



Canadian Centre for Swine Improvement Inc.

Impact of genetics and feeding on loin marbling levels of Canadian hogs



Laurence Maignel¹, Jean-Paul Daigle², Stefanie Wyss¹, Frédéric Fortin², Brian Sullivan¹

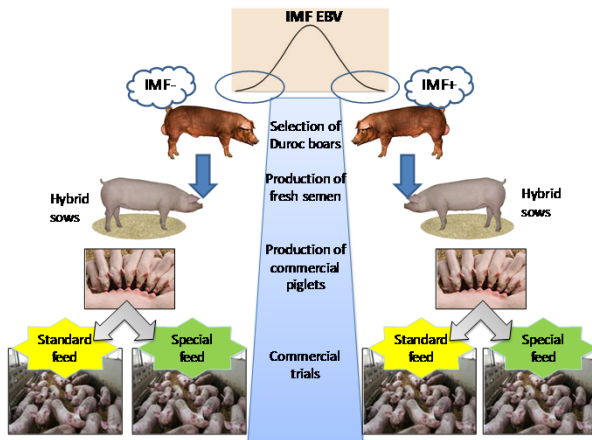
¹Canadian Centre for Swine Improvement (CCSI), Central Experimental Farm, Building #54, 960 Carling Avenue, Ottawa, Ontario, K1A 0C6

²Centre de développement du porc du Québec (CDPQ), Place de la Cité, tour Belle Cour, 2590, boul. Laurier, bureau 450, Québec City, Québec G1V 4M6

CONTEXT

Intramuscular fat (IMF) is a highly heritable trait but is also strongly influenced by feeding strategies. Since 2009, loin IMF predicted on live pigs using ultrasonic scanning has been included in the Canadian swine technician accreditation program and in genetic evaluations for Duroc pigs. A research project involving 6,000 Duroc pigs scanned across Canada was designed to broaden the live IMF database and confirm genetic parameters estimated in a previous study. Data collected in the project were also used for genetic evaluation and selection of Duroc boars with extreme (high or low) breeding values for IMF to produce commercial pigs tested in two research trials (in Western and Eastern Canada) using two different feeding programs to study the impact of genetics and feeding on loin marbling levels.

EXPERIMENTAL DESIGN



The 'Special feed' was formulated with a low lysine/net energy ratio compared to the standard feed.

MAIN RESULTS

Growth and Feed Intake

Trait	N	Overall Mean	Boar Group			Feeding Program			Gender		
			IMF-	IMF+	signif	STD	LLINE	signif	C	F	signif
On-test weight (kg)	48	30.05	29.99	30.10	ns	30.02	30.07	ns	30.66	29.44	***
Off-test weight (kg)	48	124.4	123.2	125.6	**	126.1	122.7	***	128.4	120.4	***
Days on test	48	98.5	98.6	98.4	ns	97.8	99.2	ns	97.7	99.3	*
ADG on test (g/d)	48	2.69	2.65	2.73	**	2.67	2.70	ns	2.84	2.54	***
ADG on test (g/d)	48	948	936	959	*	972	923	***	985	910	***
FCR on test (kg/kg)	48	2.84	2.83	2.85	ns	2.75	2.93	***	2.89	2.79	***
On-test weight (kg)	344	31.88	31.86	31.49	ns	31.58	31.77	ns	31.96	31.39	ns
Off-test weight (kg)	344	124.3	124.6	124.0	ns	125.6	123.0	**	126.1	122.4	***
Days on test	344	97.3	97.8	96.7	ns	95.5	99.0	***	92.9	101.6	***
ADFI on test (kg)	344	2.49	2.46	2.53	*	2.47	2.51	*	2.62	2.36	***
ADG on test (g/d)	344	960	959	961	ns	990	931	***	1021	899	***
FCR on test (kg/kg)	344	2.59	2.57	2.62	ns	2.52	2.67	***	2.60	2.59	ns

Carcass Quality

Trait	N	Overall Mean	Boar Group			Feeding Program			Gender		
			IMF-	IMF+	signif	STD	LLINE	signif	C	F	signif
Hot carcass weight (kg)	1004	96.9	95.8	98.0	***	98.1	95.8	***	100.1	93.8	***
Carcass fat (mm)	1004	16.24	16.19	16.29	ns	15.50	16.98	***	17.13	15.35	***
Carcass lean (mm)	1004	60.55	60.57	60.52	ns	62.29	58.80	***	60.13	60.96	*
Lean yield (%)	1004	61.70	61.72	61.68	ns	62.16	61.24	***	61.25	62.15	***
Carcass yield (%)	153	78.64	78.53	78.75	ns	78.10	79.18	***	78.39	78.89	ns
Loin eye area (cm ²)	153	49.41	50.14	48.67	ns	51.20	47.62	***	48.46	50.35	*
Loin weight (kg)	153	10.98	10.99	10.96	ns	11.03	10.96	ns	10.90	11.05	ns
Leg weight (kg)	153	11.27	11.32	11.22	ns	11.37	11.17	*	11.23	11.31	ns
Belly weight (kg)	153	8.28	8.34	8.21	ns	8.18	8.37	*	8.33	8.22	ns
Shoulder weight (kg)	153	11.08	11.09	11.06	ns	11.11	11.04	ns	11.04	11.12	ns
Hot carcass weight (kg)	339	100.6	100.7	100.5	ns	100.6	100.6	ns	100.5	100.7	ns
Carcass fat (mm)	334	18.47	18.38	18.55	ns	17.80	19.16	**	19.81	17.22	***
Carcass lean (mm)	334	65.53	66.38	64.88	**	66.94	64.11	***	65.27	65.79	ns
Lean yield (%)	334	60.73	60.82	60.65	ns	61.12	60.34	***	60.13	61.34	***
Carcass yield (%)	340	80.94	80.99	80.88	ns	80.84	81.04	ns	80.80	81.08	*
Loin eye area (cm ²)	344	50.48	51.54	49.42	**	52.03	48.93	***	48.77	50.20	***
Loin weight (kg)	342	12.59	12.65	12.53	ns	12.61	12.58	ns	12.50	12.69	***
Leg weight (kg)	341	11.49	11.51	11.46	ns	11.56	11.41	***	11.39	11.58	***
Belly weight (kg)	342	7.71	7.67	7.76	ns	7.71	7.72	ns	7.68	7.74	ns
Shoulder weight (kg)	341	12.05	12.04	12.06	ns	12.04	12.06	ns	12.13	11.97	**

