Composition and quality of fat tissues in entire male pigs

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Introduction

Entire male pigs (boars) make up approximately 20% of the national pig kill in UK and to a large extent the early fears over boar taint have been shown to be exaggerated. However, more recently, some meat traders have said that fat tissue quality of boar carcasses is inferior to that of castrates; boars are said to have soft floppy fat which separates from lean more easily and consequently looks unattractive and is more difficult to slice. Since fat firmness is known to decline with fat thickness this difference between boars and castrates could simply be an effect of fatness. This work was therefore done to separate the effects on fat quality of fat thickness and castration.

Materials and Methods

Experiment 1

Thirty-two boars and 32 castrates from 14 litters were fed a diet containing 13.6 MJDE/kg at different levels from 27 to 87 kg live weight in order to produce pigs with a wide range in subcutaneous fat thickness. The following analytical procedures were used: Carcass composition (Brown and Wood, 1979); subjective fat firmness at the last rib position (Wood and Enser, 1982); and fatty acid composition of triglycerides from backfat samples from the last rib (Wood et al, 1978).

Experiment 2

Thirteen boars, 10 castrates and 21 gilts from 5 litters were fed a diet containing 13.0 MJDE/kg from 20 to 68 kg live weight. The same procedures were used as in Experiment 1.

Experiment 3

Twenty boars and 20 gilts from 12 litters were fed either a high energy: medium protein diet (12.9 MJDE, 179 g crude protein/kg) or a low energy: high protein diet (10.8 MJDE, 213 g crude protein/kg) from 20 to 87 kg live weight. The aim was to produce a wider range in backfat thickness than in Experiment 1. In addition to the procedures used in Experiments 1 and 2, firmness of the shoulder fat was objectively measured using the Instron materials testing machine as described by Dransfield and Jones (1983).

Results

Experiment 1

At the mean value for fat thickness (14 mm P2), boars had higher concentrations of water in backfat than castrates and lower concentrations of lipid (Table 1). There were only small differences in fatty acid composition as shown by the concentrations of stearic acid (C18:0) and linoleic acid (C18:2), these fatty acids having the most marked effects on lipid melting point. There was no difference in firmness.

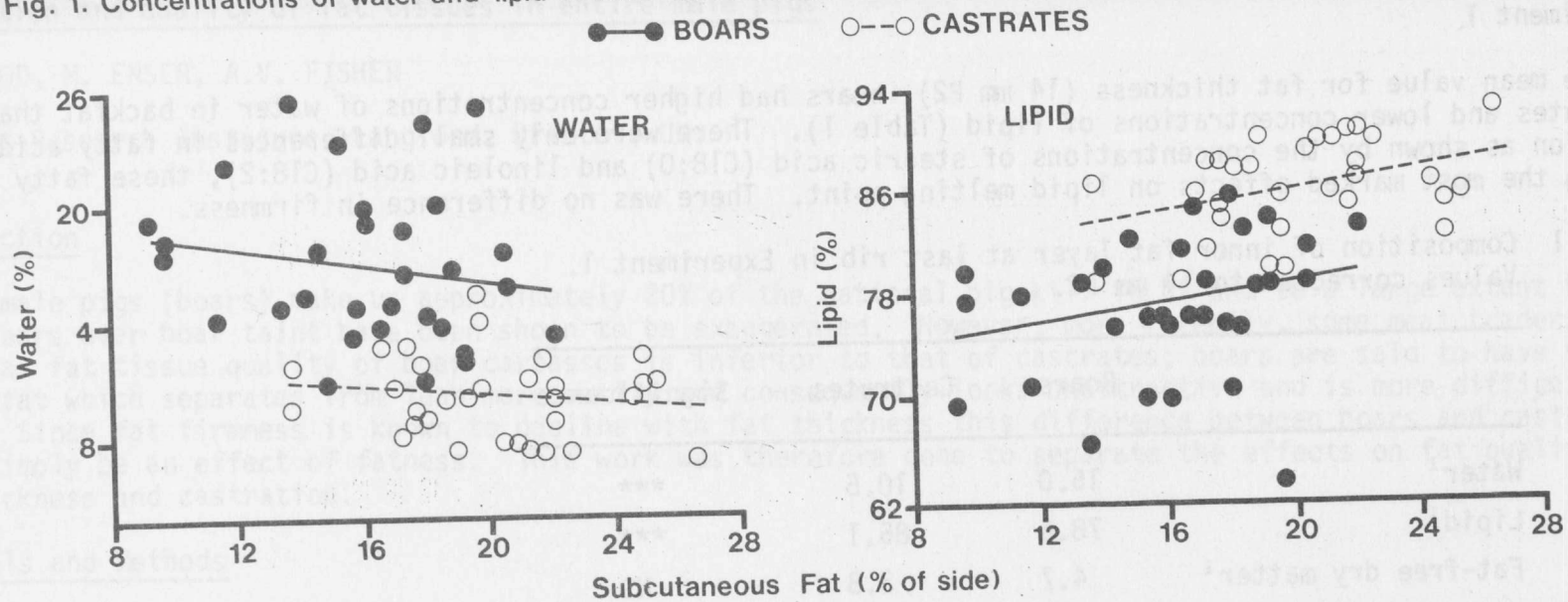
Table 1 Composition of inner fat layer at last rib in Experiment 1. Values corrected to 14 mm P2.

