INTRAMUSCULAR FAT DEPOSITION PATTERN IN FEMALE FINISHER PIGS IN WESTERN AUSTRALIA

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Background

The last ten years, in keeping with the increased consumer health awareness, has seen the overall fat content of Australian pork reduced by 60-65%. In order to achieve this the Australian pork industry 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, the use of in-feed anti-microbial agents, metabolic modifiers to improve carcass leanness. At the same time, the pig industry also gradually adopted heavier slaughter weights to maximise production efficiencies. The production of leaner and heavier pigs has had a detrimental effect on intramuscular fat (IMF) levels and the perception is that Australian pork is now tougher, less moist and has reduced flavour. Recent studies by Channon and Baud (2001) indicate that IMF levels in Australian pigs are as low as 1% in some genotypes while in others, IMF levels can vary between <1% to 4%. The IMF threshold for optimal pork eating quality is 2.5% (Bejerholm and Barton-Gade, 1986).

Objective

The majority of the research to date has concentrated on the use of 'coloured' breeds such as Duroc to increase the level of IMF to improve the eating quality of pork. However, the cost of changing a herd's genotype to improve IMF levels can be cost prohibitive given that the present payment schedule is based on carcass weight and backfat and not quality parameters. Cisneros *et al.* (1996) investigated the use of nutrition to improve the quality of pork and reported that reducing the protein to energy ratio of the finisher phase increased IMF deposition, but was also associated with a corresponding increase in carcass fat and decreased feed conversion. Hence there is a need to develop a dietary management strategy that is both economically feasible to the pork producer and consistently delivers quality pork with appropriate IMF levels (>2.5%) suitable for both the export and domestic consumer. However, before any on-farm nutritional strategies to increase IMF can be undertaken, it is essential to gain a better understanding of IMF deposition in pigs in relation to body fat and muscle deposition. The objective of this experiment was to determine the IMF deposition pattern of crossbred female pigs with high Duroc bloodlines (50%) in relation to body fat and lean muscle deposition.

Methods

A total of 80 Large White x Landrace x Duroc crossbred (approximately 50% Duroc bloodlines) female pigs of similar age were used in this experiment. The pigs were group housed (8 pigs per pen) in 10 pens. The pigs were stratified by weight and randomly allocated to one of the 10 pens. The pigs in each pen were allocated a slaughter age over a 10-week period betqween 16 to 25 weeks of age. All pigs were *ad libitum* fed a commercial grower and finisher diet and had *ad libitum* access to water via nipple drinkers. At their pre-designated slaughter age, all the pigs from a pen were transported 20 km to a commercial abattoir. The pigs were stunned using a carbon dioxide dip-lift stunner (Butina, Denmark). Exsanguination, scalding, dehairing and evisceration were performed according to standard commercial procedures prior to entering the chiller. Twenty-four hours post-slaughter the right side of each carcass was divided into primal cuts (shoulder, loin, belly and ham), weighed and frozen. The total body fat and lean content of each half carcass and then each primal cut (shoulder, loin, belly and ham) was estimated using the Dual Energy X-ray Absorptiometry (DXA) method. Muscle samples of *Longissimus dorsi*, *Biceps femoris* and *Supraspinatis* were collected for intramuscular fat % which was determined chemically using the ether extraction method (AOAC, 1990).

Results and Discussion

The change in the live weight, carcass weight, backfat thickness, fat and lean muscle content of the carcass, and intramuscular fat levels in the shoulder, loin and ham primal cuts of femals crossbred pigs from 16 to 25 weeks of age are presented in Table 1. The results indicate that liveweight and carcass weight significantly increased from 16 to 25 weeks of age. Backfat depth at the P2 site and carcass fat significantly increased from 16 to 25 weeks of age, while carcass lean muscle gradually decreased ($P<0.05$) for the same period. The intramuscular fat % of the shoulder and loin muscles did not change significantly from 16 to 25 weeks of age, however, IMF levels of the ham muscle varied with age, peaking at 21 weeks of age. The intramuscular fat % was highest in the shoulder muscle, lowest in the ham, while the loin muscle had intermediate IMF levels. The average IMF level in the loin, and shoulder muscle of female pigs from pigs aged 16 to 25 weeks reported in this experiment were similar to or above the threshold 2-2.5% level. However, the IMF levels in the ham from pigs slaughtered at 17 and 19 weeks of age were below the IMF threshold required for optimal eating quality. Results from the present experiment indicate that the IMF levels in the shoulder, loin and the ham for the most part remained relatively constant during 16 to 25 weeks of age (69 to 120 kg live weight). This is consistent with the recent studies which similarly reported no effect of slaughter weight on IMF % in pigs slaughtered at 80, 100 and 120 kg liveweight (Ellis *et al.*, 1996). Also, the IMF % in the shoulder, loin, and ham muscles were poorly correlated ($r^2 = <0.225$) with age, carcass weight, backfat at the P2 site, carcass fat % and carcass lean muscle %.

Conclusion

The results from this experiment indicate that intramuscular fat levels in crossbred female pigs that have high Duroc bloodline are higher or at similar levels to the threshold vale of 2.5% required for optimal eating quality. These data also indicate that intramuscular fat levels differ according to anatomical location of the muscle and are poorly correlated to carcass fat or lean muscle tissue content. These data indicate that IMF development in the finisher pigs occurred in the period prior to 16 weeks of age or 68 kg liveweight. This would suggest that the weaner and grower growth phases are the most appropriate periods to nutritionally manipulate intramuscular fat deposition in pigs to improve the eating quality of pork without negatively affecting the carcass quality.

Pertinent Literature

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Table 1. The effect of age on live weight, carcass weight, lean muscle and fat content of the carcass and intramuscular fat (IMF) percentage in the shoulder, loin and ham primal cuts of female pigs.

	Age (weeks)											
	16	17	18	19	20	21	22	23	24	25	l.s.d.	P-value
Live weight (kg)	68.7	72.3	72.5	79.1	87.7	94.9	104.6	107.2	112.0	119.7	9.60	<0.001
Carcass weight[1] (kg)	44.4	44.0	45.4	50.4	55.0	60.2	67.2	69.4	72.8	77.6	6.42	<0.001
Backfat - P2 site (mm)	11.1	10.4	10.7	11.3	12.7	12.5	13.4	12.6	16.0	15.8	2.83	<0.001
Carcass fat (%)	17.8	17.6	16.1	16.0	17.7	17.6	17.9	18.7	20.4	19.1	2.19	0.008
Carcass lean (%)	79.9	80.2	81.4	81.4	79.8	79.9	79.5	78.6	77.3	78.4	2.15	0.007
Shoulder IMF (%)	3.95	3.14	4.20	4.57	3.62	4.42	4.63	4.30	4.20	3.77	1.13	0.238
Loin IMF (%)	2.77	2.70	2.84	3.11	2.76	3.12	2.88	2.52	2.75	2.32	0.791	0.665
Ham IMF (%)	2.63	1.80	2.35	1.98	2.33	2.94	2.88	2.34	2.21	2.19	0.687	0.003

[1]AUSMEAT Trim 13 - Head OFF, flare OUT, foretrotters OFF, hindtrotters ON