VÄLISAUTORID

PHENOTYPIC EVALUATION OF THE LEANNESS OF BREEDING PIGS IN LITHUANIA

R. Klimas, A. Klimienė

Abstract

In 1996–1998, a study was conducted for comparative evaluation of the backfat thickness and lean content in pigs of various breeds measured with the ultrasonic *Piglog 105* apparatus and control slaughtering at 100 kg weight. The comparison of the two methods indicated that the average thickness and meat percentage differed by 1.32 mm ($P<0.05$) and 2.79% ($P<0.001$), respectively. High ($r=0.76$ and 0.83) and statistically reliable ($P<0.01$) correlation coefficients for backfat thickness and meat percentage determined with *Piglog 105* and control slaughtering show the prospects of phenotypic evaluation of pig leanness in pig selection.

In three years time, 31.846 pigs of various breeds were evaluated at the pig breeding centres of Lithuania with the *Piglog 105* apparatus. The average lean meat content for pure-bred Lithuanian White pigs was 49.20%, bacon (LB-B1) type Lithuanian White – 50.72%, meat (LB-M1) type Lithuanian White – 51.68%, Yorkshire – 52.67%, German Landrace – 52.83%, Finnish Landrace – 56.83%, Norwegian Landrace – 59.01%, Hampshire – 56.23% and Pietrain – 60.15%.

These findings were the basis for preparation of the requirements for determining of the meat percentage on live pigs with *Piglog 105*. Subsequently, the requirements were added to the rules for pig assessment. In Lithuania, breeding pigs are evaluated on a 100 point scale and meat percentage of pigs is worth up to 30 points.

Key words: pig breeds, selection, phenotype, *Piglog 105*, backfat thickness, lean meat percentage.

Introduction

Control slaughtering of pigs is the most accurate method for evaluation of the carcass traits of pigs. However, numerous valuable breeding pigs are being lost at selection of boars and sows for the carcass traits of their fattened and slaughtered progeny. Therefore, phenotypic evaluation of carcass traits on live pigs at progeny testing stations and breeding centres is being performed alongside with control slaughtering of pigs (Danish..., 1993; De Vries, Kanis, 1994; Nicholas, 1996; Merks *et al*., 1997; Glodek, 1998).

There are several methods of phenotypic evaluation, however, one of the most progressive is usage of ultrasonic equipment (Põldvere, Eilart, 1999; Tänavots *et al*., 1999). The ultrasonic apparatus *Piglog 105* (Piglog..., 1991; Demo *et al*., 1995; Timmi, Mölder, 1995; Results..., 1998; Tänavots *et al*., 1999) is being used for measurements of backfat thickness and meat percentage on live breeding pigs. Since 1996, the selection of breeding pigs at the pig breeding centres of Lithuania is carried out by using *Piglog 105* (Klimas, Džiaugys, 1997).

The objectives of the present study were, first, to compare backfat thickness and meat percentage data for pigs of various breeds obtained by *Piglog 105* and control slaughtering methods and, second, to analyse ultrasonic leanness data for breeding pigs. On the basis of these findings, rules for pig assessment had to be supplemented with the requirements for meat percentage determination on live pigs with *Piglog 105*.

Materials and methods

The study was carried out in 1996–1998. 160 pigs with an average weight of 100 kg were used for comparative evaluation of backfat thickness and meat percentage by two different methods, i.e. ultrasonic (*Piglog 105*) and control slaughtering. The pigs were of different breeds (Lithuanian White, bacon (LB-B1) and meat (LB-M1) type Lithuanian White, Yorkshire, Landrace). Meat:fat:bone ratio was determined by carcass dressing of 88 pigs.

Analysis of the ultrasonic (*Piglog 105*) leanness parameters for pigs of different breeds (n=31.846) was based on the data obtained from the State Pig Breeding Station.

The meat percentage was determined with *Piglog 105* by measuring the backfat thickness (mm) on live pigs at two points (Piglog..., 1991):

1) behind the last rib and 7 cm sideways from the middle dorsal line (FAT-1);

2) 10 cm from the last rib towards the cranial part and 7 cm sideways from the middle dorsal line (FAT-2).

The meat percentage is determined with *Piglog 105* according to the formula:

$$Y = 64.39 - 0.28x_1 + 0.14x_2 - 0.55x_3,$$

where Y – meat percentage,
x_1 – FAT-1 data, mm,
x_2 – thickness of the *musculus longissimus dorsi*, mm.
x_3 – FAT-2 data, mm.

