EFFECTS OF CARCASS FATNESS AND SEX ON THE COMPOSITION AND QUALITY OF PIGMEAT

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SUMMARY

Meat quality and chemical composition were measured in 300 'pork weight' (58 kg) carcasses falling into 3 fatness groups (8, 12 and 16 mm P2). Higher concentrations of water and C18:2 and lower concentrations of lipid in thinner backfat caused butchers to remark on the poor fat quality of loins from the 8 mm group, observations confirmed by laboratory tests. Muscle lipid in *M.longissimus* declined to 0.5% in the leanest group which caused a Consumer panel and a trained taste panel to remark on significantly less juicy meat. Entire males had higher concentrations of C18:2 than females throughout the range of P2 levels investigated.

INTRODUCTION

Research conducted in the 1970s at Bristol showed only small effects of fatness on the eating quality of pigmeat (eg Rhodes, 1970). Since then, backfat levels in the UK have fallen by about 0.5 mm per year, and presently average 13 mm at P2 (Meat and Livestock Commission [MLC], 1987). Some retailers have said that below 10 mm P2 various aspects of meat quality, including eating quality, are unsatisfactory and abattoirs have suggested that price penalties might be employed. The present study was therefore done to provide objective information of the effects of fat thickness on meat quality. Some of the results have been published by Kempster et al. (1986) and Wood et al. (1986).

MATERIALS AND METHODS

Three hundred carcasses (mean weight 58 kg) were selected in 10 abattoirs. In each abattoir, 5 producer groups of pigs were identified on a particular day, consisting of 3 entire males and 3 females falling into 1 of 3 fat thickness groups: lean, medium and fat (average P2 8, 12 and 16 mm).

The left side of each carcass was evaluated at the MLC's Meat Technology and Training Centre, Blisworth. Reflectance in *M.longissimus* at the last rib was measured with an EEL meter. Drip loss was measured in a chop from the last rib after hanging in a plastic bag at 0°C for 48h.

Leg and loin joints were evaluated for butchery and presentation characteristics by 45 butchers from independent and multiple retailers throughout the UK (Butcher panel). Loin chops, shoulder joints and leg joints were evaluated for eating

Table 1. Muscle and fat quality in loin

	P2 (mm) 8	12	16	SED and signif.
m. longissimus				
Reflectance (EEL)	47.3	45.7	44.9	0.87*
Drip loss (%) a	4.8	3.8	3.0	0.28***
Water (%)	75.7	75.6	75.4	0.96**
Lipid (%) b	0.5	0.7	1.0	0.04***
Subcutaneous fat c				
Firmness (1-8) d	3.3	4.3	5.5	0.17***
Firmness (g) e	432	637	913	46.7***
Lipid (%) b	69.2	77.0	81.6	0.73***
Cohesiveness f	52	23	4	

a % of muscle weight; b ether-extractable; c Firmness in shoulder fat, lipid and cohesiveness in loin fat; d Finger test; e Compression test; f % of samples showing 'fat separation'.

Table 2. Results from Butcher panel evaluation of loin joint[a]

	P2 (mm) 8	12	16	Signif.
Much too fat	0	4	39	***
Much too lean	15	1	0	***
Fat too soft	32	15	6	***
Excessive tissue separation	46	18	11	***
Muscle too wet	40	23	18	***
Will cook and eat poorly	28	10	14	***

[a] Values are % of loins in categories indicated

Table 3. Eating quality of loin chops

	P2 (mm) 8	16	Signif.
Consumer panel a			
Extremely or very tender	35	37	**
Slightly to extremely tough	18	12	**
Extremely or very juicy	16	23	***
Dry	16	9	***
Excellent or very good flavour	35	35	NS
Trained taste panel b			
Tenderness	1.0	1.1	NS
Juiciness	1.1	1.3	**
Flavour	1.5	1.7	NS
Overall acceptability	0.7	1.0	NS

a Figures are % of samples in a given category.
b Scores for tenderness, flavour and overall acceptability on a scale -7 to +7. Juiciness scale 0 (dry) to 4 (extremely juicy)

Table 4. Fatty acid composition of backfat (last rib, inner layer, as % of total fatty acids)

	P2 (mm)			SED and
	8	12	16	significance
C14:0	1.5	1.5	1.5	0.02 NS
C16:0	24.5	25.4	25.9	0.18 ***
C16:1	2.7	2.7	2.7	0.06 NS
C18:0	13.1	13.8	13.9	0.21 ***
C18:1	40.3	41.8	43.1	0.31 ***
C18:2	14.9	12.4	10.6	0.37 ***
C18:3	1.1	0.9	0.8	0.04 ***

quality by a Consumer panel consisting of 300 families who used their own individual cooking methods.

A foreloin joint and backfat samples were evaluated at IFR for objective meat quality tests. The chemical composition of muscle and subcutaneous fat was determined using standard methods. Firmness in the inner layer of shoulder fat was evaluated subjectively and objectively at 1°C using a Stevens compression response analyser (Stevens Weighing Machines, St Albans, UK). Chops were cut from the foreloin and evaluated by a trained taste panel following grilling to a central temperature of 80°C.

RESULTS

Results for muscle and fat quality are shown in Table 1. Reflectance and drip loss in *M.longissimus* increased slightly as fat thickness increased. The concentration of muscle lipid ('marbling fat') also increased with fat thickness (correlation 0.56). The firmness and cohesiveness of backfat increased markedly at higher P2 levels.

