MEAT COLOUR IN DANISH LANDRACE PIGS *ANNO* 1973 AND 1995. I. GROWTH PERFORMANCE TRAITS AND THEIR RELATION TO MEAT COLOUR

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INTRODUCTION

Breeding programmes including selection for growth performance traits, *e.g.* daily gain and carcass lean content, may affect meat quality characteristics negatively through correlated responses, as reported by Cameron (1990) and Hovenier *et al.* (1992). Moreover, in the four Danish pig breeds, the amount of pigment in *M. longissimus dorsi* and *M. biceps femoris* has declined steadily from 1983 to 1988 (Barton-Gade, 1990). The reason for this is unknown. In an attempt to understand *in vivo* regulation of meat quality traits, a comparison was made of meat colour and related physiological parameters in two groups of pigs sampled from the Danish Landrace population in 1973 and 1995, respectively. Growth performance traits were expected to differ significantly between the two groups of pigs because of an intensive selection for these traits in the Danish Landrace from 1973 to 1995. This paper comprises preliminary results on the relation between meat colour and daily gain, kg feed/kg gain and carcass lean content. Results on the colour stability of meat from the same two groups of pigs are reported by Juncher *et al.* (1996).

MATERIALS AND METHODS

The present experiment included 77 Danish Landrace female pigs. Half of these (40) constitutes a group of Danish Landrace pigs *anno* 1973, originating from a herd of Danish Landrace pigs founded on a random sample taken in 1973 from all certified breeding herds in Denmark. This herd has not been selected for growth performance traits, and the inbreeding coefficient has been kept low. The second half of the animals (37) was bought in 1995 as piglets from certified breeding herds and is assumed to represent the Danish Landrace *anno* 1995. In the growth interval from 40 to approximately 100 kg live weight, all the pigs were housed in the same stable, grouped in pens of 6 and fed a Danish *anno* 1995 standard grower/finishing diet semi *ad libitum*.

Muscle Sampling, Meat and Carcass Quality Evaluation

After less than 5 min transport, the pigs were slaughtered at an experimental abattoir, using CO_2-stunning. pH was measured in *M. longissimus dorsi* (LD) 45 min (pH_1) and 24 h (pH_2) *post mortem* at the level of the last rib curvature with a HAMILTON pH electrode with proteolyte (P/N:238'080, HAMILTON Bonaduz AG, Schwitzerland). Following slaughtering, the carcasses were chilled overnight at 2°C, and the loin and ham joints were dissected into lean, bone, fat and skin. The carcass lean content was estimated from the following equation (Mortensen and Bejerholm, 1986):

$$\text{Carcass lean content} = 0.64 + 1.29 * (\text{kg meat + bone in loin}) + 1.80 * (\text{kg meat + bone in ham}) / \text{kg cold carcass}$$

Colour measurement was performed 24 h *post mortem* on a 4 cm thick chop, excised from LD at the level of the 5th lumbar vertebra and bloomed for 1 h at 2°C, using a Minolta Chroma Meter CR-300, with a D_{65} light source, calibrated against white tile. The tristimulus parameters L* a* and b* (representing lightness, redness and yellowness, respectively) were measured on four fixed sites of each chop surface.

Statistical Analysis

Data was analysed statistically by the GLM procedure of SAS (SAS, 1988). The statistical model included the effects of pig type with kg cold carcass as a covariate. Corrected means were estimated by the LSMEANS option of SAS. From the residual variation obtained after correcting for the effect of pig type, Pearson's correlation coefficients were calculated using the CORR procedure. Effects of pig type and correlation coefficients were considered significant if $P < 0.05$.

RESULTS AND DISCUSSION

Results on growth performance, carcass composition, pH and meat colour are presented in Table 1. Danish Landrace pigs *anno* 1995 consumed significantly less (47%) feed per kg gain and had significantly higher daily gain and carcass lean content (968 *vs.* 658 g/day and 59.9 *vs.* 57.3%) than the Danish Landrace pigs *anno* 1973. With respect to meat quality characteristics, there was no effect of pig type on either pH_1 or pH_2. However, the lightness (L*) was 9% higher, and the redness (a*) 12% lower in meat from pigs *anno* 1995 compared to *anno* 1973. The yellowness (b*) did not differ significantly between the two pig types.

