Effect of Gender on Chemical Composition, Cooking Loss, Sensory Evaluation and Boar Taint of Finishing Pigs Slaughtered at 110 kg

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ABSTRACT: The experiment was conducted to study meat quality in terms of nutritive values, cooking loss, shear force values and sensory evaluation of meat as well as study skatole in backfat and testosterone in blood plasma concentration from different gender of finishing pigs. Twenty-four samples of each loin muscle, backfat and blood from 8 boars, 8 barrows and 8 gilts were used in this experiment. These samples were collected from left carcass of pigs slaughtered at 110 kg live weight. The chemical composition of loin chop of barrows had higher fat than boars and gilts (2.55 vs 1.63 and 1.57 %, respectively; $P<0.05$). Moisture and protein percentages were not significantly different, however boars tended to have higher percentage than gilts and barrows, respectively. Shear force value of boars was higher than those of gilts and barrows (Maximum force 35.84 33.92 and 26.45 N; Total energy 0.14 0.12 and 0.10 J, respectively; $P<0.05$). Grilling loss was not significantly different, however boars tended to be higher than in gilts and barrows, respectively. From sensory evaluation in boars had lower degree of tenderness and juiciness than gilts and barrows (tenderness 2.86 vs 3.53 and 3.55; $P<0.01$, juiciness 2.82 vs 3.11 and 3.41; $P<0.05$). Overall acceptability of boars was lower than barrows (2.97 vs 3.41; $P<0.05$) but no significantly different from gilts (3.31). Flavour was not significantly different, however gilts tended to be better than barrows and boars, respectively. Skatole concentrations from boars had higher value than barrows and gilts (49.09 vs 37.60 and 32.85 μg/g; $P<0.05$). Eating quality from sensory evaluation was significantly positively correlated between 0.76 to 0.92. Tenderness, flavour and overall acceptability were significantly negatively correlated with skatole ($r= -0.58, -0.48$ and $–0.58$, $n=24$; $P<0.01$). Juiciness was negatively correlated with skatole ($r= -0.41$, $n=24$; $P<0.05$). Flavour and overall acceptability were significantly negatively correlated with testosterone ($r= -0.52$ and $–0.52$, $n=24$; $P<0.01$). Tenderness and juiciness were significantly negatively correlated with testosterone ($r= -0.44$ and $–0.41$, $n=24$; $P<0.05$). Skatole concentration tended to correlate positively with testosterone concentration ($r= 0.31$, $n=24$; $P>0.05$)

Keywords: boar, meat quality, taint

Introduction

Pork is one of major meat consumption in Thailand that encourage the farmers try to improve to meet consumer desire. It's quite normal that consumer choose to purchase pork with highly lean less fat meat because they are aware of health problem like case of cardiovascular disease. So one of the alternatives to response to consumer desire is boar production. In general, boars are reported to be more efficient than gilts and barrows in terms of production performance and carcass quality (Jaturasitha *et al*., 2000; Blanchard *et al*., 1999). However, the high carcass quality will affect negatively meat quality.

Boar taint is the most restriction for consumer acceptance in many countries, among them Thailand. One component of boar taint is feacal-like (skatole) which is due to

tryptophan (Burgon *et al*., 1992) and fiber (Jensen *et al.*, 1992) entering the colon. In EU, Skatole concentration in boar less than 0.25 ppm is allowed to sell as fresh meat

The objective of this study was to compare the meat quality in terms of chemical composition, cooking loss, panel test and off-flavour of pigs of different gender slaughtered at 110 kg, based on diets limited in content of tryptophan and fiber.

Materials and methods

Loin muscle (Longissimus dorsi, LD) was collected from left carcass between 10^{th} – 15^{th} ribs from three different 3 ways crossbred finishing pig (boar, barrow and gilt) fed from 30 – 110 kg with basal feed with tryptophan and fiber restricted to 0.19% and 3.6% of dietary dry matter in the finishing period and slaughtered at 110 kg of live weight at Chiang Mai Meat and Dairy Products Unit, Chiang Mai. The samples (8 each) were divided into 3 groups depending on gender and this experiment was designed in CRD experiment.

After chilling for 24 h, subsequent analysis was undertaken. The left side of the carcass between 10^{th} and 15^{th} rib, was cut perpendicular to the spine.

Chemical composition

LD muscle between the 11^{th} and the 12^{th} ribs without connective tissue and tendon was homogenized and analyzed for chemical composition such as % moisture, % protein and % fat (AOAC, 1990).