Meat Quality (loin)

Trait	N	Overall Mean	Boar Group			Feeding Program			Gender		
			IMF-	IMF+	signif	STD	LLINE	signif	C	F	signif
Ultimate pH	153	5.55	5.56	5.55	ns	5.56	5.55	ns	5.54	5.56	ns
Minolta L*	153	46.95	46.33	47.57	ns	46.79	47.11	ns	46.85	47.04	ns
Minolta a*	153	6.62	6.53	6.71	ns	6.49	6.76	ns	6.66	6.58	ns
Minolta b*	153	1.88	1.65	2.10	**	1.70	2.05	*	1.89	1.86	ns
Colour score (points)	153	2.80	2.87	2.73	ns	2.82	2.78	ns	2.69	2.91	*
Drip loss (%)	153	1.08	1.13	1.09	ns	1.19	1.03	ns	1.07	0.95	*
Fat hardness	153	23.48	23.80	23.16	ns	22.88	24.08	ns	24.60	22.36	ns
Marbling score (points)	341	11.49	11.51	11.46	ns	11.56	11.41	***	11.39	11.58	***
Chemical IMF (%)	319	2.35	2.14	2.57	***	2.04	2.66	***	2.55	2.15	***
Shear Force (g)	82	1935	1945	1928	**	2020	1851	**	1894	1978	**
Ultimate pH	340	5.54	5.54	5.55	ns	5.54	5.55	ns	5.54	5.55	ns
Minolta L*	343	53.54	53.63	53.44	ns	53.22	53.85	*	54.02	53.05	**
Minolta a*	342	4.63	4.46	4.80	ns	4.54	4.72	ns	4.75	4.51	ns
Minolta b*	343	7.32	7.28	7.36	ns	7.19	7.44	*	7.56	7.07	***
Colour score (points)	344	3.47	3.42	3.53	ns	3.49	3.46	ns	3.43	3.51	ns
Drip loss (%)	343	5.49	5.77	5.20	ns	5.26	5.72	ns	5.79	5.18	*
Fat hardness	335	48.82	49.48	48.16	ns	47.19	50.41	**	44.77	52.57	***
Marbling score (points)	344	2.48	2.27	2.71	**	2.37	2.59	**	2.54	2.43	ns
Chemical IMF (%)	302	1.82	1.63	2.03	**	1.63	2.03	***	2.04	1.62	***
Shear Force (g)	82	2225	2327	2121	**	2233	2185	**	(not estimable)		

Significance level: ns=not significant (P>0.05), *P value<0.05, **P value<0.01, ***P value<0.001

SENSORY RESULTS

Boar Group	Western Trial				Eastern Trial			
	Standard feed	Special feed	Standard feed	Special feed	Standard feed	Special feed	Standard feed	Special feed
High IMF	High IMF	Low IMF	High IMF	Low IMF	High IMF	Low IMF	High IMF	Low IMF
Number of loins	20	20	20	20	15	15	14	11
Cooked Pork Aroma Intensity	5.68	5.82	5.85	5.83	5.28	5.18	5.22	5.27
Initial Juiciness	5.34a	5.28a	5.74b	5.43b	5.21a	5.25a	5.71b	5.55b
Initial Tenderness	5.56a	5.61a	5.92b	5.71a	5.39a	5.40a	5.87b	5.45a
Overall Juiciness	5.31a	5.25a	5.58b	5.36a	5.10a	5.08a	5.51b	5.41b
Overall Tenderness	5.51a	5.56a	5.87b	5.71b	5.47a	5.33a	5.83b	5.42a
Connective Tissue	4.95	5.03	5.09	5.10	5.06	5.05	5.43	5.08
Pork Flavour Intensity	5.26	5.43	5.47	5.50	5.16	5.14	5.32	5.19
Overall Palatability	4.76a	4.69a	5.02b	4.85b	4.30a	4.26a	4.62b	4.29a

CONCLUSIONS

- The special feed increased loin IMF by +0.4 to +0.6%, increased backfat by 1 to 2 mm and decreased lean depth by 2 to 4 mm. It also decreased growth rate by 40 to 50 g/day.
- Using boars with high IMF EBVs allowed increasing loin IMF by 0.3 to 0.5% in these trials without any adverse effects on growth and carcass quality.
- Pork from the most marbled group (produced with boars with high potential for IMF and using a special feeding program) was evaluated by a sensory panel as more tender and palatable than pork from the other three groups.
- The project provided valuable information about the effect of genetics and management (especially feeding) on marbling levels in pork loins.

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