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COMPARABLE ESTIMATION OF MEAT PRODUCTION OF LITHUANIAN LOCAL AND IMPORT INTENSIVE SELECTION PIGS

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In the produced and consumed meat balance a part of pork is increasing in last years in the world. Increasing pork production, the demands for meat quality are increasing too. If it is known a genetic potential of separate breeds pigs of meat production it is searching most favorable crossbreeding combinations. In Lithuania the main breed of pigs is Lithuania white and beside this intensive selection import breeds pigs are breeding too.

The purpose of this work is to make comparison estimation of meat characteristics and meat quality of Lithuanian White (LW) Germany Landrace (GL), Sweden Yorkshire (SY), English Large White (ELW) and German Large White (GLW).

The tests showed that pigs of intensive selection has reached 100 kg mass 5-15 days faster than LW pigs ($p<0.01$). GL pigs growed most quickly. Their increase weight during a day was 115 bigger than LW pigs ($p<0.05$). SY breeds pigs had a bigger increase weight too ($p<0.05-<0.01$). The length of carcasses sides of other breeds pigs has separated too ($p<0.05-0.001$). Comporting with others breeds, muscularity of LW pigs was 0.71-2.21% smaller ($p<0.001->0.005$). There are indicated statistical reliability of meat chemical compositions, pH, color, L*, a*, b*, drip loss, cooking loss, water holding capacity of tested breeds ($p<0.001-p<0.05$).

It is made conclusion that it is best to cross Lithuania white pigs with Germany Landrace and Sweden Yorkshire.

INTRODUCTION

Meat is an important source of proteins for the human nutrition. Meat from various animal species differs according to nutritional value, culinary and technological characteristics [Honikel, 2004]. Meat composition from the consumed meat in the human nutrition is different in various countries depending on traditions. During the last years pork amount is increasing in the whole produced meat balance from many countries. In the world meat balance pork makes 39.4%, in Europe – 49.3%. Pork is well preserved, also is calorific and rich in proteins containing unsaturated fatty acids, mineral matter and vitamins. In comparison with other animal meat it has less collagen and elastin [Koptelova *et al*., 2005; Burmistrov *et al*., 2005; Popov, 2005; Mysik, 2006].

Pork quantity and quality depends on many factors: breed, individual animal characteristics, sex, age, feeding, keeping and others [Wood *et al*., 1994; Claeys *et al*., 2001; Knap *et al*., 2001; Honikel, 2004; Koptelova *et al*., 2005; Jukna *et al*., 2005].

An intensive selection of pigs according to growth speed, feed consumption, fat thickness and lean meat over the last decades has resulted negative subsequence. Pigs became more stress-susceptible and have lower meat quality [Sellier, 1994; Leach *et al*., 1996; Andersen *et al*., 1998; Nyström, 1999; Lefaucher, 2001].

During the last years more attention is paid to the meat quality. Therefore in pig husbandry developed countries pig selection is performed according to the meat quality [Schworer *et al*., 1994].

Lithuanian White is the main pig breed in Lithuania. Lithuanian White pigs are undemanding for feed, less stress-susceptible and well acclimatized to the local conditions. Breeding with English Large White pigs has improved their meat characteristics [Klimas *et al*., 2004].

Swedish Yorkshire, German Landrace, Large White and other pig breeds of intensive selection were imported from abroad for breeding with Lithuanian White pigs. An efficiency of crossing among breeds and degree of heterosis depends on genetic peculiarities of breeds chosen for crossing [Koptelova *et al*., 2005; Gerasimov *et al*., 2006; Nechreva *et al*., 2006].

According to Pierzchala *et al*. [2003] it is possible to make an influence on offspring quality by choosing animals for the crossing.

The objective of the study was to evaluate meat production of Lithuanian White and imported pig breeds of intensive selection.

