Genetic parameters for meat quality and production traits in Finnish Landrace and Large White pigs

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Introduction…

- Quality of red meat affects to acceptability of meat
- Technological value is important to meat production industry
- Consumers want avoid additives (salt, phosphates) ➡ quality becomes more important

…introduction…

- Minolta colour meter and CIElab system since 1994

- The breeding objective has been loin quality

- Ham quality has not been routinely measured

…introduction…

- In preliminary study at 1999, quality of five muscles was measured from 1000 station test pigs
- Aim of that study was to compare the different muscles and to estimate heritabilities of quality traits

- Due to results, also ham quality was decided to include into breeding programme of pig
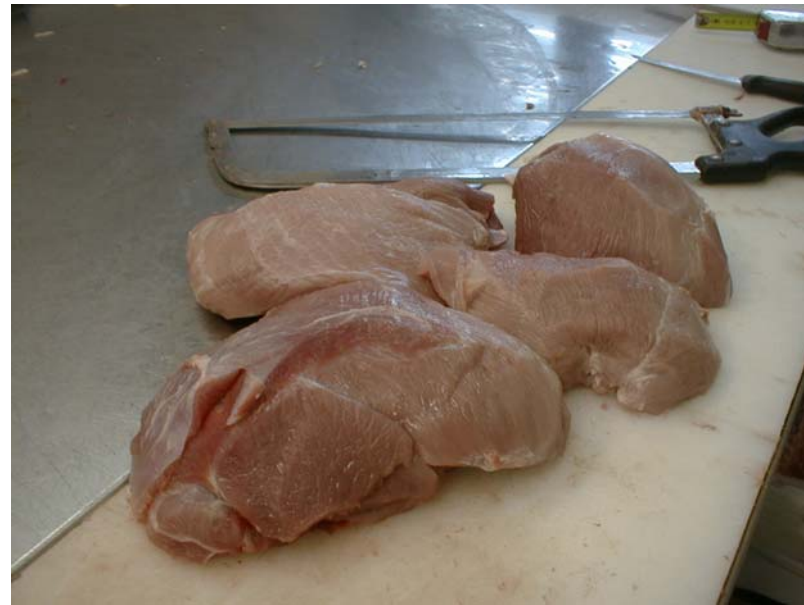
The main purpose of this study was to estimate reliable genetic parameters of loin and ham quality traits in Finnish Landrace (FL) and Large White (LW) pigs to be used in national breeding programme

Data

- Data was obtained from Finnish Animal Breeding Association (national pig breeding programme)

- Station test animals, half-sib design

- Populations free from halothane gene

Data stucture

	FL	LW
Animals with records	7685	7467
Half-sib groups	749	706
Full-sib groups	2701	2605
Pedigree animals	7316	6566

Measured traits

- Average daily gain (ADG) from 30 to 100 kg
- Meat-%
- Meat quality
  - Loin (*longissimus* at last rib)
  - Ham (*semimembranosus*, lightest side)
  - pHu, L* (lightness), a* (redness) and b* (yellowness)

Statistical methods

- Multitrait animal model, REML
- DMU package (Madsen and Jensen, 2000)
- Models
  - ADG and meat-%: start age, rearing batch and sex (fixed) and litter, animal and residual (random)

  - Quality traits: rearing batch, sex, time from slaughter to dissection (fixed) and litter, slaughter batch, animal and residual (random)

- Breeds were analysed separately

Results

Means and standard deviations

	FL		LW	
	Mean	S.D.	Mean	S.D.
ADG	1043	94	1019	98
Meat-%	63.9	2.2	64.1	1.8
Loin				
pHu	5.54	0.15	5.57	0.14
L*	55.63	3.15	54.97	3.16
a*	7.41	1.28	6.76	1.20
b*	3.30	1.18	2.95	1.14
Ham				
pHu	5.60	0.14	5.62	0.13
L*	61.1	3.6	61.0	3.6
a*	6.86	1.54	6.54	1.50
b*	4.84	1.39	4.71	1.34

Heritabilities (h^2), litter effect (c^2) and slaughter batch (d^2)

