

Effect of pig growth rate and health status on meat eating quality

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Introduction Growth rate is an important performance indicator in pig production and therefore influences profitability. There is also evidence that faster growing pigs have superior tenderness (MLC, 1989), possibly linked to faster muscle protein deposition through the activity and expression of proteolytic enzymes. Slow growth could also result in higher boar taint levels in entire male pigs because they will be older and sexually more mature at slaughter (MLC, 1989). The current project was therefore undertaken to investigate the effect of variations in growth rate on tenderness and boar taint.

Materials and methods Two hundred and twenty five loins were examined from Large White x Landrace pigs involved in a 3 x 2 x 2 factorial experiment. Factors were 3 growth categories (Fast, Slow and Interrupted), 2 sexes and two final live weights, 90 and 110kg. Growth rate was measured between weaning and slaughter, with pigs fed *ad libitum*. Guidelines for fast growth were >600 g/d to 90kg and >700 g/d to 110kg. Guidelines for slow growth were around 500 g/d to 90kg and 590 g/d to 110kg. Interrupted growth pigs were those that had suffered a period of weight loss presumed to be due to infection. Final numbers in the 3 growth categories were 96 fast, 86 slow and 43 interrupted. Loins were delivered to Bristol University where various meat quality measurements were made. The loins were conditioned at 1°C for 10 days then stored at -20°C before analysis. A Stable Microsystems Texture Analyser fitted with Volodkevitch jaws was used to measure toughness. Skatole and androstenone concentrations in subcutaneous fat from the loin region were measured using the procedures of Whittington *et al.* (2004). Steaks 2.5cm thick were presented to a 10 member taste panel for sensory analysis after griddling to 72°C internal temperature. Data were statistically analysed using general linear models (GLM), with growth category, carcass weight group and sex as factors and including interaction terms.

Results The growth rate, fat thickness, toughness and skatole measurements from both sexes and carcass weights are presented in Table 1. P₂ fat thickness was approximately 1mm greater in the Fast than the Slow and Interrupted groups. There was a strong tendency for toughness to be lower in the Fast group but a significant growth category x carcass weight interaction prevented this being a statistically significant effect. Results in Table 2 show that toughness was significantly lower in the Fast groups at both 90 and 110 kg carcass weight.

Table 1 Growth rate, P₂ fat thickness, toughness and skatole in growth category groups

Variable	Growth category			p-value	sig.	sed
	Fast	Slow	Interr			
Finisher ADG (kg)	0.74 ^a	0.57 ^b	0.56 ^b	†	*	0.036
P ₂ (mm)	10.13 ^a	9.06 ^b	8.43 ^b	<0.001	***	0.351
Toughness (kg)	4.40	5.22	5.41	*	ns	0.405
Skatole (µg/g)	0.068 ^a	0.052 ^b	0.054 ^{ab}	0.005	**	0.007

† * Sig. Interactions between sex and growth category and carcass wt and growth category respectively

Table 2 Effects of growth category on toughness in carcass weight groups

Weight	Growth category			p-value	sig.	sed
	Fast	Slow	Interr			
90 kg	4.49 ^b	4.81 ^{ab}	5.35 ^a	0.019	*	0.305
110 kg	4.32 ^b	5.63 ^a	5.47 ^a	<0.001	***	0.272

The results for skatole and androstenone in males are in Table 3. The concentrations of both the compounds were highest in the Fast group. There were no significant differences in taint compound concentrations between 90 and 110kg carcass weight groups in males. The results for eating quality for Fast and Slow groups only for males weighing 110kg are in Table 4. Tenderness was higher in the fast group; abnormal odour and flavour were not significantly different between the groups.

Table 3 Effects of growth category on skatole and androstenone concentrations in males(µg/g)

Variable	Growth category			vr	p-value	sig.	sed
	Fast	Slow	Interr				
Androstenone	0.500	0.383	0.397	3.21	0.045	*	0.062
Skatole	0.080 ^a	0.056 ^b	0.060 ^{ab}	4.90	0.009	**	0.011

Conclusions The results show that pork tenderness was increased in pigs growing relatively rapidly in the finishing period. Skatole and androstenone concentrations were not higher in slow growing males and odour/flavour scores were not reduced. Therefore fast growth will benefit tenderness but not necessarily odour/flavour.