	Boars	Castrates	Significance
Water[1]	16.0	10.5	***
Lipid[1]	78.6	85.1	***
Fat-free dry matter[1]	4.7	3.8	NS
C18:0[2]	15.2	14.2	*
C18:2[2]	12.5	13.7	NS
Firmness[3]	3.0	3.0	NS

[1] % of fresh weight [2] % of fatty acids [3] Scores 1 v soft to 5 v firm

The effect of castration on the water and lipid content of backfat was apparent throughout the whole range of values for backfat thickness and proportion of subcutaneous fat in the carcass (Figure 1).

Fig. 1. Concentrations of water and lipid in inner backfat layer in relation to subcutaneous fat content of side.



There was no effect of castration on the relationship between the percentages of water and lipid in backfat. The pooled equation was % lipid = 98.9 - (1.27 x % water).

Experiment 2

Slaughtering at a similar final live weight produced characteristic differences in carcass composition between boars on the one hand and castrates and gilts on the other (Table 2). Differences in the concentrations of water and lipid were found between boars and the other two groups, the values for castrates and gilts being similar. The inner fat layer had a higher concentration of water and a lower concentration of lipid than the outer layer.

Table 2 Composition of carcass (side) and outer and inner fat layers at last rib in Experiment 2.

	Boars	Castrates	Gilts	s.e. of difference and significance
% of side				
Lean	58.2	55.4	57.3	0.88 **
Subcutaneous fat	17.1	20.7	19.3	0.94 ***
Outer fat layer (%)				
Water	16.7	12.7	13.3	0.83 ***
Lipid	78.3	84.1	83.2	1.30 ***
Fat-free dry matter	4.7	3.6	3.9	0.25 ***
Inner fat layer (%)				
Water	19.3	15.2	15.7	1.35 **
Lipid	73.8	80.5	79.6	1.89 ***
Fat-free dry matter	5.6	4.3	4.2	0.50 *

Experiment 3

Boars were leaner and had thinner fat than castrates (Table 3) and the mean values for firmness and cohesiveness were lower in boars. There were quite strong correlations between fat thickness and these measures of fat quality (r = 0.5 - 0.7) showing that the lower values for firmness and cohesiveness in boars were largely the result of thinner fat.

Table 3 Objective measurement of fat quality in Experiment 3

	Boars	Castrates	Significance
Lean (% of side)	63.6	61.1	*
C fat thickness[1] (mm)	6.2	8.8	**
Firmness[2] 2.5 mm	1.4	2.2	*
4.0 mm	3.1	5.1	**
Cohesiveness[3]	4.0	5.1	*

