58th AnnualMeeting of European Association for Animal Production. Dublin, Ireland – 26 – 29 August 2007
Commission of Pig Production, Session 26, abstract no 1544

Genetic parameters for carcass traits, bone strength and osteochondrosis in Finnish Landrace and Finnish Large White pigs

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Keywords: heritability; correlation, pig, carcass quality; bone strength, osteochondrosis

Introduction

Meat percentage in one of the economically most important traits in pig breeding. On the other hand, the leg weakness cause rejections and economical losses to slaughter pig industry. The objectives of this study were to increase the knowledge of heritability of osteochondrosis and bone strength and to study the correlations among carcass traits, osteochondrosis and bone strength.

Material and method

Data was station test animals from Finnish national pig breeding programme and contained records from 464 Finnish Landrace and 326 Finnish Large White pigs. On an average there were 9 half or full sibs per sire. Pigs were slaughtered at 100 kg live weight. Carcasses were dissected and measured at Finnish Meat Research Institute (Hämeenlinna). The relationship data obtained from Faba Breeding. Studied carcass traits were Hennessy GP4 meat-%, old and new station test meat percentage and proportion of valuable cuts, bones and subcutaneous fat in commercially dissected carcasses. Bone strength (breaking force, kg) was measured from *fibula* using three point bending test. Osteochondrosis was recorded from cut joint at proximal end of *humerus* and at distal end of *femur* using visual analogue scale of 1 to 6, where 1 = no changes and 6 = severe changes.

Data was analysed using multitrait animal model and DMU programme (Jensen, J. & Madsen, P. 2000. *A user guide to DMU. A Package for analysing Multivariate Mixed Models.* National Institute of Animal Science, Tjele, Denmark).

Model contains breed, rearing batch, slaughter weight and sex as fixed effect and litter, additive animal and residual term as random effect. Breeds were analysed together.

Results and discussion

The means and standard deviation of studied traits were presented in Table 1. Variation of breaking force was large (from 6 kg to 46 kg). Proportion of bone was larger in Finnish Large White than in Finnish Landrace. Large White has also stronger bones than Landrace (breaking force 27 kg and 24 kg respectively). 64 % of Large White and 70 % of Landrace pigs have no osteochondrosis at humerus or at femur. There was no incidence of severe osteochondrosis in this data.

Heritabilities

Heritabilities are presented in Table 2. Heritabilities for carcass traits were moderate or high (from 0.15 to 0.42) The heritability of breaking force was moderate (0.27). The heritability of osteochondrosis at *humerus* were low (0.03) but moderate at *femur* (0.26).

Genetic correlations

Genetic correlations between carcass traits are presented in Table 3 and between carcass traits and bone strength and osteochondrosis in Table 4. Correlations among carcass traits were high (0.42 – 1) in exception the proportion of bones. Correlation between meat percentage and breaking force were low (-0.13 – 0.30). Both proportion of bones and bone strength were negatively correlated with osteochondrosis (-0.09 – -0.23, favourable). Correlation between osteochondrosis at *humerus* and at *femur* was low (0.04). Correlation between meat percentage and osteochondrosis were in most cases moderately and unfavourable (0.46).

Phenotypic correlations

Phenotypic correlations between carcass traits are presented in Table 5 and between carcass traits and bone strength and osteochondrosis in Table 6. Correlations between different meat percentages and valuable cuts were high (from 0.46 to 0.86). Correlations between meat percentages and proportion of bones or fat were low (0.03 – -0.29). Correlation between meat percentage and breaking force was low (0.0 – 0.11) and also correlation between meat percentage and osteochondrosis was low. Proportion of bones and bone strength were moderately correlated (0.22 – 0.23) but correlation between proportion of bones and osteochondrosis was low.

Conclusions

The heritability estimates showed that it is possible to get genetic improvement in bone strength and to decrease osteochondrosis at distal end of femur. The genetic correlations between meat percentage and breaking force or proportion of bones were low, so the selection for better meat percentage presumable doesn't have harm full effect on bones. But due to unfavourable correlation between meat percentage and osteochondrosis, joint evaluating should be included into a selection programme.

Aknowledgements

This study was part of larger project "Development, measurement and genetics of slaughter quality of Finnish Pigs" The authors would like to thank Ministry of Agriculture and Forestry and The Meat Board of the Finnish Food and Drink Industries Federation for financial support.

