EFFECT OF ORGANIC REARING SYSTEM ON PORK QUALITY AND PREFERENCE

Liorančas, V., Bakutis, B. and Januskeviciene, G.

Lithuanian Veterinary Academy, Tilzes 18, 47181, Kaunas, Lithuania, viktoras@lva.lt

SUMMARY

Although organic meat production is only a small proportion of the total meat production in EU, it is increasing in size to take demands of certain market segments into account. The current Lithuanian production systems for pig meat are optimized for high production and uniform product quality. However, to adapt to sustainability goals concerning animal welfare and environment impact and to improve the competitiveness of Lithuanian meat, the conventional systems must be continuously evaluated.

This study concerns scientific studies results comparing indoor and outdoor pig finishing systems. There are some real differences in pork quality noted in the literature. However, differences in pork quality vary among the different environments that were investigated. Consumer perception is such that when they enter a retail environment they are willing to buy pork products with social assurances.

Keywords: pig finishing systems, pork quality; pork quality measures

INTRODUCTION

The consumers of organic pork associate organic pig production with a high standard of animal health and welfare and with a high degree of food safety and quality. The development of organic pig production in the European Union is affected by EU-regulation 1804/1999 (Anon., 1999). This EU-regulation, which was implemented in 2000, provides a framework for animal health and welfare management in organic pig production.

At present, only a few organic animal husbandry farms exist within the Lithuania, but the market is developing and a major expansion in organic production is anticipated. Although, organic pig production is a small-scale system compared with organic milk and beef production. This weaker development seems most likely to be due to difficulties for pig producers to comply with the organic standards, which impose comparatively more pronounced changes in the way of production than e.g. in ruminant production systems. Pigs should have access to roughage and to grazing in the summer period although finishers can be kept in barns if access to an outdoor rum. Information on the optimal methods to achieve biologically and economically efficient production under organic standards is urgently needed. In this study overview of scientific studies focusing on rearing system influence on pork quality and preference has been done.

PORK QUALITY IN AN INDOOR AND OUTDOOR FINISHED PIGS

Although benefits and options of keeping pigs in free range systems have been described in different European countries (Van der Wal, 1993; Watson & Edwards, 1997), this production method is not very common in some EU countries. There are some advantages and disadvantages shown in Table 1. Post-mortem pH and water holding capacity may be reduced in outdoor pigs (Warriss et al., Enfält et al., 1997). A comparison of the effects of environmental housing systems on pork colour and sensory characteristics are included in Table 1. Loins from outdoor reared pigs had a lower ultimate pH, higher drip loss, and higher Warner-Bratzler shear force values (Enfält et al., 1997) than loins from indoor finished pigs during the winter months in Sweden. Meat from outdoor finished pigs also had more lactate and crude protein, higher glycolytic potential, less intramuscular fat, and less water (Enfält et al., 1997).

Several researchers have found no differences in pork eating quality measurements comparing pork from indoor and outdoor reared pigs (van der Wal, 1991; Barton-Gade and Blaabjerg, 1989). Beattie et al. (2000) reported that pigs from enriched environments produced pork with greater tenderness than pigs rose in barren environments. Jonsäll et al. (2001) reported that ham from outdoor reared pigs was less juicy and acidulous than ham from indoor reared pigs ($P < 0.05$) but no differences were found in tenderness, odour intensity, or meat taste between the indoor and outdoor reared groups. Maw et al. (2001) reported that pigs housed on straw bedding produced bacon with a stronger fried meat flavour than bacon from pigs housed on concrete or slats ($P < 0.05$). Bacon from straw-bedded pigs was darker in colour than bacon from pigs raised either on concrete or slatted flooring (Maw et al., 2001). Other researchers have found no effect of physical activity on sensory qualities of cuts from the ham and loin (Petersen et al., 1997; van der Wal et al., 1993; Essén–Gustavsson et al., 1988), but the degrees of exercise and enrichment of the environments varied.

A summary of carcass measurements, colour scores, and sensory characteristics comparing loins of pigs raised in indoor and outdoor finishing systems is included in Table 2. Pigs finished outdoors during the warm months had more back fat at the last rib than pigs finished indoors. For the group processed in March, the outdoor- born pigs had more back fat at the 1st and last rib than the indoor-born group. Also, outdoor-reared pigs had more back fat at the last rib but less marbling on the loin eye.

Outdoor born and finished pigs had lower L* and higher a* values than indoor born and finished pigs ($P < 0.05$). Minolta a* values were highest for the pigs born and finished outdoors, indicating a redder colour of the loin muscle.

Chops from the outdoor-born pigs (processed in July) had more desirable sensory panel scores for flavour intensity (Table 2) and lower shear force values, indicating more tender meat. However, no differences were detected in sensory panel scores or shear force values of loins from pigs processed in March. Loins from both groups had acceptable shear force values that would be considered very tender by most consumers (Miller et al., 2001).

Other studies compared each of the following finishing systems: indoors on concrete slats, indoors in converted poultry buildings on deep bedding with curtain sides, outdoors on a dirt lot, and outdoors on alfalfa pasture. Results from these experiments showed that pigs finished in alternative systems have similar carcass and pork quality characteristics compared to pigs finished in a conventional indoor system (Jessica G. et al., 2003). Outdoor-housed pigs grew faster than indoor-housed pigs during the warm months (Gentry et al., 2002a). Seasonal differences in growth patterns may exist with outdoor finished pigs. Outdoor-reared pigs had heavier carcass weights, less back fat at the last rib, larger loin eye area, and higher loin marbling scores ($P <$

0.05, Gentry et al., 2002a). In addition to growth and pork quality advantages, loins from the outdoor-finished pigs had higher scores for initial juiciness (more desirable) and less off-flavour ($P < 0.05$) as evaluated by a trained sensory panel. Overall, outdoor or deep-bedded systems may increase growth rates of pigs if suitable land area and resources are available, but pork quality of loins will be similar for pigs finished in either conventional or alternative systems.