Table 2 comprises correlation coefficients calculated between meat quality, growth performance and carcass composition traits. Significant negative correlation was found between the number of days in experiment and L* ($r = -0.24$) and between kg feed/kg gain and L* and b* ($r = -0.73$ and -0.58). Between daily gain and L* and b*, the correlations were insignificant, while significant correlation was found between the lean content in loin and ham and L* and b* ($0.23 < r < 0.28$). Moreover, a significant correlation of $r = -0.27$ appeared between L* and pH_2. No significant correlations were found between a* and the traits investigated.

CONCLUSIONS

The present study demonstrated significant differences in L* and a* values, determined 24 h *post mortem*, between Danish Landrace pigs *anno* 1973 and 1995. The L* value was strongly, negatively correlated to the amount of feed consumed per kg gain, the age of the animals (days in experiment) and the lean content in loin and ham. This result indicate that pigs with a low feed conversion ratio may produce meat with a more light colour. However, the effect of other factors influencing meat colour, such as the content of myoglobin and hemaglobin in the muscle and muscle fibre characteristics, has to be analysed before drawing any final conclusions.

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Table 1. Growth performance, carcass composition and meat quality characteristics in Danish Landrace pigs *anno* 1973 and 1995. LSMEANS, (standard errors) and significance level (P)

	Danish Landrace pigs *anno* 1973	Danish Landrace pigs *anno* 1995	P
Number of animals	40	37	-
Days in experiment	86 (1.6)	60 (1.7)	<0.01
Daily gain, g	658 (14)	968 (15)	<0.01
Kg feed/kg gain per pen	3.60 (0.11)	2.79 (0.11)	<0.01
Carcass weight, kg	69.4 (0.7)	72.5 (0.8)	<0.01
Carcass lean, %	57.3 (0.7)	59.9 (0.8)	0.02
Lean in loin, %	62.9 (0.6)	65.2 (0.6)	0.02
Lean in ham, %	69.1 (0.6)	70.7 (0.6)	0.06
Meat colour: L*	49.8 (3.5)	54.2 (3.6)	<0.01
a*	9.12 (1.8)	8.05 (1.9)	<0.01
b*	7.23 (1.5)	7.45 (1.6)	0.33
pH_1	6.17 (0.04)	6.18 (0.04)	0.85
pH_2	5.51 (0.02)	5.50 (0.02)	0.69

Tabel 2. Correlation coefficients between growth performance and meat quality traits. Coefficients in bold type are statistically significant

	Days in exp.	Daily gain	Kg feed/kg gain[1]	Carcass lean	Lean in loin	Lean in ham	pH_1	pH_2	L*	a*	b*
Days in exp.	1	**-0.83**	0.49	-0.07	-0.03	-0.04	0.03	0.20	**-0.24**	-0.09	-0.07
Daily gain		1	-0.56	0.05	0.09	0.11	-0.02	-0.14	0.22	-0.20	-0.02
Kg feed/kg gain[1]			1	0.01	**-0.66**	**-0.65**	0.12	-0.08	**-0.73**	0.01	**-0.58**
Carcass lean				1	**0.29**	**0.30**	0.01	-0.01	0.07	-0.05	0.01
Lean in loin					1	**0.71**	-0.01	0.08	**0.23**	0.13	**0.28**
Lean in ham						1	-0.06	0.21	**0.25**	0.08	**0.24**
pH_1							1	0.16	0.00	-0.20	-0.10
pH_2								1	**-0.27**	-0.05	**-0.22**
L*									1	-0.04	**0.59**
a*										1	**0.75**
b*											1

1: All correlation coefficients including kg feed/kg gain were calculated from means per pen