Measurements were taken for breeding pigs at 85–110 kg live weight. The investigation data were processed biometrically.

Results and discussion

The backfat thickness at 6–7th rib measured at control slaughtering was by 1.03–3.69 mm lower, depending on the pig breed, than that measured on live pigs ultrasonically (Table 1). The comparison of the two methods indicated that the average difference for all pigs (n=160) in measuring backfat thickness amounted to 1.32 mm ($P<0.05$).

Meat percentage at control slaughtering was by 1.85–4.22% higher than that determined with the apparatus *Piglog 105* on live pigs (Table 1). The difference between the two methods in measuring the meat percentage for all pigs (n=88) was on the average 2.79% ($P<0.001$).

The average of all pigs indicated that correlation coefficients (Table 1) for backfat thickness and meat percentage obtained by two different methods were high (r=0.76 and 0.83, respectively) and statistically reliable ($P<0.01$).

Table 1. Comparative evaluation of carcass traits by ultrasonic and control slaughtering methods

Breed	Backfat thickness at 6–7th rib, mm				Lean meat percentage in carcass			
	No. of pigs	*Piglog 105*	Control slaughter	Correlation coefficient (r)	No. of pigs	*Piglog 105*	Control slaughter	Correlation coefficient (r)
Pure-bred Lithuanian White	50	25.58±0.70	24.42±0.68	0.64	30	48.93±0.57	51.35±0.67	0.77
Bacon (LB-B1) type Lithuanian White	36	22.17±0.79	20.58±0.84	0.61	12	51.64±0.92	53.49±0.80	0.42
Meat (LB-M1) type Lithuanian White	48	25.17±0.65	24.14±0.62	0.78	22	51.71±0.51	54.55±0.90	0.82
Yorkshire	10	23.80±1.05	22.60±0.85	0.34	10	51.32±0.53	54.32±0.53	0.10
Landrace	16	17.25±1.14	13.56±1.98	0.88	14	56.27±0.69	60.49±1.19	0.86
Total	160	23.67±0.42	22.35±0.47	0.76	88	51.44±0.38	54.23±0.50	0.83

The analysis of the lean meat content data measured on pigs of different breeds with *Piglog 105* over the period of three years indicated (Table 2) that pure-bred Lithuanian White pigs had the highest backfat thickness and the lowest meat percentage (49.20%), while Pietrain and Norwegian Landrace pigs were characterized by the lowest backfat thickness and the highest meat percentage (60.15 and 59.01%, respectively). The meat percentage of LB-B1 type pigs was by 1.03, LB-M1 type pigs by 2.48, Yorkshire by 3.47, German Landrace by 3.63, Finnish Landrace by 7.63, Norwegian Landrace by 9.81, Hampshire by 7.03 and Pietrain pigs by 10.95% higher than that of pure-bred Lithuanian White pigs ($P<0.001$).

If compared with the data for 1996, the lean meat content of pure-bred Lithuanian White pigs in 1998 has increased by 1.09% ($P<0.001$) due to selection. This repeatedly indicates that improvement of the lean content of pigs by pure breeding takes more time and thoroughness. Higher lean meat content of LB-B1 and LB-M1 type pigs if compared with that of pure-bred Lithuanian Whites was affected by the use of, respectively, Yorkshire and Landrace boars.

The investigation data showed that the lean meat content of boars was by 1–3% higher than that of gilts.

Table 2. Data of 1996–1998 for measurements of backfat thickness and lean meat content with *Piglog 105* at the pig breeding centres