MATERIALS AND METHODS

The research was carried out with Lithuanian White (LW), Swedish Yorkshire (SY), German Landrace (GL), English Large White (ELW) and German Large White (GLW) pig breeds. 40 piglets: 20 gilts and 20 boar castrates of two

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months old were picked from each breed. For the experiment offspring from five boars from each breed were chosen. Experimental piglets of two months old were collected into Baisogala State Breeding Station of Pigs and were grown under the same standard conditions until they have reached the weight of 95-100 kg. The standard combined forage was used which 1 kg energetic value was 13.4 MJ of metabolism energy, crude proteins made 16% of all dry matter of the ration.

When feeding was finished the age until pigs have reached the weight of 100 kg (days), medium daily gain per day (g) during control and consumed amount of feeds for to grow 1 kg of weight were fixed.

Control slaughtering was performed in the Station after pigs have reached the necessary weight. Carcass weight, muscularity, length of carcass part, fat thickness behind the last rib was measured after slaughter.

The samples for meat quality evaluation were taken from *musculus longissimus dorsi* between the 12th and the last rib 36 h after slaughter and were kept at + 4°C in the fridge. Meat pH (by a pH-meter), meat color according to CIE-LAB method by measuring meat lightness L*, redness a* and yellowness b*, dry matter amount by drying samples at 105°C until the fixed weight, fat amount according to Soxlet method, protein amount according to Kjeldal method, ash amount by drying meat organic matter at 600–800°C and drip loss according to sample weight loss during 36 h by hanging them for 36 hours at + 4°C temperature were determined at the Laboratory of Meat Characteristics and Quality Assessment at Lithuanian Veterinary Academy 36 hours after slaughter. Meat water holding capacity according to Grau and Hamm method, shear force according to Warner–Bratzler method and cooking loss by cooking meat in a circulating water bath for 30 min were determined 48 h after slaughter.

The data was analysed by using statistical R pack version 2.0.1.

Differences dependability between groups was established according to Student. Differences were statistically significant when $p<0.05$.

RESULTS AND DISCUSSION

Experiment has showed that pigs of intensive selection have reached 100 kg weight 5-15.4 days faster than Lithuanian White pigs (Table 1). The biggest difference of this index was comparing them with German Landrace and Swedish Yorkshire pigs (0.01). The biggest daily gain was from German Landrace pigs. Comparing with Lithuanian White the difference between them was 115 g ($p<0.01$). SY pigs were the second according to the daily gain. Their daily gain per day was 87.2 g bigger than Lithuanian White pigs ($p<0.05$). Daily gain from other breeds was similar to Lithuanian White pigs. GLW and ELW pigs consumed the biggest amount and SY pigs consumed the lowest amount of feeds for to grow 1 kg of weight ($p<0.01–<0.05$). The differences of feed consumption for to grow 1 kg of weight among other breeds were less. Input of feed consumption for to grow 1 kg of weight were a bit higher from LW than from SY and GL pigs, and lower than ELW and GLW pigs. The longest carcass parts were from GL pigs and shortest were from SY pigs. The difference between them was 4.94 cm ($p<0.001$). Carcass parts from LW pigs were 2.41 cm shorter than from GL pigs ($p<0.01$), 0.89 cm shorter than from ELW pigs and 4.94 cm longer than from SY pigs ($p<0.001$). The differences of ham weight among investigated pig breeds were small. The highest lean meat amount was from GL and the lowest was from LW pigs. The difference between them was 2.21% ($p<0.01$). Lean meat amount from other breeds was 0.71-1.56% higher than from LW pigs ($p<0.05$). The thickest fat at the last rib was from LW pigs and the thinnest fat was from ELW pigs. The difference between them was 1.9 mm ($p<0.001$). Fat thickness at the last rib from other breeds was 1.2-1.7 mm thinner than from LW pigs ($p<0.001$).

Dispersive analysis has shown that breed had the biggest influence on daily gain – 17.82%, on feed consumption for to grow 1 kg of weight – 14.22%, on age when pigs have reached 100 kg of weight – 13.89%, on ham weight – 8.18%, on lean meat – 7.95% and on the length of carcass part – 6.72%.

Various indexes of meat production from all investigated gilts and boars castrates differed very little. However, all differences statistically were not significant ($p>0.05$).

