

GENETIC TREND AND RELATIONSHIP OF MEATINESS TRAITS OF DIFFERENT BREED PIGS RAISED IN LITHUANIA

Ramutis Klimas and Asta Klimienė

Šiauliai University, P. Višinskio 19, Šiauliai, LT-77156, LITHUANIA
E-MAIL: BTMC@CR.SU.LT

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The purpose of this study was to determine the genetic trend of leanness for purebred pigs, and to determine the relations between meatiness traits, age and live weight of animals. The estimation of meatiness traits (backfat and loin lean thickness, lean meat percentage) of purebred Lithuanian White (LW), Large White (La.W), Yorkshire (Y), Landrace (L), Duroc (D) and Pietrain (P) pigs grown in breeding centres was evaluated by apparatus Piglog 105, during 2000–2006. In 2006, the average lean meat percentage of purebred pigs in the breeding centres of Lithuania ranged from 56.9% (LW) to 59.5% (D). During the observation period (2000–2006), the genetic trend of the leanness of LW was 6.9% ($P < 0.001$), La.W and L, respectively, was 2.2 and 2.5% ($P < 0.01$), D was 1.6% ($P < 0.05$), Y was 0.2% and P was 0.6%. A higher genetic trend of the leanness in the LW pig breed can be explained by import of English La.W boars. Correlation analysis showed that lean meat percentage of pigs is more related to backfat thickness ($r =$ from -0.84 to -0.95, $P < 0.001$), than to loin lean thickness ($r =$ from 0.11 to 0.30). Live weight of pigs had more influence on mentioned meatiness traits than age.

Key words: *pigs, meatiness traits, selection, correlation.*

INTRODUCTION

Meatiness of pig depends on numerous factors. Breed is one of them (De Vries and Kanis, 1994; Somelar *et al.*, 2000; Klimienė and Klimas, 2001; Michalska *et al.*, 2007). Fat and lean tissue differ at different periods of pig weight in various pig breeds (Kolstad, 2000). However, backfat thickness is an indicator of pig leanness, because a lower backfat thickness is associated with a higher lean meat content. Also, it has been shown (Vege *et al.*, 2000; Tänavots *et al.*, 2002; Veide, 2002) that the correlation coefficients for these traits are highly negative ($r =$ till -0.6 to -0.9).

Pig breeding in Lithuania is a traditional branch of animal husbandry. Pork accounts over 50% of the total meat production. With increasing demands for lean pork, selection of pigs in the country is developed namely by this trend. Selection of boars and sows is carried out in the breeding centres is based on half carcass length, backfat thickness, loin lean area and weight of ham of progeny fattened at a control fattening station and slaughtered at average weight 95 kg. Since 1996 (Klimas and Klimienė, 2000), breeding progeny in the breeding centres of Lithuania have been selected for backfat thickness and lean meat percentage determined by *in vivo* using the ultrasonic apparatus *Piglog 105* (phenotypical evaluation). By the end of 2006, at the breeding centres about 25% of all purebred pigs were Lithuanian White, 13%—Large White, 18%—Yorkshire, 42%—Landrace, and

2%—Lithuanian native pigs (gene pool), Duroc and Pietrain (Rekštys, 2006).

The purpose of this study was to determine the genetic trend of leanness for purebred pigs, and to determine the relations between meatiness traits, age and live weight of animals.

MATERIALS AND METHODS

Lean meat percentage (leanness) and other meatiness traits (backfat and loin lean thickness) of purebred Lithuanian White (LW), Large White (La. W), Yorkshire (Y), Landrace (L), Duroc (D) and Pietrain (P) pigs grown in the breeding centres were estimated using an ultrasonic apparatus *Piglog 105*, during 2000–2006. The number of tested purebred pigs of different breed for determination of the genetic trend of the leanness, is presented in Table 1 (total $n = 26\,953$). Correlation coefficient (r) of meatiness traits with age and live weight of breeding progeny ($n = 5402$) are defined.