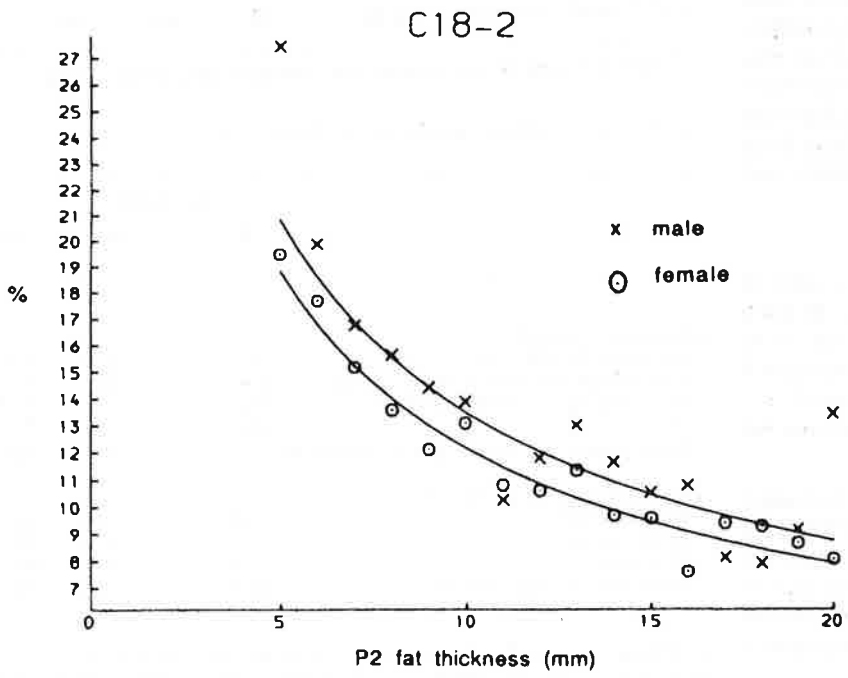

Fig. 1. Relationships between C18:2 (% of fatty acids) and P2 in entire male and female pigs.

The main results from the Butcher panel are shown in Table 2. Thirty-nine percent of loins from fat carcasses were 'much too fat' whereas only 15% of loins from lean carcasses were 'much too lean'. The results for fat softness and cohesiveness and muscle wetness show clear effects of fat thickness as expected from the results in Table 1. Butchers predicted that almost double the proportion of lean carcasses compared with fat carcasses would 'cook poorly'.

The main results from the Consumer panel (MLC) and the trained taste panel (IFR) involving chops from the 'lean' and 'fat' carcasses are given in Table 3. The Consumer panel considered chops from the lean (8 mm P2) carcasses to be less tender and juicy than those from the fat (16 mm P2) carcasses. The trained taste panel similarly gave lower scores for tenderness and juiciness to the lean chops (although only the juiciness differences was significant). The correlations between mean taste panel score and muscle lipid were 0.13, o.31 and 0.22 for tenderness, juiciness and overall acceptability respectively.

The main results for the fatty acid composition of backfat from the loin region (inner layer) are shown in Table 4. The concentrations of several fatty acids were affected by fat thickness, particularly C18:2 (linoleic acid). Relationships between fatty acid concentrations and P2 were curvilinear and there were consistent differences between the sexes (eg Fig 1).

DISCUSSION

The fact that the 6 pigs from individual producers were balanced across the fat thickness groups makes it extremely unlikely that the slightly higher paleness and drip loss of muscle from lean pigs was due to stress susceptibility (the halothane gene) or environmental factors. The greater wetness perceived by butchers was possibly connected with the higher water and lower fat content of *M.longissimus* from these pigs. No differences in reflectance or drip loss from leg or hand (shoulder) joints was detected (not shown).

The subjective scores of butchers and the objective tests at IFR show clear effects of fat thickness on the firmness and cohesiveness of backfat. These aspects of fat quality are an important part of the meat industry's overall perception of very lean pigs (MLC, 1983) and contribute to the butcher's view that meat from lean carcasses will 'cook and eat poorly' (Table 2). These predictions were only partly true, however. The Consumer panel and the trained taste panel detected lower tenderness and particularly lower juiciness in the leanest chops but good quality could not be guaranteed at 16 mm P2. At this high fat level, above the ideal

level for most UK consumers, 9% of chops were considered 'dry' (against 16% in the 8 mm group).

Nevertheless, the data strongly suggest that, in the absence of processing or other changes which can improve eating quality independently of P2, 8 mm P2 should be considered an optimum level for light pork carcasses.

The sex effect on fat tissue composition has been observed before (eg Wood and Enser, 1982) although this is the clearest evidence so far that there are 'real' differences between the sexes, independent of fat thickness. There was a consistent difference between the sexes in fatty acid composition (not only C18:2) so that entires had concentrations similar to gilts in which P2 values were about 15% lower throughout the range 5-20 mm.

The ratio of polyunsaturated to saturated fatty acids in the leanest group (0.41, 0.44 in entire males) was close to the recommended value for the UK diet as a whole (Department of Health and Social Security, 1984). Thus a reduction in the butcher's perceptions of quality and in juiciness on eating has to be balanced against possibly more visually attractive and 'healthier' meat.

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