	FL h^2	LW h^2	FL c^2	LW c^2	FL d^2	LW d^2
ADG	0.33	0.39	0.09	0.07		
Meat-%	0.39	0.47	0.09	0.04		
Loin						
pHu	0.12	0.20	0.07	0.05	0.09	0.15
L*	0.17	0.32	0.05	0.04	0.09	0.11
a*	0.43	0.42	0.01	0.07	0.10	0.08
b*	0.18	0.20	0.02	0.04	0.13	0.13
Ham						
pHu	0.12	0.19	0.04	0.08	0.11	0.16
L*	0.10	0.10	0.04	0.04	0.07	0.08
a*	0.33	0.25	0.02	0.05	0.08	0.06
b*	0.09	0.11	0.04	0.04	0.09	0.08

Genetic correlations between ADG and meat-% and quality traits

FL		Loin				Ham			
		pHu	L*	a*	b*	pHu	L*	a*	b*
	ADG	0.05	0.03	0.01	0.01	0.15	0.10	-0.14	-0.22
	Meat-%	-0.31	0.33	-0.02	0.23	-0.39	0.26	-0.17	-0.10
LW		Loin				Ham			
		pHu	L*	a*	b*	pHu	L*	a*	b*
	ADG	-0.05	0.12	0.03	0.09	0.03	0.01	-0.09	-0.27
	Meat-%	-0.29	0.22	-0.08	0.15	-0.40	0.21	-0.24	0.24

Heritabilities (on diagonal), genetics (above diagonal) and phenotypic (below diagonal) correlations in FL

		Loin				Ham			
		pHu	L*	a*	b*	pHu	L*	a*	b*
Loin	pHu	**0.12**	-0.70	-0.23	-0.54	0.88	-0.28	0.06	0.01
	L*	-0.59	**0.17**	-0.39	0.38	-0.66	0.65	-0.41	-0.33
	a*	-0.21	0.07	**0.43**	0.75	-0.20	-0.33	0.68	0.72
	b*	-0.35	0.56	0.57	**0.18**	-0.53	0.07	0.29	0.55
Ham	pHu	0.58	-0.38	-0.12	-0.23	**0.12**	-0.37	0.19	0.16
	L*	-0.21	0.33	-0.07	0.14	-0.25	**0.10**	-0.79	-0.57
	a*	-0.04	-0.07	0.40	0.12	-0.01	-0.38	**0.33**	0.86
	b*	0.16	0.14	0.19	0.22	-0.16	0.34	0.47	**0.09**

Heritabilities (on diagonal), genetics (above diagonal) and phenotypic (below diagonal) correlations in LW

		Loin				Ham			
		pHu	L*	a*	b*	pHu	L*	a*	b*
Loin	pHu	**0.20**	-0.84	-0.31	-0.83	0.92	-0.28	-0.17	-0.46
	L*	-0.56	**0.32**	-0.17	0.75	-0.82	0.68	-0.16	0.38
	a*	-0.21	0.05	**0.42**	0.46	-0.25	-0.36	0.66	0.45
	b*	-0.35	0.56	0.49	**0.20**	-0.82	0.31	0.31	0.71
Ham	pHu	0.58	-0.39	-0.14	-0.26	**0.19**	-0.52	-0.09	0.08
	L*	-0.16	0.32	-0.09	0.11	-0.04	**0.10**	-0.62	-0.54
	a*	-0.07	0.07	0.40	0.13	0.14	-0.37	**0.25**	0.68
	b*	-0.14	0.14	0.18	0.24	-0.25	0.38	0.44	**0.11**

Conclusions

- Heritabilities of quality traits were usually low or moderate

- Heritability of a* was clearly higher

- Genetic correlation between ADG and meat quality was low

- Genetic correlation of same quality trait in loin and ham was high but clearly under one

…conclusions

- Genetic correlation between meat-% and quality was moderate and unfavourable

- Due to unfavourable correlation, the meat quality should be included in selection programme

- Including the a* into breeding value estimation as correlated trait will increase the accuracy of breeding values

- The heritability estimates showed that it is possible to get genetic improvement in meat quality

Thank you for your attention!

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