Phenotypic evaluation of pig meatiness traits. At breeding centres measurements were made for breeding progeny at 85–110 kg live weight. Lean meat percentage was determined with a *Piglog 105* by measuring the backfat thickness (mm) on live pigs at two points (Anonymous, 1991):

- 1) between the 3rd and 4th last lumbar vertebrae and 7 cm sideways from the middle dorsal line (FAT-1);

Table 1
DATA FOR LEAN MEAT CONTENT IN PIGS OF DIFFERENT BREEDS MEASURED USING A PIGLOG 105

Parameter	Year				Comparison (\pm) 2006/2000
	2000	2002	2004	2006	
Lithuanian White (LW)					
No. of pigs	1939	2320	1790	1846	
Lean meat %	50.0	51.9	56.7	56.9	+6.9***
Large White (La.W)					
No. of pigs	416	335	550	1285	
Lean meat %	56.3	58.1	58.4	58.5	+2.2**
Yorkshire (Y)					
No. of pigs	1348	1371	1386	1351	
Lean meat %	57.8	57.8	57.6	58.0	+0.2
Landrace (L)					
No. of pigs	1479	1726	3779	3218	
Lean meat %	56.3	57.6	58.1	58.8	+2.5**
Duroc (D)					
No. of pigs	60	59	106	43	
Lean meat %	57.9	59.7	59.1	59.5	+1.6*
Pietrain (P)					
No. of pigs	223	153	104	66	
Lean meat %	60.0	58.5	58.7	59.4	-0.6

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

2) 10 cm from the last rib towards the cranial part and 7 cm sideways from the middle dorsal line (FAT-2). The thickness of the loin lean (*musculus longissimus dorsi*) is also measured at this point.

The lean meat percentage was determined according to the in-coded *Piglog 105* formula. Age (in days) and live weight of pigs were entered in the apparatus programme before backfat measurements.

Statistical analysis. Data were processed using the statistical package Statistica for Windows version 6.0 (StatSoft,

2001) following Tucker (2003). Differences were considered significant when $P < 0.05$.

RESULTS

In 2006, at the breeding centres of the country the average lean meat percentage of Lithuanian White pigs was 56.9%, that of Yorkshire 58.0%, Large White 58.5%, Landrace 58.8%, Pietrain 59.4% and Duroc 59.5% (Table 1).

Compared with the data for 2000, the leanness of Lithuanian White pigs in 2006 has increased by 6.9% ($P < 0.001$), that of Large White and Landrace, respectively, by 2.2 and 2.5% ($P < 0.01$), Duroc by 1.6% ($P < 0.05$), Yorkshire by 0.2%; and lean tissue deposition in Pietrain pigs decreased by 0.6% (Table 1 and Fig. 1).

Relationships of meatiness traits of pigs for different breeds are shown in Table 2. The highest correlation coefficients were obtained between backfat thickness in both points and lean meat percentage ($r =$ from -0.84 to -0.95), indicating that a thinner backfat is associated with higher relative muscularity of pigs ($P < 0.001$). Much smaller influence on the lean meat percentage of pigs had thickness of loin lean ($r =$ from 0.11 to 0.30). High positive correlation coefficients were found between backfat thickness in both points ($r =$ from 0.69 to 0.84). Therefore, thickening of backfat is similar at both back points ($P < 0.001$). However, both in the first point (FAT-1) and in the second (FAT-2) relationships between backfat and loin lean thickness differed widely among genotypes ($r =$ -0.04 to 0.51).

Meatiness traits of breeding progeny were related to age and live weight (Table 2). Correlation between age of pigs and backfat thickness in both points was positive in all groups ($r =$ from 0.01 to 0.35), while it was negative between age and relative muscularity in 5 groups ($r =$ from -0.01 to -0.29), but slightly positive ($r = 0.10$) and insignificantly for Pietrains.