Meat quality analysis has showed that dry matter amount from all pig breeds was differed very little (Table 2). Protein is the most valuable part of meat. Its amount was similar from all investigated pig meat. Intramuscular fat increases meat nutritional value and taste. Although too big amount of intramuscular fat inhibits gastric juice exudation and make difficult to digest protein [Zajas, 1981]. Nowadays lean meat is required. Though too little amount of intramuscular fat

TABLE 1. Meat characteristics from different pig breeds.

Indexes	Breed				
	LW	GL	SY	ELW	GLW
Age at 100 kg weight (days)	184.87±3.71	169.44±3.63**	169.68±3.24**	179.88±2.70	176.42±3.31
Daily weight gain (g)	775.52±27.68*	890.47±27.79*	862.69±26.61*	775.54±22.43	772.33±27.79
Intake of metabolizable energy to grow 1 kg of weight (MJ)	29.75±0.51	28.08±0.71	27.97±0.62**	30.64±0.78*	30.99±0.71*
Carcass part length (cm)	97.56±0.60	99.97±0.53**	92.62±0.45***	98.45±0.55	97.32±0.53
Ham weight (kg)	11.21±0.15	11.56±0.13	10.53±0.15	11.33±0.10	11.24±0.12
Lean meat (%)	55.03±0.52	57.24±0.58**	56.15±0.47	56.59±0.63	55.74±0.58
Fat thickness at the last rib (mm)	16.90±0.17	15.70±0.22***	15.40±0.30***	15.00±0.19***	15.2±0.13***

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

TABLE 2. Chemical composition and physical characteristics of *musculus longissimus dorsi* from different pig breeds.

Indexes	Breed				
	LW	GL	SY	ELW	GLW
Dry matter (%)	26.84±0.40	27.59±0.47	26.54±0.53	26.01±0.22	26.20±0.47
Protein (%)	24.08±1.65	23.78±0.45	23.35±0.49	23.12±0.23	23.73±0.44
Fat (%)	1.60±0.10	1.41±0.07	1.68±0.08	1.36±0.07*	1.28±0.06*
Ash (%)	1.16±0.04	1.19±0.01	1.15±0.01	1.18±0.01	1.19±0.01
pH	5.52±0.04	5.39±0.02*	5.43±0.02	5.44±0.01	5.47±0.02
Lightness L*	53.78±0.57	55.68±0.60*	54.21±0.40	54.49±0.62	52.91±0.40
Redness a*	14.21±0.32	13.80±0.30	14.51±0.34	14.37±0.33	14.53±0.19
Yellowness b*	7.20±0.38	6.79±0.43	6.61±0.39	6.56±0.31	5.98±0.28*
Drip loss (%)	7.20±0.65	10.04±0.76**	8.68±0.78	9.03±0.71	8.64±0.64
Water holding capacity (mg/%)	58.48±0.45	57.08±1.15	58.23±0.60	58.06±1.05	59.01±0.91
Cooking loss (%)	26.66±0.62	28.06±0.50	28.74±0.55	28.82±0.51*	28.40±0.49*
Shear force (kg/cm^2)	1.46±0.11	1.35±0.07	1.60±0.09	1.90±0.15*	1.56±0.08

