MARBLING CHARACTERISTICS IN PORK MEAT

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INTRODUCTION

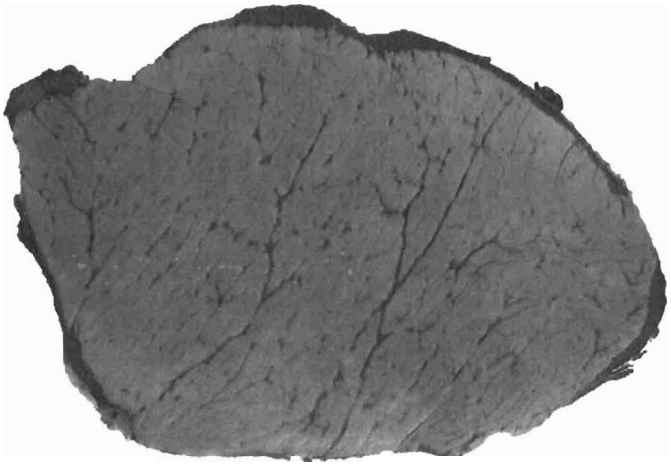
Recommended intramuscular fat (IMF) contents for acceptable palatability in pork range from 2 to 4%. Nevertheless, the role of intramuscular lipids with regard to the sensory and biophysical properties of pork is still the subject of much debate. As previously indicated in beef studies, differences in eating quality can be attributed to the fat distribution within the meat rather than the total fat content. Marbling distribution like other marbling characteristics can be studied using computer image analysis (CIA) that is a technique largely used in the food production industry. However, the attempts to evaluate the efficiency of CIA to assess marbling properties in pork are very scarce.

EXPERIMENTAL PROCEDURES

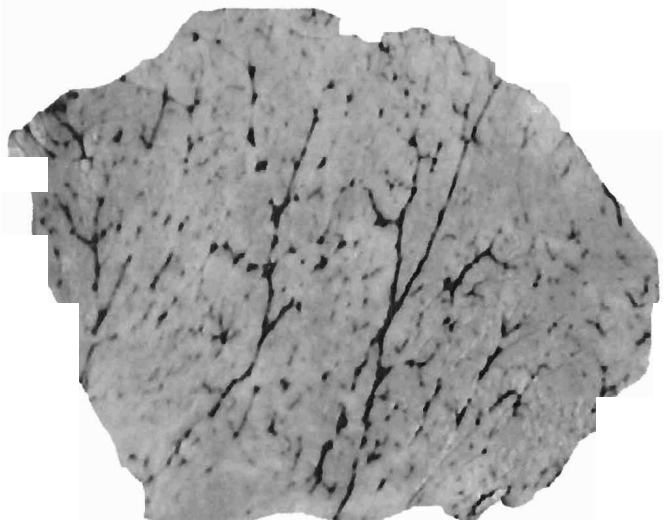
Sixty gilts of three different genotypes (20 Meishan-derived dam line [M], 20 Large White [LW] and 20 Synthetic Genex 3000 [SG]) were slaughtered at 110 (± 3.1) kg body weight at the experimental abattoir of the Dairy and Swine Research and Development Centre of Agriculture Canada in Lennoxville (Quebec). Muscle chops were removed from the middle section (around the grading site) of the Longissimus (L) for the marbling score assessment (from 1=devoid to 10= abundant; NPPC, 1999), chemical analysis of intramuscular fat (IMF) content and Warner-Bratzler shear force analysis. The slices that were evaluated for marbling were stained and digital images were taken and imported into a computer image editing program for the CIA assessment (Figure 1). From these images, marbling fleck area (cm^2), proportion (%) of areas of fat flecks, number of marbling flecks, number of marbling flecks per sq. cm (flecks/cm^2), total length of marbling flecks (cm) and proportion (%) of the three largest fat areas were assessed.

Figure 1. Stained (a) and CIA image (b) of the Longissimus muscle slice

(a)



(b)



RESULTS

As expected, M carcasses were fatter than LW and SG ones (data not shown) in the present study. However, the higher carcass fatness found in the M line was not reflected in a higher fat deposition at the muscle level. Surprisingly, in fact, marbling score and IMF content in the SG loins were higher than in LW and M ones. However, despite the differences in IMF content between the lines, shear force values did not differ significantly (Table 1).

Table 1. Meat quality traits in the longissimus muscle of LW, M and SG gilts*

	Genotype		
	LW	M	SG
Marbling score	1.62[b]	1.71[b]	2.39[a]
IMF (%)	1.22[b]	1.58[ab]	2.01[a]
Shear force (N)	17.5	20.6	18.1

*Values on the same line followed by different letter differ

The L muscle of the SG line showed better marbling characteristics as showed by the largest total marbling fleck area, the higher proportion of marbling fleck area over the muscle area and the higher number of marbling flecks both on the whole muscle area and per cm2 of muscle area (Table 2). Based on the results from previous studies on beef, the lower the proportion of the three largest fleck is, the finer is marbling. No difference was found in this trait between the lines. However, on average the SG line was 8 lower percent units lower compared to the M line meaning that in the SG loins marbling is potentially finer.

Table 2. CIA marbling variables in the longissimus muscle of LW, M and SG gilts*

	Genotype		
	LW	M	SG
Total marbling fleck area (cm^2)	0.41[b]	0.52[b]	0.71[a]
Proportion of marbling fleck area (%)	1.05[b]	1.50[ab]	1.84[a]
No. marbling flecks	137[b]	145[b]	200[a]
No. marbling flecks/cm^2	3.52[b]	4.20[ab]	5.14[a]
Total length of marbling flecks (cm)	10.2[b]	12.5[b]	17.5[a]
Proportion of three largest fleck areas (%)	24.0	26.9	18.9

*Values on the same line followed by different letter differ ($P<0.05$)

The proportion of fleck areas and number of flecks per cm2 showed the highest correlation with IMF content (Table 3). This means that these two traits reflect IMF content variation in the L muscle. The lack of correlation between average fleck area and IMF would mean that neither large nor small flecks are representative of the fat content in the muscle. Most of the CIA marbling traits were negatively correlated with shear force values.

Table 3. Correlations between CIA marbling properties and IMF content and shear force values in the longissimus muscle

	IMF	Shear force
Total marbling fleck area (cm^2)	0.57*	-0.27*
Proportion of marbling fleck area (%)	0.60*	-0.28*
No. marbling flecks	0.61*	-0.30*
No. marbling flecks/cm^2	0.67*	-0.30*
Total length of marbling flecks (cm)	0.59*	-0.27*
Proportion of three largest fleck areas (%)	-0.30*	0.20

* ($P<0.05$)

CONCLUSIONS

The longissimus muscle of SG line had better marbling properties, in terms of greater fineness and better distribution of fat over the muscle surface. Based on the correlations obtained, the more and the finer fat flecks are, the higher the IMF content is and potentially, more tender is the pork. This means that higher contents of IMF can be reached in pork meat without being negatively perceived by the consumer. CIA technique can be a possible tool for the comprehensive marbling analysis and IMF content prediction through the measurement of traits that a conventional subjective assessment would not be able to detect.

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