Relationships between live weight and meatiness traits of pigs were close and not contradictory. With increasing mass

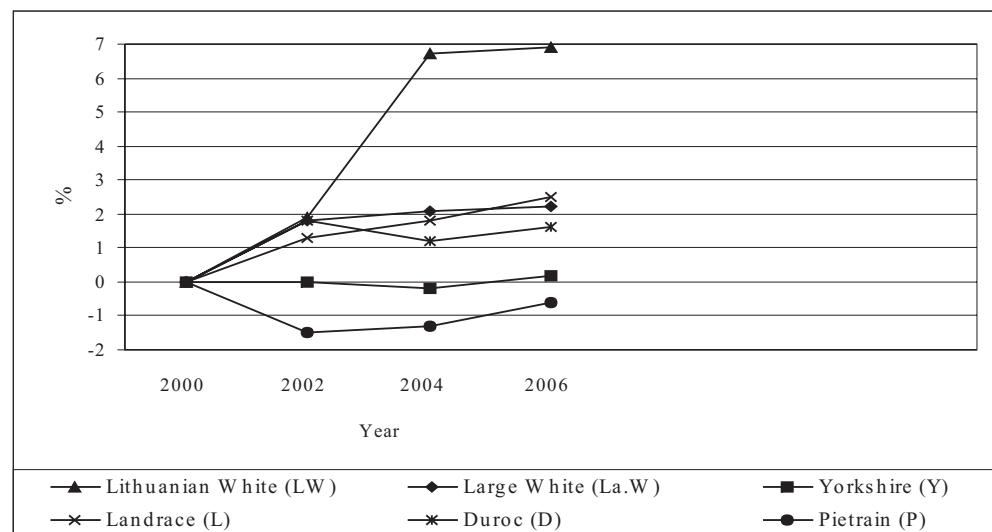


Fig. 1. Genetic trend of leanness in the pig breeding centres.

Table 2

CORRELATION COEFFICIENTS (r) OF MEATINESS TRAITS WITH AGE AND LIVE WEIGHT OF PIG DIFFERENT BREEDS

Parameter	Breed					
	LW	La.W	Y	L	P	D
No. of pigs	2835	334	1372	618	163	80
Age, in days — backfat thickness at point FAT-1, mm	0.12***	0.18***	0.18***	0.04	0.01	0.29**
Age, in days — backfat thickness at point FAT-2, mm	0.12***	0.22***	0.19***	0.02	0.03	0.35**
Age, in days — loin lean thickness, mm	0.01	0.02	0.12***	0.05	0.34***	0.23*
Age, in days — lean meat content, %	-0.12***	-0.21***	-0.16***	-0.01	0.10	-0.29**
Live weight, kg — backfat thickness at point FAT-1, mm	0.14***	0.37***	0.39***	0.25***	0.07	0.38***
Live weight, kg — backfat thickness at point FAT-2, mm	0.14***	0.34***	0.37***	0.30***	0.17*	0.45***
Live weight, kg — loin lean thickness, mm	0.19***	0.31***	0.34***	0.34***	0.39***	0.51***
Live weight, kg — lean meat content, %	-0.10***	-0.27***	-0.31***	-0.14***	0.02	-0.27*
Backfat thickness at point FAT-1, mm — backfat thickness at point FAT-2, mm	0.84***	0.75***	0.77***	0.79***	0.69***	0.82***
Backfat thickness at point FAT-1, mm — loin lean thickness, mm	-0.05*	0.28***	0.04	0.12**	0.14	0.51***
Backfat thickness at point FAT-1, mm — lean meat content, %	-0.92***	-0.85***	-0.90***	-0.86***	-0.85***	-0.84***
Backfat thickness at point FAT-2, mm — loin lean thickness, mm	-0.12***	0.22***	-0.04	0.14***	0.04	0.45***
Backfat thickness at point FAT-2, mm — lean meat content, %	-0.95***	-0.89***	-0.93***	-0.87***	-0.87***	-0.89***
Loin lean thickness, mm — lean meat content, %	0.30***	0.11*	0.24***	0.28***	0.25**	0.11

For abbreviations see Table 1. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

of the body, thickness of backfat ($r =$ from 0.07 to 0.45) and thickness of loin lean ($r =$ from 0.19 to 0.51, $P < 0.001$) of breeding progeny also increased, when relative muscularity in many groups (in five groups) was decreasing ($r =$ from -0.10 to -0.31). There was no correlation between live weight and relative muscularity ($r = 0.02$) for the Pietrain group.