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

worsens meat taste characteristics. Intramuscular fat amount from all investigated pig breeds is low. The lowest amount was from ADB and VDB, the biggest amount was from LB pig meat ($p<0.05$). The amount of mineral matter from all pig breeds was also similar. Meat pH is an important index of meat quality which specifies ability for the longer conservation and some technological characteristics. The differences of meat pH among breeds were low. The highest pH was from LW pigs and the lowest pH was from GL pigs ($p<0.05$). The differences of pH among other breeds were less significant. Colour gives meat not only aesthetic appearance, but also it is associated with some culinary and technological characteristics. The darkest meat was from GLW and LW pigs and the lightest was from GL pigs ($p<0.05$). The biggest meat lightness L* difference was determined between GL and GLW pigs ($p<0.001$). The difference of meat redness a* between these breeds was also the highest ($p<0.05$). Meat redness a* from LW pigs was similar to the other breeds. LW pigs had the highest meat yellowness b*. The difference was significant in comparison with GLW pigs ($p<0.05$). In comparison with other pig breeds the differences of this index were not significant. Growing drip loss of pork is one of the live problems of intensive pig selection. LW pig meat had the lowest and GL pig meat had the highest drip loss ($p<0.01$). The differences of drip loss among other breeds statistically were not significant. The differences of water holding capacity among breeds statistically were not significant. LW pigs had the lowest cooking loss. Cooking loss from other breeds was 1.4-2.16% higher ($p<0.05->0.05$). Meat shear force is an important index of meat quality. Tender meat is more tasteful and easily digested. Meat shear force depends on muscle tissue and its protein structure [Zajas, 1981]. The toughest meat was from ELW pigs and the lowest shear force was from GL pigs. The difference between these breeds was 0.55 kg/cm^2 ($p<0.01$). Meat shear force from LW pigs was a bit less than from SY, ELW and GLW pig meat, and bigger than from GL pig meat. Although the differences were statistically significant only in comparison with ELW pig meat. Lower differences of meat quality indexes among breeds than inside breeds were established in the previous research of Jukna *et al*. [2005]. Similar results were determined by Popov [2005] by comparing meat chemical composition from Large White, Duroc and Landrace pigs. Although Koptelova *et al*. [2005], Burmistrov *et al*. [2005] established that breed has an influence on meat chemical composition.

Dispersive analysis has showed that breed influence on meat quality indexes is unequal. The biggest breed influence was on the amount of intramuscular fat (14.56%), on meat pH (13.74%), on meat shear force (11.31%), on meat lightness L* (10.98%) and on cooking loss (9.19%). Breed influence on the other meat quality indexes was less: on meat drip loss – 7.86%, on ash amount – 7.63%, on meat redness a* – 3.47%, on meat yellowness b* – 2.97%, on dry matter amount – 2.76%, on protein amount – 2.67% and on water holding capacity – 1.17%.

Gilts and boar castrates were grouped separate for to clear up sex influence on meat quality. In our research the differences of meat quality indexes among gilts and boar castrates statistically were not significant. The tendency is observed that gilt meat had the lower amount of intramuscular fat and drip loss in comparison with boar castrates. Some authors have established the differences among different meat quality indexes from gilts and boar castrates. They stated that gilt meat had more proteins and less intramuscular fat in comparison with boar castrates meat [Wood, 1994; Braunscheid *et al*., 1998; Knap *et al*., 2001; Piedrafita *et al*., 2001; Guy *et al*., 2002].

CONCLUSIONS

1. The biggest daily gain per day was from German Landrace and Swedish yorkshire pigs. Their daily gain was accordingly 115.0 g ($p<0.01$) and 87.2 g ($p<0.01$) bigger than Lithuanian White pigs.

2. German Landrace had the highest lean meat content. Their lean meat was 2.21% ($p<0.01$) higher than Lithuanian

White pigs. In comparison with other breeds the difference of lean meat from Lithuanian White pigs was low and statistically not significant.

3. The biggest amount of intramuscular fat was from Lithuanian White pigs, the lowest amount was in English Large White and German Large White pig meat ($p<0.05$). German Large White and Lithuanian White pig meat was the darkest and the lightest meat was from German Landrace ($p<0.05$). The lowest drip loss was from Lithuanian White and the biggest was from German Landrace pig meat ($p<0.01$). English Large White pigs had the toughest meat and the lowest shear force was from German Landrace pig meat. The difference between them was 0.55 kg/cm^2 ($p<0.01$).

4. Dispersive analysis has showed that breed had an influence on daily gain per day – 17.82%, on the amount of intramuscular fat – 14.56%, on meat pH – 13.74%, on meat shear force – 11.31%, on meat lightness L* – 10.98%, on cooking loss – 9.19% and on the drip loss – 7.86%.

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