Cooking loss

For cooking loss in terms of grilling and boiling loss, 2.5 cm thick of LD between the 12-13 and the 13-14 ribs was used. The samples were weighted and put into polythene bag and frozen at –20 °C until the analysis would be performed by first thawing at 4 °C for 24 hours. Then the samples were absorbed with soft paper until dried then weighted before being put in convector oven or vacuum heat resistant plastic bag for grilling or boiling until the internal temperature reached 72 °C and then cooled at room temperature and weighted again. Cooking loss was determined after cooling the samples for 30 min at room temperature.

From each boiling sample, 6 cores, diameter 12.7 mm, 20-22 mm long, were obtained and the shear force was determined using a Warner Blatzler Shear device attached to an Instron Model 5565 Universal test machine. The shear force was determined using test speed 200 mm/min with a 5 kN load cell calibrated to read over the range 0 to 50 N.

Sensory evaluation

LD muscle between the 14^{th} and the 15^{th} ribs without connective tissue and tendon was evaluated for panel taste. LD was roasted in convector oven at 200 °C for 10 minutes then cut into small pieces (1.25 x 1.25 cm) and served on warm plate to 6 panelists which were trained, and tested according to Viriyajari (1992).

Boar taint

Boar taint was determined by the concentration of skatole using HPLC (Model Shimadzu, japan) according to Dehnhard *et al*. (1993) and testosterone in blood plasma was analyzed by the RIA method according to Wasser *et al*. (1993).

All the data on meat quality traits and off-flavour were assessed by Analysis of Variance (Chantaluckhana, 1997). The test on difference among means of various group was performed by LSD and the study on the correlation among various factor was done by Pearson Correlation through SPSS program for Windows (Vanitbuncha, 1999).

Results and discussion

Nutritive value

Moisture percentage was not statistically significantly different among groups but that in boars tended to be higher than those in gilts and barrows, respectively (table 1). Weatherup *et al.* (1998) and Nold *et al.* (1999), however reported that in their studies that boars had higher meat moisture content than gilts and barrows ($p<0.05$). For protein content, the present study found no statistical difference among the three groups but boars tended to have more meat protein content than gilts and barrows which were similar to the results of Kumar and Barsual (1991). Boars and gilts were found to have lower fat content than barrows. Although were not statistically different in terms of fat content in meat (Intramuscular fat, IMF). This result supported finding by Friesen *et al.* (1994). The difference in nutritive values among groups can be ascribed to the different of hormone in different gender. Androgen, especially, produced in testicles, which functions to promote muscle growth and change, enhance protein synthesis while reducing fat accumulation in animals, presents less in gilts and barrows (Khanthapanit, 1986)

Cooking loss

LD from boars and gilts had higher boiling loss percentage as compared to barrows (22.09 and 23.10 vs 16.22%; respectively; $p<0.05$) but there was no difference in grilling loss percentage among the 3 groups studied. However, boars had a tendency to have higher grilling loss percentage than those of gilts and barrows (20.22, 19.75 and 17.58%; respectively) as also stated by Weatherup *et al*. (1998) This might due to the more aggressive behavior of boars which leads to great intensity of stress which in tern draws more glycogen into use. This consequently affects greatly the post mortem glycolysis process leading to high drip loss. Figure 1 shows that boiling loss was positively correlated with grilling loss ($r=0.77$; $p<0.06$). This can be explained that boars had higher protein content when meat is cooked the meat protein will be denatured such that protein looses water dissolving capacity and gives risk to coagulation of protein molecule (Khanthapanit, 1986).

Boar taint

Skatole concentration in backfat, as an indicator of boar taint, it was found that boar backfat had significantly higher concentration than those of barrows and gilts (49.09, 37.60 and 32.88 μg/g respectively; $p<0.05$) similar to the findings of Nold *et al*. (1997). For this stydy skatole concentration is lower than the EU regulation. Testosterone concentration in boar blood plasma was higher than those in barrows and gilts (277.67, 0.09 and 0.020 pg/ml; respectively; $p<0.01$). Patterson (1968) reported that the pathway of androstrenone and testoseterone synthesis was the same so that in this study testosterone was a indirect indicator of androstenone.

