizer Animal Health) is increasing in Australia and it's effect on consumer acceptability especially for Asian consumers merits investigation.

Therefore the aim of the present experiment was to investigate the effect of finisher diet (maize-soybean and barley-lupin) and sex (entire male, immunological castrate male, surgical castrate male and female) on the sensory quality of the *M. Longissimus thoracis* using a Japanese consumer panel.

II. MATERIALS AND METHODS

A. Animals, diet and housing

Fifty-six crossbred (Large White x Landrace) pigs were used to investigate the effect of finisher diet (maize-soybean and barley-lupin) and sex (entire male, immunological castrate male, surgical castrate male and female) on the sensory quality of *M.*

Longissimus thoracis using a Japanese consumer panel. The diets were formulated to be isoenergetic and were fed as a mash. All pigs were individually housed and had *ad libitum* access to feed and water.

B. Slaughter

At approximately 120kg LW, the pigs were transported 20km to a commercial abattoir and slaughtered under commercial conditions. Twenty-four hours post-slaughter, the *M. Longissimus thoracis* muscle from the pigs (right side) was removed for objective and sensory pork quality measurements.

A. Objective pork quality assessment

The pH of the *M. Longissimus thoracis* muscle between the 12th and 13th rib was determined at 24h (pH_u) 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.

B. Sensory pork quality assessment

Four pigs per treatment were randomly selected and five steaks per *M. Longissimus thoracis* were used. The 160 individually wrapped and identified boneless loin steaks were used for the consumer taste panel assessment [1]. Each steak was halved after cooking and tasted by two consumers. Thirty-two boar taint free loin steaks (20mm thickness) were collected from either the surgically or immunologically castrated pigs for use 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 standardised 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. Japanese consumers were recruited for this sensory consumer taste panel. 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 score the steaks for odour, tenderness, juiciness, flavour and overall acceptability (1=dislike extremely, 100=like extremely).

D. Statistics

Analysis of variance (ANOVA) was used to analyse the main effects of diet (D) and Sex (S) and their interactions on the objective and sensory pork quality measurements using GENSTAT 11th Edition (VSN International Ltd, Hemel Hempstead, UK).

III. RESULTS & DISCUSSION

The objective pork quality results are presented in Table 1. Pork loin from pigs fed the barley lupin diet had a lower (P= 0.002) loin muscle pH at 24 hours post-slaughter compared to pigs fed the maize-soybean diet. There was no effect of diet on other objective pork quality measurements (backfat, muscle or fat colour and drip loss). Backfat from immunologically castrated male pigs had a higher (P=0.012) b* value compared to female, entire and surgically castrated male pigs.

The sensory pork quality results using a Japanese consumer taste panel are presented in Table 2. The Japanese consumer taste panel preferred pork from pigs fed the maize-soybean diet and considered that it had a better flavour (P=0.056), was more tender (P=0.013), more juicy (P=0.023) and higher overall acceptability (P=0.007) compared to pigs fed the barley-lupin diet. There was an effect of sex on aroma of pork with consumers rating pork from entire male pigs lower (P=0.030) compared to pork from castrated male (ICM and SCM) and female pigs. There was no effect of sex on the other sensory attributes of pork.

Table 1. The influence of diet (barley lupin – BL and maize soybean – MS) and sex (female – F, entire males – EM, immunological castrate males – ICM, surgical castrate male – SCM) on objective pork quality measurements of the *M. Longissimus thoracis*.

	Diet			Sex				l.s.d.	P values	
	B L	M S	l.s.d.	F	EM	ICM	SCM		D	S
Muscle pHu	5.49	5.58	0.050	5.55	5.54	5.53	5.53	0.094	0.002	0.948
Drip Loss %	4.4	4.3	1.56	4.1	4.8	4.4	4.4	2.54	0.819	0.958
Muscle colour										
L	54.7	52.4	3.34	51.9	52.3	54.8	55.3	5.32	0.175	0.332
a	10.2	10.4	1.02	9.9	10.2	11.0	10.4	1.62	0.701	0.569
b	1.4	1.3	0.858	0.9	0.9	1.6	1.9	1.31	0.984	0.208
Fat colour										
L	78.2	78.5	0.641	78.3	78.2	78.2	78.4	1.07	0.315	0.979
a	8.3	8.3	0.564	8.1	8.2	8.7	8.4	0.882	0.792	0.432
b	-0.2	-0.2	0.604	-0.4	-1.2	0.6	-0.2	0.851	1.00	0.012

Table 2. The influence of diet (barley lupin – B L and maize soybean – M S) and sex (female – F, entire males – EM, immunological castrate males – ICM, surgical castrate male – SCM) on sensory quality of the *M. Longissimus thoracis* assessed by a Japanese consumer taste panel^A.

	Diet			Sex				l.s.d.	P values	
	B L	M S	l.s.d.	F	EM	ICM	SCM		D	S
Aroma	66.6	67.5	6.16	69.0	61.9	69.4	67.9	8.72	0.711	0.030
Flavour	57.9	64.4	6.69	60.4	60.5	63.4	60.2	9.45	0.056	0.894
Tenderness	48.5	58.5	7.87	55.6	51.1	54.1	53.4	11.13	0.013	0.882
Juiciness	53.1	61.0	6.85	57.5	55.4	60.6	54.7	9.68	0.023	0.632
Overall										
Acceptability	53.3	62.8	6.92	57.4	55.7	60.7	58.4	9.78	0.007	0.794

^A Acceptability score line score: 1 = dislike extremely; 100 = like extremely.

The negative effect of the barley-lupin diet on ultimate pH and the sensory traits of flavour, tenderness, juiciness and overall acceptability are unexpected. There is little or no information on the effect of barley-lupin in finisher pig diets on pork quality, with the majority of studies conducted to date only reporting effects of barley-lupin diets on growth performance and carcass quality.

These data are in contrast to those reported by Zraly et al. [2] who reported no effect of lupin in finisher diets on muscle pH and the sensory attributes of pork compared to a barley-wheat diet. Interestingly, Zraly et al. [2] also reported that supplementing a lupin diet with 2% sunflower oil improved the tenderness and juiciness of pork compared to the control barley-wheat diets and the lupin diet not supplemented with sunflower oil. Similarly, Vicenti et al. [3] reported that use of sweet lupins in diets fed to bulls had no effect on objective and sensory meat quality attributes compared to bulls fed a soyabean based diet. Pethick et al. [4] reported no significant difference in the

consumer acceptance of the *M. longissimus thoracis et lumborum* obtained from lambs finished on pasture or fed a lupin grain-based diets.

The pigs in this experiment were slaughtered on the same day, assigned to the same slaughter batch at the abattoir and chilled in the same chiller. Given this, it is highly unlikely that post-slaughter factors have contributed to the lower muscle pH and consumer sensory quality scores. Based on these data, it is important that this experiment be investigated further to verify the results. Additionally, it would be wise to also repeat this experiment using a larger sample size.

IV. CONCLUSIONS

The results from this experiment indicate that finisher phase pig diet and the sex of the pig can influence the sensory quality of the *M. Longissimus thoracis*. The results from this study also indicate that the Japanese consumer panel rated pork from immunological castrated male pigs similarly to pork from female and surgically castrated male pigs.

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