Table 4 Eating quality of griddled loins steaks (1 to 8 scales). Comparison of Fast and Slow groups in 110 kg males

	Growth category			p-value	sig.	sed
	Fast	Slow	Interr			
Pork odour of fat	3.73	4.20	4.20	0.025	*	0.205
Abnormal odour of fat	2.69	2.50	2.50	0.438	ns	0.241
Tenderness	4.22	3.81	3.81	0.004	**	0.139
Pork Flavour	3.95	3.91	3.91	0.804	ns	0.189
Abnormal Flavour	2.86	3.05	3.05	0.390	ns	0.217
Flavour liking	4.50	4.20	4.20	0.107	ns	0.183
Overall liking	4.33	3.91	3.91	0.020	*	0.179

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References

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Effects of low protein diets on fat deposition in the whole body and within the muscle and subcutaneous adipose tissue of pigs

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Introduction Protein is an expensive nutrient in pig diets and high protein diets lead to high N excretion, a source of pollution. Low protein nutritional strategies are therefore needed, but these often increase fat deposition. This study compared three nutritional strategies differing in protein and energy supply using genotypes with different propensities for fat deposition.

Materials and methods One hundred and ninety-two entire male pigs; half 0.75 Duroc (D) and half 0.75 Large White (LW) were fed *ad libitum* from 40 to 120 kg live weight on one of three nutritional strategies (Table 1). The pigs were group fed, eight animals per pen, on a breed x nutritional strategy basis, over four replicates. The dietary protein content was reduced across the strategies, with the concentration of lysine and other amino acids being reduced in relation to protein. The pigs were reared at Harper Adams then transported to the University of Bristol abattoir, where they were slaughtered and dissected as described by Brown and Wood, (1979). Data were analysed using GLM with breed and nutritional strategy as factors.

Table 1 Nutritional strategies

Wt range	Baseline (B)			SOTA ^d			LP ^e		
	DE ^a	CP ^b	L ^c	DE	CP	L	DE	CP	L
40-65	13.5	210	12	14.0	195	12	14.0	195	12
65-90	13.5	210	12	13.5	180	11	13.5	165	10
90-120	13.5	210	12	13.0	170	10	13.0	130	7

^a MJ Digestible Energy/kg ; ^b g/kg crude protein; ^c g/kg lysine; ^d 'state of the art'; ^e Low protein

Results Table 2 shows several significant breed x nutritional strategy interactions for different measures of fat within the empty body (carcass plus red and green offal components). The values in Duroc were similar across the nutritional strategies, rising slightly in some cases from B to SOTA to LP, while a greater response to nutritional strategy was found in LW, where the amount of fat increased significantly across the strategies in the order Baseline < SOTA < Low N. The same pattern was also found for the concentrations of intramuscular fatty acids in the *longissimus dorsi* muscle (LD) and in the subcutaneous adipose tissue depot in LW.

Table 2 The effects of breed x nutritional strategy on overall fat distribution

Variable	Duroc			LW			S.E.D.	P value
	B	SOTA	LP	B	SOTA	LP		
<u>Body measurements</u>								
Empty body weight (kg)	105.4	104.7	105.8	107.5	106.1	107.4	1.40	>0.05
P2 fat depth (mm)	17.9 ^b	18.9 ^b	19.0 ^b	13.8 ^a	15.0 ^a	18.4 ^b	0.93	0.013
Fat % EBW	15.5 ^b	15.7 ^b	15.9 ^b	12.1 ^a	13.7 ^a	16.9 ^b	0.77	<0.001
<u>EB fat depots (kg)</u>								
Total fat	16.5 ^{bc}	16.5 ^{bc}	16.8 ^{bc}	13.0 ^a	14.5 ^{ab}	18.2 ^c	0.88	<0.001
Subcutaneous	11.9 ^b	11.8 ^b	11.9 ^b	9.8 ^a	10.1 ^{ab}	13.4 ^b	0.59	<0.001
Intermuscular	3.5 ^b	3.7 ^b	3.7 ^b	2.6 ^a	3.0 ^{ab}	3.8 ^b	0.28	0.018
Thoracic (g)	44.3 ^a	51.1 ^{ab}	51.5 ^{ab}	41.9 ^a	45.2 ^a	66.0 ^b	6.00	0.035
Flare (g)	809.1 ^{ab}	851.3 ^b	838.8 ^b	566.0 ^a	699.3 ^{ab}	1007.3 ^b	0.07	<0.001
Omental & mesenteric (g)	151.3	149.3	162.5	124.1	130.7	156.0	16.80	>0.05
<u>Total fatty acid weights</u>								
LD muscle (mg/100g)	1785	1946	2078	914	957	1185	161	>0.05
Subcut adipose (g/100g)	73.9 ^{ab}	74.1 ^{ab}	73.9 ^{ab}	70.8 ^a	71.7 ^a	75.5 ^b	1.30	0.018

SED standard error of difference, maximum quoted. Means in a row with the same superscript do not differ significantly. Tukey-Kramer test at the 0.05 level, *post-hoc*.

Conclusions These results show that different pig breeds respond differently in terms of fat deposition to the levels of nutrients supplied, particularly protein and energy. Therefore it is necessary to balance diets to genotypes, especially for leaner genotypes such as LW, to avoid excess levels of fat deposition within the body.

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References

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