DISCUSSION

Pig breeds in Lithuania are classified into three groups:

- maternal breed – Lithuanian native, Lithuanian White, Large White/Yorkshire;
- intermediate breed – Landrace;
- paternal breed – Duroc, Pietrain and their hybrids with Landrace pigs.

The breeding progeny is raised and distributed by 43 pig breeding centres. By the end of the year 2006, about 8% of all pigs were bred in these centres (Rekštys, 2006). Pig selection carried out in breeding centres is directed towards higher litter size and milk yield and improvement of fattening and carcass traits. The main quality indicator of pig carcasses is the percentage of lean meat. Studies of genetic factors and search and introduction of more progressive selection methods become very important due to increased demand for high quality pork.

According to the *Piglog 105* data obtained in 2006, the average lean meat percentage of purebred pigs in the breeding centres of Lithuania ranged from 56.9% (Lithuanian White)

to 59.5% (Duroc), which indicated that the selection of breeding progeny in Lithuanian breeding centres shown by a phenotypic method of meatiness evaluation (*Piglog 105*), was highly effective. During the observation period (2000–2006), the genetic trend of the muscularity of the pigs ranged from 6.9% (Lithuanian White) to 0.6% (Pietrain). By their leanness, Lithuanian Whites are becoming comparable to Yorkshires and Large Whites bred in the country. A higher genetic trend of the leanness of the Lithuanian White pig breed is probably due to import of English Large White boars (Klimas *et al.*, 2005). English Large Whites had the biggest influence on nurture of Lithuanian Whites (Makoveckas, 1986), and additional infusion of blood of this breed may be considered as pure breeding. According to the used schemes of breeding, improvement of genetic potential of the population of purebred Lithuanian Whites with boars of the English Large White breed started in 2002 in nine breeding centres (Klimas *et al.*, 2004). During the study period, leanness of Yorkshires and Pietrains was not statistically significant. However, muscularity of Pietrain pigs decreased by 0.6% indicating difficultly of this breed in adapting in Lithuania.

Carrying out the selection of pigs according to several productivity traits, it is necessary to know their interrelation. The magnitude of correlation between different production traits of pigs depends on many factors, the most important being breed, genetic structure of the herd, the level of productivity and environmental conditions (Nicholas, 1996; Vege *et al.*, 2000; Tänavots *et al.*, 2002; Hoste, 2003). Correlations of meatiness traits of pigs bred in Lithuania in most cases have been determined by evaluating carcasses (Klimas and Klimienė, 2000; Mikelénas and Štuopytė,

2000). Correlations between meatiness traits, evaluated in breeding centres using the apparatus *Piglog 105*, and age and live weight of investigated animals for most breeds were determined for the first time. Depending on breed, lean meat percentage of pigs was more related to their back-fat thickness ($r =$ from -0.84 to -0.95 , $P < 0.001$), than to loin lean thickness ($r =$ from 0.11 to 0.30). Increase of back-fat thickness in one point of the back ($r =$ from 0.69 to 0.84 , $P < 0.001$). It was also found that live weight of pigs had a greater influence on meatiness traits than age.

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ĢĒNĒTISKAIS UZLABOJUMS UN GAĻAS ĪPAŠĪBU PAZĪMU SAVSTARPEJĀ SAISTĪBA DAŽĀDĀM LIETUVĀ AUDZĒTĀM CŪKU ŠĶIRNĒM

Būtiskākais Lietuvā audzēto cūku ģenētiskais uzlabojums saistīts ar angļu šķirnes *Large White* iekrustošanu. Sniegtas korelācijas starp galvenajām gaļas īpašības nosakošajām pazīmēm un analizēta to ietekme uz gaļas kvalitāti.