Sensory evaluation and shear values

Table 2 gives the results of sensory evaluation of LD of different gender. LD from boars was inferior to barrows and gilts' in terms of tenderness (2.86, 3.55 and 3.53; respectively; $p<0.01$). These results were similar to the work by Nold *et al.* (1997) and the results of shear values in terms of maximum force. Juiciness and overall acceptability of

boars' LD were lower than those of barrows and gilts ($p<0.05$) but there was no difference in flavour among groups that meaned the panelist could not detect the off-flavour from boar meat.

Correlation among meat quality parameters

Table 3 gives the results of correlations among meat quality traits. The sensory evaluation in terms of tenderness, flavour, juiciness and overall acceptability were highly positively correlated ($p<0.010$) but flavour and overall acceptability were highly negatively correlated with skatole concentration. These results were confirmed by the findings of Nold *et al*. (1997) and Bonneau *et al*. (1997).

Conclusion

From this study it can be stated that boars meat was inferior to borrows and gilts in terms of meat quality but boar meat production is an alternative way to produce lean carcass with special goal without off-flavour to be detected.

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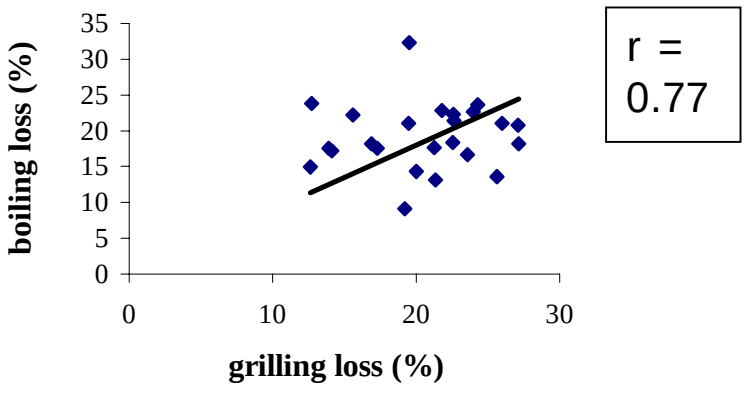

Fig 1: Correlation of boiling and grilling loss

Table 1: Nutritive value, cooking loss and skatole and testosterone concentration of different gender

Parameter	Barrow	Boar	Gilt	Mean	SE
No. of samples	8	8	8	-	-
Nutritive value of loin (LD)[1/]					
Moisture, %	73.22	73.43	73.36	73.33	0.18
Protein, %	21.34	21.69	21.45	21.49	0.12
Fat, %	2.55[a]	1.63[b]	1.57[b]	1.92	0.20
Cooking loss					
Boiling loss, %	16.22[b]	22.09[a]	23.10[a]	20.47	0.91
Grilling loss, %	17.58	20.22	19.75	19.18	0.96
Skatole, µg/g	37.60[b]	49.09[a]	32.88[b]	39.86	2.31
Testosterone, pg/ml	0.09[B]	277.67[A]	0.02[B]	92.59	45.90

[a, b] Mean within row showing different superscripts are significantly different (P<0.05)

Table 2: Sensory evaluation and shear values of LD of different gender

Criteria	Barrow	Boar	Gilt	Mean	SE
Loin chop (*Longissimus dorsi)*					
Tenderness[1/]	3.55[A]	2.86[B]	3.53[A]	3.30	0.08
Flavour[1/]	3.24	3.10	3.30	3.21	0.07
Juiciness[1/]	3.29[a]	2.82[b]	3.11[a]	3.06	0.08
Overall acceptability[1/]	3.41[a]	2.97[b]	3.31[ab]	3.22	0.08
Shear force					
Maximum force, N	26.45[b]	35.84[a]	33.92[a]	32.07	1.32
Extension, mm	17.87	17.98	17.19	17.68	0.21
Energy, J	0.10[b]	0.14[a]	0.12[ab]	0.12	0.01

[A, B] Mean within row showing different superscripts are highly significantly different (P < 0.01)

Table 3: Correlation between panel test, skatole and testosterone concentration of finishing pigs on different gender

	Tenderness	Flavour	Juiciness	Acceptabilit	Skatole	Testosteron
Tenderness	-	0.76**	0.77**	0.89**	-0.58**	-0.44*
Flavour	-	-	0.85**	0.92**	-0.48**	-0.52**
Juiciness	-	-	-	0.88**	-0.41*	-0.41*
Acceptabilit	-	-	-	-	-0.58**	-0.52**
Skatole	-	-	-	-	-	0.31
Testosteron	-	-	-	-	-	-

Correlations significantly different : ** = P<0.01; * = P<0.05