PE7.18 The Effects of Vaccination Against Boar Taint on the Quality of Pork 202.00

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***Abstract* – Two studies were conducted to assess objective meat quality and sensory properties of pork from pigs vaccinated with the boar taint vaccine, Improvac. The first studied pork bellies and the second pork loins. Pork was evaluated for objective meat quality parameters, pH, colour, water holding capacity, cook loss, shear force and intramuscular fat. A trained sensory panel assessed the raw and cooked sensory attributes of both bellies and loins. These studies demonstrate that vaccination to control boar taint can be used without any negative effects on either the objective meat quality or the sensory properties of pork bellies or loins.**

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***Index Terms* – Boar taint, castration, Improvac, meat quality.**

I. INTRODUCTION

Boar taint is a sensory defect of pork and occurs mainly in pork from non-castrated male pigs. It is predominantly caused by two compounds, skatole and androstenone [1]. Because the elimination of boar taint is critical to consumer acceptance of pork, physical castration of the young male pig is generally practiced. However, surgical castration results in significant reductions in growth performance and raises serious animal welfare and environmental concerns [2]. An emerging new alternative method of boar taint control that is gaining increasing popularity internationally is vaccination or immunocastration. According to Dikeman [3], immunocastration showed very good potential for preventing boar taint and improving marbling as well as being able to capitalize on the growth, feed efficiency and carcass leanness of boars. Jaros [4] also reported that immunocastration in boars, as an alternative method to controlling boar taint, improved carcass quality and daily growth gain compared to surgical castration. Studies have demonstrated that pork from boars vaccinated to control boar taint was of the same quality as pork from female or surgically castrated pigs [5]. .

In Korea, pork bellies are the favorite part of the pig, accounting for 64.9% of total pork meat consumption. Large amounts of bellies were imported from foreign countries, about 92,638 ton (44% of the import by pork cut) in 2006 [6]. Thus, understanding the eating qualities of pork bellies is a very important component of improving pork's competitiveness in Korea.

The aim of this research was to compare the meat quality and the sensory properties of pork bellies and pork loins from boars vaccinated with the boar taint vaccine, Improvac, with bellies and loins from physically castrated boars.

II. MATERIALS AND METHODS

To compare the pork quality of boars vaccinated with Improvac with that from physical castrates 2 experiments were performed. The first compared pork bellies and the second pork loins.

A. Experiment 1 - Pork Belly

Animals and pork samples: A total of 80 pigs, (large white x landrace) from the same farm and genetic origin, were systematically divided into four groups (20 surgically castrated, 20 vaccinated with Improvac, 20 non-castrated boars, and 20 gilts). Improvac was administered subcutaneously as 2 x 2 mL doses; first dose at about 9 weeks and the second dose at about 20 weeks of age. Pigs were slaughtered at 26 weeks of age and processed using normal practices for the commercial slaughterhouse. After chilling overnight at 4^{o}C, pork bellies between the 5th ribs to 9th ribs were removed from the left side of each carcass (each 1.5~2.0 kg). The bellies were vacuum-packed and transported to the Meat Science Laboratory, Konkuk University where they were kept at 4°C until testing. The area between the 5th though 7th ribs was cut from the whole belly to determine meat quality traits. Samples from between the 7th and 9th areas were used for visual and sensory evaluations.

Sensory assessment:

A trained sensory panel was used; initially 20 panelists began the screening procedure. Training was given over a 4 week period (8 sessions) in order to increase the sensitivity of the panel to androstenone and skatole. After training 12 panelists were selected. Panelists were seated at round tables with 4 people per table and screens between panelists. An electric hot-plate was centered in the middle of each table. Panellists were briefed thoroughly on the questionnaires and test methodology prior to commencement and were only informed that they would taste different pork products, they were not informed of the treatments.

Before cooking, each table was presented (in the centre) with 4 pieces of raw belly. The raw belly was scored for color, fat/meat structure, and overall preference using a 10-point scale.

After evaluation of the raw pork the samples were cooked on the electric grill at 180^{o}C to an end-point of 75^{o}C. Only samples from the same treatment were cooked at the same time so as to avoid cross contamination. The hot plates were washed in warm water between each cooking session. Panel sessions were held on 4 days with a total of 80 samples being evaluated by each panellist (20 samples/treatment).

The cooked belly slices were assessed for smell (boar odor), taste, tenderness, overall appeal. Smell was scored as follows: 10= extremely intense and 1= extremely bland. Other traits were scored as follows: 10= extremely acceptable and 1 = extremely unacceptable.

Objective meat quality assessment:

The following attributes of objective meat quality were measured: pH; instrumental colour using a Minolta chromameter; photographic colour by assessment against the NPPC colour standards; cooking loss after cooking on an electric grill at 180^{o}C to an end-point of 75^{o}C; intra-muscular fat by solvent extraction; shear-force using a Texture Analyser (Stable Micro-systems); water holding capacity according to the method of Grau and Hamm [7].

Statistics: Data were analyzed using SAS program. Analysis of variance was performed using the PROC GLM procedure with treatment groups as the main effect ($P < 0.05$).

B. Experiment 2 – Pork Loin

Animals: A total of 99 pigs, from the same farm and genetic origin, were systematically divided into four groups (39 surgically castrated pigs, 40 vaccinated pigs, 10 non-castrated intact boars, and 10 gilts). Improvac was administered subcutaneously as 2 x 2 mL doses; the first dose at about 9 weeks of age and the second dose at about 20 weeks of age. Pigs were slaughtered at 26 weeks of age and processed using normal practices for the commercial slaughterhouse. After overnight chilling, pork loins were removed from left side of each carcass, vacuum-packed and transported to the Meat Science Laboratory, Konkuk University. The area between the 5th though 7th ribs from all pigs was cut from the whole loin to determine the meat quality traits while samples from between the 8th and 9th ribs of the immunocastrated and surgically castrated groups were used for the sensory evaluation. The cooked loins were assessed by trained-selected panelists as described for the belly samples. Meat quality measures and statistical analysis were also conducted as described for the belly samples in experiment 1.