Table 1. Basic statistic of studied traits. FLW is Finnish Large Whiten and FL is Finnish Landrace.

	Breed	Mean	sd	V-%	Min	Max
Breaking force, kg	FLW	26.6	5.7	21.4	10.7	46.3
	FL	24.2	6	24.5	6.3	44.2
Osteochondrosis at *humerus*	FLW	1.39	0.6	41.2	1	4
	FL	1.3	0.5	36.5	1	3
Osteochondrosis at *femur*	FLW	1.39	0.6	41.2	1	4
	FL	1.32	0.5	37	1	3
Hennessy meat-%	FLW	59.7	1.7	2.8	55	64
	FL	59.6	1.9	3.2	53	66
Station test meat-%, old	FLW	63.6	1.7	2.7	58	68
	FL	63.0	1.9	3	56	69
Station test meat-%, new	FLW	61.3	2.3	3.8	54	68
	FL	61.6	2.4	3.9	52	68
Valuable cuts. %	FLW	25.9	1.4	5.5	19	31
	FL	26.4	1.4	5.3	21	30
Fat. %	FLW	5.4	1.4	25.6	2	12
	FL	5.8	1.4	23.8	2	10
Skin. %	FLW	5.7	0.7	12.9	4	7
	FL	5.7	0.8	13.2	4	8
Bones, %	FLW	19.9	1.2	5.9	17	25
	FL	18.7	1.1	5.9	15	22

Table 2. Heritabilities for studied traits.

	h^2	s.e.	c^2	s.e.
Hennessy GP4 meat-%	0.27	0.12	0.11	0.06
Station test meat-%, old	0.38	0.15	0.11	0.06
Station test meat-%, new	0.42	0.14	0.09	0.06
Valuable cuts, %	0.35	0.15	0.13	0.07
Subcutaneous fat, %	0.20	0.11	0.14	0.06
Skin, %	0.15	0.11	0.24	0.06
Bones, %	0.21	0.11	0.19	0.06
Bones weight, kg	0.16	0.10	0.19	0.06
Breaking force, kg	0.27	0.12	0.04	0.06
Osteochondrosis at *humerus*	0.03	0.08	0.00	0.06
Osteochondrosis at *femur*	0.26	0.11	0.00	0.06

Table 3. Genetic correlations between carcass traits.

	Valuable cuts, %	Fat, %	Skin, %	Bones, %
Hennessy GP4 meat-%	1.00	-0.42	-1.00	-0.29
Station test meat-%, old	0.78	-0.59	-0.92	0.03
Station test meat-%, new	0.93	-0.67	-0.93	-0.10

Table 4. Genetic correlations between carcass traits and bone strength and osteochondrosis

	Breaking force	**Osteochondrosis at *humerus***	**Osteochondrosis at *femur***
Hennessy GP4 meat-%	-0.13	-0.29	0.22
Station test meat-%, old	0.30	-0.07	0.11
Station test meat-%, new	0.11	0.26	0.46
Valuable cuts, %	-0.20	0.22	0.43
Subcutaneous fat, %	-0.21	-0.13	0.08
Skin, %	0.23	0.47	-0.27
Bones, %	0.90	-0.23	-0.09
Bones weight, kg	0.88	-0.17	-0.21
Breaking force		0.29	-0.26
Osteochondrosis at humerus			0.04

Table 5. Phenotypic correlations between carcass traits.

	Valuable cuts, %	**Fat, %**	**Skin, %**	**Bones, %**
Hennessy GP4 meat-%	0.46	-0.53	-0.08	0.22
Station test meat-%, old	0.70	-0.64	-0.02	0.30
Station test meat-%, new	0.86	-0.59	-0.07	0.06

Table 6. Phenotypic correlations between carcass traits and bone strength and osteochondrosis

	Breaking force	**Osteochondrosis at *humerus***	**Osteochondrosis at *femur***
Hennessy GP4 meat-%	0.09	0.04	0.06
Station test meat-%, old	0.11	0.04	0.01
Station test meat-%, new	0.07	0.05	0.07
Valuable cuts, %	0.01	0.03	0.06
Subcutaneous fat, %	-0.07	-0.08	0.00
Skin, %	0.01	0.06	-0.11
Bones, %	0.23	0.05	0.08
Bones weight, kg	0.22	0.04	0.07
Breaking force		0.03	-0.05
Osteochondrosis at *humerus*			0.08