Breed	Year	No. of pigs	Weight, kg	Backfat thickness, mm		*Musculus longissimus dorsi* diameter, mm	Average lean meat %
				FAT-1	FAT-2		
Pure-bred Lithuanian White	1996	2701	91±0.2	19.94±0.06	21.88±0.06	35.83±0.08	48.40±0.06
	1997	4976	91±0.2	19.80±0.05	20.89±0.06	37.25±0.08	49.13±0.05
	1998	8575	92±0.1	19.95±0.04	20.63±0.04	39.49±0.08	49.49±0.04
	Total	16252	92±0.1	19.90±0.03	20.92±0.03	38.19±0.05	49.20±0.03
Bacon (LB-B1) type Lithuanian White	1996	1721	96±0.2	18.83±0.08	20.06±0.08	37.48±0.10	50.00±0.08
	1997	2350	93±0.2	18.05±0.08	18.87±0.08	38.79±0.13	51.14±0.07
	1998	2356	93±0.2	18.18±0.08	19.32±0.08	38.62±0.11	50.84±0.07
	Total	6427	94±0.1	18.31±0.05	19.35±0.05	38.37±0.07	50.72±0.05
Meat (LB-M1) type Lithuanian White	1996	884	96±0.3	16.84±0.08	18.09±0.08	40.11±0.12	52.27±0.07
	1997	455	95±0.7	18.21±0.15	18.84±0.16	40.17±0.29	51.27±0.15
	1998	1061	95±0.3	18.57±0.10	19.01±0.11	42.92±0.18	51.36±0.09
	Total	2400	95±0.2	17.86±0.07	18.64±0.07	41.36±0.12	51.68±0.06
Yorkshire	1996	1104	96±0.3	15.44±0.10	16.95±0.11	39.52±0.13	53.38±0.10
	1997	1306	90±0.3	16.72±0.10	17.53±0.11	39.48±0.16	52.54±0.10
	1998	1436	93±0.2	16.91±0.09	17.88±0.09	39.69±0.15	52.24±0.09
	Total	3846	93±0.2	16.42±0.06	17.49±0.07	39.57±0.09	52.67±0.06
German Landrace	1996	243	93±0.7	16.72±0.18	17.67±0.18	43.17±0.25	52.92±0.17
	1997	771	93±0.4	16.86±0.12	17.41±0.12	43.21±0.23	52.99±0.11
	1998	1049	95±0.3	17.15±0.09	17.96±0.10	44.08±0.19	52.70±0.09
	Total	2063	94±0.2	16.99±0.07	17.72±0.07	43.65±0.13	52.83±0.07
Finnish Landrace	1996	34	93±2.4	12.68±0.47	12.85±0.43	42.97±0.89	57.15±0.45
	1997	68	98±1.7	13.03±0.34	13.70±0.39	42.72±0.62	56.50±0.36
	1998	179	101±0.8	13.50±0.22	13.84±0.21	47.60±0.44	56.89±0.22
	Total	281	99±0.8	13.29±0.18	13.69±0.19	45.86±0.37	56.83±0.18
Norwegian Landrace	1996	–	–	–	–	–	–
	1997	98	94±1.0	11.15±0.18	11.33±0.19	42.84±0.50	58.60±0.19
	1998	124	99±0.9	11.14±0.13	11.09±0.13	47.76±0.41	59.34±0.12
	Total	222	97±0.7	11.14±0.11	11.19±0.11	45.59±0.36	59.01±0.11
Hampshire	1996	–	–	–	–	–	–
	1997	11	95±4.0	11.73±0.65	12.36±0.64	49.18±2.00	58.62±0.46
	1998	67	93±1.1	14.95±0.38	15.28±0.39	50.40±0.68	55.84±0.38
	Total	78	94±1.1	14.49±0.36	14.87±0.36	50.23±0.65	56.23±0.35
Pietrain	1996	30	97±1.6	10.40±0.27	10.93±0.31	51.97±0.90	60.30±0.31
	1997	113	95±1.6	10.70±0.17	11.23±0.19	53.29±0.67	60.15±0.20
	1998	134	92±0.7	11.04±0.19	11.13±0.19	53.48±0.49	60.11±0.20
	Total	277	94±0.8	10.83±0.12	11.15±0.13	53.24±0.39	60.15±0.13

Table 3. Distribution of different breeds (%) by lean meat percentage (Data for 1996–1998)