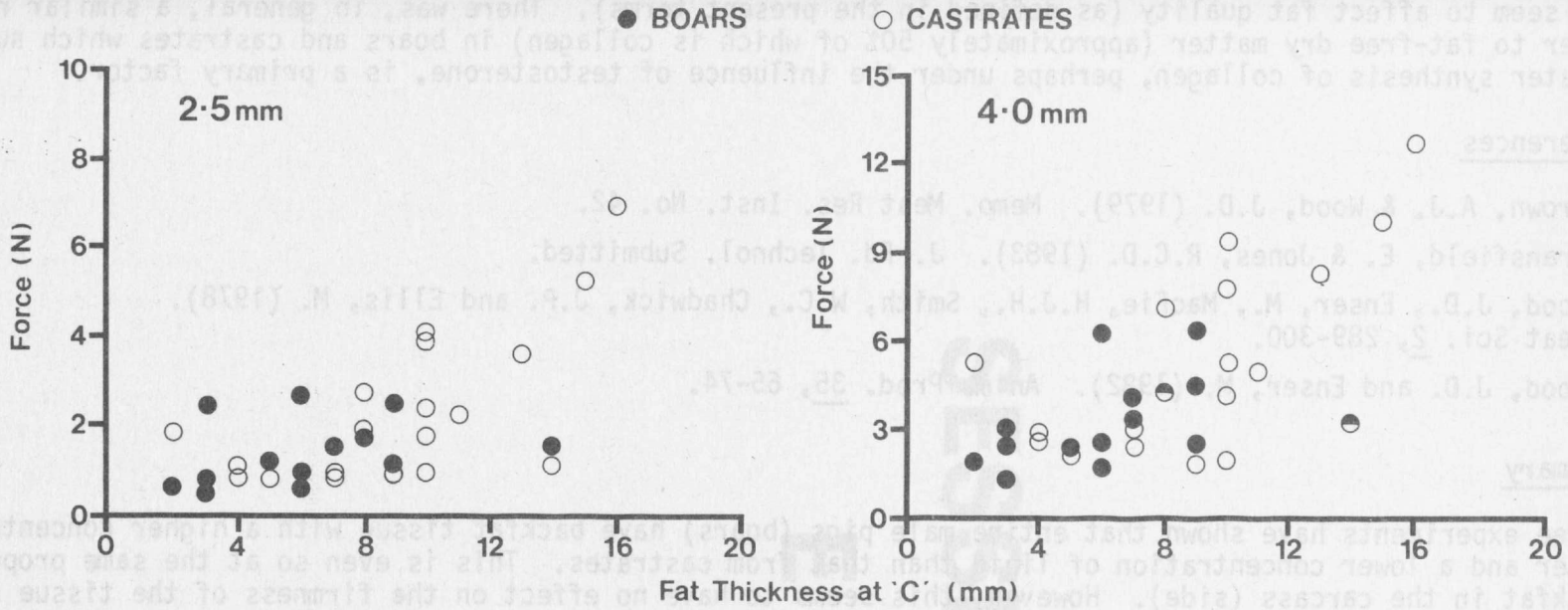
[1]Excludes skin thickness. [2]Force recorded (N) at 2.5 & 4.0 mm punch travel in inner layer at 3°C.

[3]Peak stress ($Nm^{-2} \times 10^{3}$) recorded during extension of tissue cores.

Inspection of the individual results for firmness (Figure 2) showed that castrates had firmer fat than boars above about 10 mm C(14 mm P2) but below this there was no real difference between boars and castrates.

Both boars and castrates had similar relationships between the cohesiveness of fat tissue and fat thickness showing that boars have slightly less cohesive tissues (Table 3) because they have thinner fat.

Fig. 2. Firmness measured at 2·5mm and 4·0mm depth in inner fat layer.



Discussion

The well documented advantage of boars over castrates in carcass lean content was demonstrated in all three experiments. It is this which makes boars so attractive to producers.

Undoubtedly, however, there are some disadvantages in the use of boars, some of which are associated with their greater leanness. Subjective and objective measures of fat quality changed with fat thickness indicating firmer and more cohesive fat tissues as fat thickness increased. Boars therefore, have slightly lower fat quality than castrates in most practical situations because they have thinner fat. At the same fat thickness in Experiment 1 (Table 1), subjective scores for fat firmness were the same in boars and castrates. The relationships between objective firmness and fat thickness were more complex (Figure 2), but within the range 2-9 mm C (corresponds to 6-13 mm P2), where 70% of the pigs lay, there was no effect of castration on firmness. Firmer fat in castrates was only obvious above 10 mm C (14 mm P2), a value which only 1 boar reached.

There was a clear effect of castration on the water, lipid and fat-free dry matter content of backfat which did not seem to affect fat quality (as defined in the present terms). There was, in general, a similar ratio of water to fat-free dry matter (approximately 50% of which is collagen) in boars and castrates which suggests that greater synthesis of collagen, perhaps under the influence of testosterone, is a primary factor.

References

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Summary

Three experiments have shown that entire male pigs (boars) have backfat tissue with a higher concentration of water and a lower concentration of lipid than that from castrates. This is even so at the same proportion of backfat in the carcass (side). However, this seems to have no effect on the firmness of the tissue since subjective fat firmness scores were similar in boars and castrates at the same fat thickness. Objective measurement of firmness produced a similar result, although castrates had firmer fat than boars at high levels of backfat thickness (> 14 mm P2) which only 1 boar reached. The results show that 'fat quality' is influenced by fat thickness and boars, having thinner fat than castrates or gilts, will tend to produce lower quality fat, particularly so if lean genotypes are underfed.