III. RESULTS AND DISCUSSION

Experiment 1: Pork Belly

The results are summarised in Tables 1 and 2. The pigs vaccinated with Improvac had a significantly higher pH than the bellies from both the castrates and females, although this difference was quite small. Compared to the physical castrates, pork bellies from the vaccinated boars showed slightly lower (but statistically significant) lightness (L value) and a higher redness (a*-value). However there were no differences between pork bellies from vaccinated or castrated pigs for photographic colour. The belly from the castrates had a higher water holding capacity than the belly from the vaccinated pigs. Similarly for cooking loss and shear force pork bellies from boars vaccinated with Improvac were the same as pork bellies from the castrates. Intra-muscular fat was significantly lower in the vaccinated pigs compared to the castrates but was similar to the bellies from the females.

For the visual evaluation of the raw samples, pork belly from the vaccinated boars was evaluated as being better than pork from the castrates in all traits (color, fat/meat structure, and overall preference). In the cooked samples the assessment of boar odour was not significantly different among the groups. With taste, tenderness, and overall appeal vaccinated boars were rated similar to the castrates.

Experiment 2: Pork Loin

The results are summarised in Table 3 and 4. The pH of the four treatments ranged between 5.62-5.71 and no significant differences were observed between the treatments. There were no differences between the castrates and vaccinated pigs in any meat quality measure - photographic color, CIE L*(lightness) and b*(yellowness); the NPPC color standard; water holding capacity; drip loss; cook loss; shear force or intra-muscular fat.

In contrast to the belly samples the loins from the castrated pigs had a higher rating for colour and overall when assessed visually before cooking. After cooking the loins from the vaccinated boars were judged to be the same as loins from the physically castrated boars.

IV. CONCLUSION

The eating quality of pork bellies is very important to the Korean swine industry. This study demonstrated that using vaccination to control boar taint in male pigs, rather than physical castration, does not have any negative effects on either the objective meat quality or the sensory properties of pork bellies. Similarly pork loins from vaccinates and castrates were judged to be of the same high quality.

Utilization of this technology will enable the Korean swine industry to increase its competitiveness by the raising of more efficient boars, rather than surgical castrates, with no negative effect on pork quality.

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Table 1: Objective meat quality, visual and sensory assessment of pork bellies.

Traits		Castrates	Vaccinates	Boars	Gilts
pH		5.79^{B}	5.95^{A}	5.83^{AB}	5.79^{B}
Color	L^*	61.27^{A}	58.43^{B}	56.74^{B}	57.49^{B}
	a^*	12.98^{B}	14.56^{A}	13.77^{AB}	13.20^{B}
	b^*	4.60^{A}	4.54^{A}	3.39^{B}	3.50^{B}
Photographic color		3.41^{B}	3.38^{B}	3.28^{B}	3.67^{A}
Cooking loss (%)		31.26^{AB}	31.01^{B}	30.74^{B}	32.64^{A}
Water holding (%)		36.1^{A}	32.8^{B}	34.0^{AB}	36.2^{A}
Shear force (N)		90.91	82.79	84.95	87.88
Intramuscular fat (%)		21.07^{A}	18.25^{B}	15.78^{C}	18.66^{B}
Visual					
Color		7.76^{B}	8.07^{A}	7.88^{AB}	8.01^{A}
Fat/meat structure		7.58^{B}	8.03^{A}	7.78^{B}	8.01^{A}
Overall preference		7.69^{C}	8.11^{A}	7.83^{BC}	8.01^{AB}
Sensory					
Smell (boar odor)		2.58	3.28	3.05	2.56
Taste		7.78	7.58	7.62	7.73
Tenderness		7.87^{A}	7.67^{AB}	7.56^{B}	7.77^{A}
Overall appeal		7.78^{A}	7.55^{AB}	7.52^{B}	7.74^{AB}

Attributes in the same row with different superscripts are statistically different (P<0.05).

Table 2: Objective meat quality, visual and sensory assessment of pork loins.

Traits		Castrates	Vaccinates	Boars	Gilts
pH		5.66	5.62	5.68	5.71
Color	L^*	55.93	55.47	54.95	55.20
	a^*	13.70^{B}	13.84^{AB}	14.19^{A}	13.73^{B}
	b^*	3.22	2.88	3.20	2.87
Photographic color		2.04	1.95	1.96	2.21
WHC (%)		41.24	40.48	42.97	42.21
Cooking loss (%)		33.14	32.723	32.82	32.51
Shear force (kg)		4.30^{AB}	4.48^{AB}	5.02^{A}	3.93^{B}
Intramuscular fat (%)		2.65	2.15	2.75	2.39
Visual					
Color		7.55^{A}	7.34^{B}	ND	ND
Overall preference		7.63^{A}	7.30^{B}	ND	ND
Sensory					
Smell (boar odor)		2.07	2.03	ND	ND
Taste		7.50	7.43	ND	ND
Tenderness		7.44	7.52	ND	ND
Juiciness		7.34	7.30	ND	ND
Overall appeal		7.53	7.54	ND	ND

Attributes in the same row with different superscripts are statistically different (P<0.05).
ND = not determined.