Breed	Year	No. of pigs	Distribution of pigs by lean meat percentage											
			under 40.0		40.0–45.0		45.1–50.0		50.1–55.0		55.1–60.0		over 60.0	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Pure-bred Lithuanian White	1996	2701	72	2.7	468	17.3	1203	44.5	842	31.2	114	4.2	2	0.1
	1997	4976	87	1.8	526	10.6	2408	48.4	1773	35.6	175	3.5	7	0.1
	1998	8575	127	1.5	862	10.0	3693	43.1	3521	41.0	366	4.3	6	0.1
	Total	16252	286	1.8	1856	11.4	7304	44.9	6136	37.8	655	4.0	15	0.1
Bacon (LB-B1) type Lithuanian White	1996	1721	42	2.4	194	11.3	566	32.9	711	41.3	202	11.7	6	0.4
	1997	2350	19	0.8	93	4.0	744	31.7	1197	50.9	289	12.3	8	0.3
	1998	2356	24	1.0	149	6.3	634	26.9	1329	56.4	216	9.2	4	0.2
	Total	6427	85	1.3	436	6.8	1944	30.2	3237	50.4	707	11.0	18	0.3
Meat (LB-M1) type Lithuanian White	1996	884	2	0.2	16	1.8	177	20.0	531	60.1	157	17.8	1	0.1
	1997	455	1	0.2	13	2.9	146	32.1	245	53.8	48	10.6	2	0.4
	1998	1061	4	0.4	37	3.5	269	25.3	640	60.3	111	10.5	0	0.0
	Total	2400	7	0.3	66	2.7	592	24.7	1416	59.0	316	13.2	3	0.1
Yorkshire	1996	1104	11	1.0	59	5.3	195	17.7	353	32.0	427	38.7	59	5.3
	1997	1306	1	0.1	20	1.5	337	25.8	613	46.9	311	23.8	24	1.9
	1998	1436	1	0.1	41	2.9	212	14.8	895	62.3	275	19.1	12	0.8
	Total	3846	13	0.3	120	3.1	744	19.3	1861	48.5	1013	26.3	95	2.5
German Landrace	1996	243	0	0.0	8	3.3	38	15.6	123	50.6	70	28.8	4	1.7
	1997	771	0	0.0	7	0.9	134	17.4	418	54.2	210	27.2	2	0.3
	1998	1049	3	0.3	13	1.2	105	10.0	726	69.2	198	18.9	4	0.4
	Total	2063	3	0.1	28	1.4	277	13.4	1267	61.4	478	23.2	10	0.5
Finnish Landrace	1996	34	0	0.0	0	0.0	3	8.8	3	8.8	21	61.8	7	20.6
	1997	68	0	0.0	0	0.0	2	2.9	20	29.4	41	60.3	5	7.4
	1998	179	0	0.0	1	0.6	4	2.2	31	17.3	124	69.3	19	10.6
	Total	281	0	0.0	1	0.4	9	3.2	54	19.2	186	66.2	31	11.0
Norwegian Landrace	1996	–	–	–	–	–	–	–	–	–	–	–	–	–
	1997	98	0	0.0	0	0.0	0	0.0	4	4.1	79	80.6	15	15.3
	1998	124	0	0.0	0	0.0	0	0.0	0	0.0	82	66.1	42	33.9
	Total	222	0	0.0	0	0.0	0	0.0	4	1.8	161	72.5	57	25.7
Hampshire	1996	–	–	–	–	–	–	–	–	–	–	–	–	–
	1997	11	0	0.0	0	0.0	0	0.0	0	0.0	9	81.8	2	18.2
	1998	67	0	0.0	0	0.0	2	3.0	24	35.8	37	55.2	4	6.0
	Total	78	0	0.0	0	0.0	2	2.5	24	30.8	46	59.0	6	7.7
Pietrain	1996	30	0	0.0	0	0.0	0	0.0	0	0.0	12	40.0	18	60.0
	1997	113	0	0.0	0	0.0	0	0.0	2	1.8	52	46.0	59	52.2
	1998	134	0	0.0	0	0.0	0	0.0	3	2.2	61	45.5	70	52.3
	Total	277	0	0.0	0	0.0	0	0.0	5	1.8	125	45.1	147	53.1

The analysis of the distribution of pigs of different breeds for the interval of their lean meat content indicated (Table 3) that the meat percentage of the greater part (44.9%) of pure-bred Lithuanian White pigs was from 45.1 to 50.0%. 50.4% of LB-B1 type pigs and 59.0% of LB-M1 type pigs, 48.5% of Yorkshire and 61.4% of German Landrace pigs had their meat percentage in the interval between 50.1 and 55.0%. The meat percentage of 66.2% of Finnish Landrace, 72.5% Norwegian Landrace and 59.0% of Hampshire pigs was from 55.1 to 60.0%. The meat percentage of 53.1% of Pietrain pigs was over 60.0%.

The findings were the basis for preparation of the requirements for determining of the lean meat percentage on live pigs with *Piglog 105* (Table 4). Subsequently, the requirements were added to the rules for pig assessment. The lean meat content of breeding pigs (progeny, boars and sows) is worth up to 30 points on a 100-point scale system for pig assessment.

