QTL detection for muscle cholesterol content and fatty acid composition in a *Duroc* population

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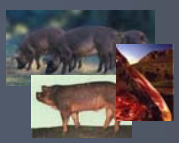
INTRODUCTION

The amount and composition of intramuscular fat have a strong influence on the sensory, nutritional and technological properties of meat.

We have carried out a QTL study in pigs dealing with intramuscular fat content, fatty acid composition and cholesterol content of muscles *Longissimus Dorsi* and *Gluteus Medius* in a Duroc population.

MATERIAL AND METHODS



Animal material

Animal material came from a high intramuscular fat commercial **Duroc population** used in the production of fine quality cured ham.

Experimental population: **370 castrated males distributed in five half-sib families**. Barrows were kept under normal intensive conditions at control station CCP-IRTA.

Variables measured from samples of *Longissimus dorsi* (LD) and *Gluteus medius* (GM) collected in the slaughterhouse

- Percentage of **intramuscular fat** in GM and LD
- **Cholesterol content** in GM and LD
- **Fatty acids** composition in GM and LD (determination of fatty acids content in the C12 - C22 interval)

Genomic information

All individuals, plus the five parental sires, were genotyped for **110 informative microsatellites** covering the whole genome.

Available data

	Mean (Standard Deviation)	
	Longissimus Dorsi	*Gluteus Medius*
Intramuscular Fat (%)	3.91 (1.53)	5.21 (2.05)
Cholesterol content (mg/g)	58.59 (9.45)	64.64(11.06)
Oleic acid content (%)	34.92 (5.18)	35.10 (4.48)
Palmitic acid content	23.47 (1.63)	23.22 (1.42)
Linoleic acid content (%)	14.16 (5.11)	14.95 (4.10)
Stearic acid content (%)	11.71 (1.21)	11.21 (1.12)

Statistical analyses

Model: $y_{ij} = \mu + f_i + ß\ bft_{ij} + \alpha\ p_{ij} + e_{ij}$

- f_i: Batch of fattening
- bft_{ij}: Backfat thickness
- p_{ij}: Probability of individual inheriting one of alleles from the common parent
- α: regression coefficient of phenotypes onto the probability p_{ij}

Software: QTL express, half-sib analysis (Knott et al., 1996). **Significance thresholds** were determined by data permutation (chromosome-wise) and Bonferroni correction (genome-wise).

RESULTS

Significant QTL for intramuscular fat, muscle cholesterol content and fatty acid composition of muscles *Gluteus Medius* and *Longissimus Dorsi*

Gluteus Medius SSC	Position (cM)	(Familiy) F-value	*Longissimus Dorsi* SSC	Position (cM)	(Family) F-values
Intramuscular Fat Content (%)					
1	16, 63	(3)6.98^{+}, (4)6.06^{+}	1	66	(4)6.50^{+}
3	**15**	**(3)12.64***	3	53, 85	(2)10.24^{++}, (5)10.73^{++}
6	92	(1)11.70^{++}	6	6	(3)7.05^{+}
7	**133**	**(1)16.48***	10	3	(5)7.27^{+}
11	19	(1)9.24^{+}	13	58, 110	(2)9.43^{++}, (3)7.15^{+}
			17	9	(2)8.85^{+}
Cholesterol content (mg/g)					
11	66	(4)9.63^{+}	**6**	**35**	**(2)14.92***
16	60	(4)7.02^{+}	8	42	(4)7.82^{+}
			11	62, 71	(1)8.56^{+}, (5)10.71^{++}
			14	42	(4)7.35^{+}
			17	0	(5)7.91^{+}
			18	6	(5)11.15^{++}

SSC = *Sus Scrofa Chromosome*
$^{+}$=p<0.05 and $^{++}$=p<0.01 at chromosome-wise level; *=p<0.05 at genome-wide level

Gluteus Medius SSC	Position (cM)	(Familiy) F-value	*Longissimus Dorsi* SSC	Position (cM)	(Family) F-values
Oleic acid content (%)					
1	25	(4)6.68^{+}	1	29	(3)7.79^{+}
3	26	(3)10.13^{++}	2	121	(5)8.47^{+}
15	67, 72	(3)7.44^{+}, (5)10.07^{+}			
Palmitic acid content (%)					
11	65, 71	(2)6.14^{+}, (5)8.66^{+}	1	28	(3)10.62^{++}
18	40	(3)14.96*	4	48, 49	(1)8.72^{+}, (2)6.72^{+}
			11	71	(5)7.70^{+}
Linoleic acid content (%)					
3	51, 26	(1)7.79^{+}, (3)11.37*	1	29	(3)6.58^{+}
15	69, 103	(3)9.98^{+}, (5)11.40^{++}	2	121	(5)8.74^{+}
16	45	(4)6.52^{+}			

SSC = *Sus Scrofa Chromosome*
$^{+}$=p<0.05 and $^{++}$=p<0.01 at chromosome-wise level; *=p<0.05 at genome-wide level

Genomic regions with significant effects on both *Longissimus Dorsi* and *Gluteus Medius* muscles:

- at SSC 1, 3 and 6 for intramuscular fat content
- at SSC 11 for cholesterol and palmitic contents

Relevant QTL for intramuscular fat content affecting only one muscle:

- at SSC 7 for *Gluteus Medius*
- at SSC 13 for *Longissimus Dorsi*

Genomic regions affecting both oleic and linoleic acids content:

- at SSC 3 and 15 for *Gluteus Medius*
- at SSC 1 and 2 for *Longissimus Dorsi*

QTL affecting palmitic content:

- at SSC 18 for *GM*
- at SSC 4 for *LD*

QTL involved in cholesterol content of *LD* at SSC 6 and 18.