Few differences were detected in loin muscle quality (colour or pH) among the experiments. Shear force values were higher (tougher) for outdoor finished pigs in three experiments but lower (more tender) in two experiments. Again, results in loin muscle quality between indoor and outdoor (or alternative) housing systems are variable (Jessica G. et al., 2003). Many other factors could be confounding results such as environmental conditions, management, diet, genetics, or others. Swine producers should consider all of these factors when choosing a production system to best suit their environment.

Table 1. Pork loin measurements of alternative systems for finisher pigs.

			Alternative vs. Conventional[a]		
Authors	Year	Systems	L*[b]	pH	Shear force[c]
Warriss et al. (UK)	1983	Non-intensive (outdoor) vs intensive	–10%	NS	–
van der Wal (Netherlands)	1991	Free range vs indoor	NS	NS	NS
van der Wal et al. (Netherlands)	1993	Straw vs. concrete	NS	NS	NS
Sather et al. (Canada)	1997	Outdoor vs. indoor-winter	NS	NS	NS
		Outdoor vs indoor-summer	–3.0%	NS	+18%
Enfalt et al. (Sweden)	1997	Outdoor vs indoor	+5.8%	–1%	+12%
Beattie et al. (UK)	2000	Enriched vs barren	–	–	–9%
Gentry et al. (Texas, USA)	2002	Outdoor pasture vs. slats, birth environment	NS	NS	NS
		Outdoor pasture vs. slats, rearing environment	–4.7%	NS	–9.1%
Olsson et al. (Sweden)	2003	Organic vs conventional	NS	–0.9%	+12.1%

[a]A positive value indicates an increase for the alternative production system and a negative value indicates a decrease for the alternative production system compared to the indoor system.
[b]A decrease in L* indicates a darker coloured loin. L* values range from 1 to 100 with 1 = pure black and 100 = pure white.
[c]A higher shear force value indicates tougher meat.

Table 2. Environmental effects on pork carcass measurements, loin shear force and sensory characteristics over seasons (Gentry et al., 2002b; Gentry et al., 2003).

Processing date	July					March			
	Birth		Rearing			Birth		Rearing	
Measure[c]	Indoor	Outdoor	Indoor	Outdoor		Indoor	Outdoor	Indoor	Outdoor
No. of pigs	12	12	12	12		12	12	12	12
1st rib BF, cm	3.8	3.7	3.8	3.7		3.9[b]	4.3[a]	4.1	4.2
Last rib BF, cm	2.5	3.1	2.8[b]	3.6[a]		2.1[b]	2.5[a]	2.2	2.4
LEA, cm^2	49.7[b]	54.6[a]	51.3	52.9		43.5	40.2	42.7	40.9
Marbling score[d]	2.3	2.7	2.5	2.5		1.3	1.3	1.5[a]	1.1[b]
Shear force, kg	2.1	2.1	2.2[a]	2.0[b]		2.2	2.1	2.1	2.1
L*[e]	49.5	49.2	50.5[a]	48.1[b]		53.6	55.0	54.9	53.8
a*[f]	1.4[b]	2.4[a]	1.6	2.2		4.2[b]	5.0[a]	4.2[b]	5.0[a]
b*[g]	10.2[b]	10.9[a]	10.5	10.7		8.9[b]	9.8[a]	9.2	9.6
Flavour intensity[h]	6.1[b]	6.5[a]	6.2	6.3		5.9	5.9	6.0	5.9

[a,b]Means in the same row within a main effect (indoor vs outdoor) with different superscripts differ ($P < 0.05$).

[c]No treatment effects were observed for firmness, sensory panel juiciness, or sensory panel tenderness scores.

[d]Marbling scores were measured on the *Longissimus* muscle at the 10th rib interface on a scale of 1 to 10, 1 = devoid and 10 = moderately abundant or greater.

[e]Minolta L* values range from 1 to 100 with 1 = pure black and 100 = pure white, a lower L* value indicates a darker colored pork chop.

[f]Minolta a* values represent red to green colours with a higher value indicating more red colours

[g]Minolta b* values represent yellow to blue colour with a higher value indicating more yellow.

[h]Scores for pork flavour intensity range from 1 to 8 with 1 = extremely bland and 8 = extremely intense pork flavor.

CONCLUSIONS

It can be concluded, that results comparing indoor and outdoor pig finishing systems have been variable. Some reasons for this variation include differences in pig birth environment, seasonal effects, and quality of ground or bedding surfaces. Improvement in pig's behaviour, performance and meat quality characteristics may be substantial when the difference in housing conditions is substantial. A possible advantage for outdoor rearing may be linked to increased a* values and decreased L* values of the loin muscle. Darker coloured pork is more desirable for export markets because of the increase in water holding capacity. A careful economic analysis should be conducted to determine if increased back fat and feed: gain that is associated with outdoor finished pigs could be offset by higher market prices for meat products from pigs finished in an outdoor environment. Alternative nutrition research could lead to decreased back fat levels of outdoor finished pigs. If consumers are willing to pay more for products that are produced as "sustainable", "natural", or others, then these production systems could be very successful in the future.

There are some real differences in pork quality noted in the literature. However, differences in pork quality vary among the different environments that were investigated. Consumer perception

is such that when they enter a retail environment they are willing to buy pork products with social assurances. In some cases, consumers may believe the alternative pork products will taste better. It can be concluded clearly that alternative products do not taste worse than conventional products. Pork produced from pigs born and reared outdoors was equal to or better than pork from conventional systems under some circumstances in our experiences.

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