Table 4. Requirements for measuring lean meat percentage in pigs with *Piglog 105*

Live weight, kg	Score										
	0	3	6	9	12	15	18	21	24	27	30
Breed group 1*											
85–90	47	48	49	50	51	52	53	54	55	56	57
91–95	46	47	48	49	50	51	52	53	54	55	56
96–100	45	46	47	48	49	50	51	52	53	54	55
101–105	44	45	46	47	48	49	50	51	52	53	54
106–110	43	44	45	46	47	48	49	50	51	52	53
Breed group 2 and 3*											
85–90	52	53	54	55	56	57	58	59	60	61	62
91–95	51	52	53	54	55	56	57	58	59	60	61
96–100	50	51	52	53	54	55	56	57	58	59	60
101–105	49	50	51	52	53	54	55	56	57	58	59
106–110	48	49	50	51	52	53	54	55	56	57	58
Breed group 4*											
85–90	41	42	43	44	45	46	47	48	49	50	51
91–95	40	41	42	43	44	45	46	47	48	49	50
96–100	39	40	41	42	43	44	45	46	47	48	49
101–105	38	39	40	41	42	43	44	45	46	47	48
106–110	37	38	39	40	41	42	43	44	45	46	47

***Note:** *Breed group 1 – Lithuanian White, bacon (LB-B1) and meat (LB-M1) types of Lithuanian White, Latvian White, Estonian Large White; Breed group 2 – Landrace, Yorkshire, Estonian bacon; Breed group 3 – Pietrain, Hampshire, Duroc; Breed group 4 – Lithuanian aboriginal. Crossbreeds were scored according to the respective breed of the dam.*

Selection of Lithuanian White pigs (pure-bred, bacon and meat types) for phenotypic evaluation of carcass traits using *Piglog 105* should be aimed at over 50% lean meat content of breeding pigs.

Conclusions

1. High (r=0.76 and 0.83) and statistically reliable (P<0.01) correlation coefficients for backfat thickness and meat percentage determined with *Piglog 105* and control slaughtering show the prospects of phenotypic evaluation of leanness in pig selection.

2. According to the data of 1996 to 1998, the average lean meat content for pure-bred Lithuanian White pigs was 49.20%, bacon (LB-B1) type Lithuanian White – 50.72%, meat (LB-M1) type Lithuanian White – 51.68%, Yorkshire – 52.67%, German Landrace – 52.83%, Finnish Landrace – 56.83%, Norwegian Landrace – 59.01%, Hampshire – 56.23% and Pietrain – 60.15%.

3. Selection of Lithuanian White pigs (pure-bred, bacon and meat types) for phenotypic evaluation of carcass traits using *Piglog 105* should be aimed at over 50% lean meat content of breeding pigs.

References

Danish purebreds and hybrids. – Sales and export association for breeding pigs. 1993. – 9 pp.

De Vries, A. G., Kanis, E. Selection for efficiency of lean tissue deposition in pigs. – Principles of pig science. Nothingham Uni. Press., p. 23…41, 1994.

Demo, P., Poltarsky, J., Fueloep, L. *et al*. Instrumental prediction of some carcass parameters of pigs at a progeny testing station. – Zivocisna Vyroba, vol. 40 (4), p. 181…185, 1995.

Glodek, P. Genetic standards and breeding methods for farm animals in the EU. – Research reports biotechnical faculty university of Ljubljana. Portorož, Slovenija, vol. 30, p. 147…154, 1998.

Klimas, R., Džiaugys, V. Fenotipinis kiaulių mėsingumo įvertinimas. – LGI mokslo darbai. Gyvulininkystė. Vilnius, T. 31, p. 47…56, 1997.

Merks, J. W. M., Hanenberg, E. H. A. T., Erp, A. J. M. Effects of selection for leanness in pigs on genetic parameters and ultrasonic backfat thickness. – 48th annual meeting of the European association for animal production. Vienna, Austria, 25–28 August, 1997.

Nicholas, F. W. Selection within populations. – Introduction to Veterinary Genetics. Oxford Uni. Press., p. 261…272, 1996.

Piglog 105 users quide. – Soborg, Denmark: SFK-Technology, 1991. – 14 pp.

Põldvere, A., Eilart, K. Different methods for estimating lean meat content of pig carcasses – 5th Baltic animal breeding conference. Collection of scientific works. Baisogala, T. 35, p. 124…131, 1999.

Results of animal recording in Estonia. – Elmator, p. 47…48, 1998.

Tänavots, A., Somelar, E., Saveli, O. *et al*. Comparison of ultrasonic equipments in pig production. – 5th Baltic animal breeding conference. Collection of scientific works. Baisogala, T. 35. p. 157…160, 1999.

Timmi, A., Mölder, R. Comparing of different methods of meat characters of pigs. – Proceedings and abstracts of the International conference "On problems of producing high-quality pork". Tartu, p. 41, 1995.