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DIFFERENCES OF PIG CARCASS TRAITS IN REGARD TO SUPPLIERS IN THE SLOVAK REPUBLIC

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ABSTRACT

Production of fattening pigs changed over the years in the Slovak Republic. While the number of small breeders is continuously decreasing, number of large farms is increasing. These changes are closely connected with the change of animal genotypes and management of breeding. Finally, distribution of carcasses is changed and different pig carcasses are delivered to slaughterhouses. The study was performed using data from six major slaughterhouses in Slovakia to analyse the structure of fattener's suppliers and to compare the characteristics of carcasses from these suppliers. Results showed differences in carcass characteristics between small and large suppliers. While the small suppliers were delivering heavier animals, large suppliers were delivering carcasses with lower backfat thickness and higher lean meat content. Moreover, the trend of increasing live weight was observed in the group of small suppliers. On the other hand, the trend of increasing muscle thickness and lean meat content was observed in the group of large producers.

Key words: pig; backfat thickness; muscle thickness; lean meat content; classification; SEUROP

INTRODUCTION

The pig sector in Slovakia have gone through changes over the last decades. The number of pigs decreased by seven percent in the period of 2015 – 2019. The proportion of local producers has been decreased, while the number of large farms has been growing up (Tomka *et al*., 2021). Simultaneously, the pig genotypes also changed, since the farmers began to use crossbreds coming from international breeding programmes. Consequently, changes in the pig population and management affect the pig carcass classification (Font-i-Furnols *et al*., 2016) and result in changes in the distribution of classified carcasses over the years (ATIS, 2009; ATIS, 2019). Changes in pig breeding, especially orientation towards higher lean meat content, are closely related to changes in pig carcass quality and may lead to problems with selling the pork (Nakev and Popova, 2019). In practice, there is a paying scheme based mostly on the lean meat content on one hand, and, on the other hand, there is a demand for high-quality pork and meat products from consumers. Discrepancies between carcass pricing and market expectations were discussed by several authors (Marcoux *et al*., 2007; Vítek *et al*., 2012).

All the mentioned changes are commonly known, however, there is a lack of detailed studies on real changes in the structure of pig population and carcass traits. This kind of information is needed in order to take adequate decisions and steps in regard to pig carcasses produced in the country. Therefore, our study was undertaken in order to bring a detailed view on the situation in the pig production in Slovakia, to ensure that the classification methods are up to date and reflect actual situation. The aim of this paper is to analyse differences and changes

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of pig carcass traits coming from different pig suppliers in the Slovak Republic.

MATERIAL AND METHODS

Data from six major slaughterhouses in Slovakia (more than 100 pigs slaughtered per week) since 2015 to 2019 were used in the study. Five slaughterhouses were using FOM apparatus and one slaughterhouse was using UFOM apparatus. ZP method was used only as alternative in case of no problems with FOM or UFOM devices. Data from ZP were not included in the study. Based on the data from Eurostat (Eurostat, 2020), the data used in this study involved from 59 % to 78 % of total slaughters during the studied period.

Data on subcutaneous backfat thickness (FT) and muscle thickness (MT) measured at the site between the second and third last ribs, 70 mm beside the mid-line of the split line by both methods were obtained. Lean-meat content (LMC) was calculated within classification process according to equations lied down in the Commission Decision 2009/622/EC and SEUROP class was attributed according to predicted LMC. In order to simplify the statistical evaluation, numbers 1 to 6 (1 referring to S and 6 referring to P class) were assigned to individual classification classes (CLASS).

Based on the producer/supplier information the information on prevailing genotype of animals or, at least, breeding program were estimated (Table 1). In case of Slovak producers with no foreign breeding program, the prevailing genotypes of pigs were obtained. Almost all of these Slovak producers used animals originated from mating of crossbreds. In dam position crossbreds Large White x Landrace were prevalent and in sire position different crosses of Yorkshire x Pietrain, Hampshire x Pietrain, or purebred Pietrain and purebred Duroc boars were prevalent.

Totally, 593 producers and suppliers delivered slaughtered pigs during the studied period. Producers and suppliers were divided into two groups. Small producers and suppliers were those delivering up to 2 000 pigs per studied period, meaning 400 pigs per year on average. Large producers and suppliers were those, who delivered more than 2 000 pigs during the studied period. In Table 2, total numbers of producers and suppliers according to the number of delivered pigs are presented.

Differences between carcass traits according to the size of suppliers were tested using GLM procedure. Three models were applied including only the effect of size of supplier (Model 1), effect of size of supplier and origin (Model 2) and effect of size of supplier and classification method (Model 3). Changes of carcass traits during the studied period in both groups of suppliers were analysed by REG procedure using SAS software v9.4. Traits were regressed on the year of slaughter and F-test was applied to test a difference of the slope from the zero, showing significance of the trend over the studied period.

Table 1. Description of producers/suppliers of pigs

	Description
CZ	Producers / suppliers from the Czech Republic
DK	Producers / suppliers within Slovakia using animals from Danish breeding program
DU	Producers / suppliers within Slovakia using animals from Dutch breeding program
HU	Producers / suppliers from Hungary
NL	Producers / suppliers from the Netherlands
PL	Producers / suppliers from Poland
SK	Producers from Slovakia
UK	Producers / suppliers within Slovakia using animals from British breeding program
XX	No detailed information on producer / supplier of animals

Table 2. Numbers of producers/suppliers according to number of delivered carcasses in 5 years

Origin		Small	Large
	Total	<2000/5y	>2000/5y
CZ	99	66	33
DU	3		3
DK	22	2	20
HU	48	35	13
NL	1	1	
PL	177	172	5
SK	14	4	10
UK	4	1	3
XX	225	219	6

RESULTS AND DISCUSSION

Changes in production

The numbers of large (> 400 pigs/year) and small (< 400 pigs/year) producers/suppliers delivering pigs over the studied period were stable or slightly changed in some groups (DK, SK, HU). Numbers of producers/suppliers from the Czech Republic and Poland even increased in last years. On the other hand, the number of producers/suppliers with no detailed information, mainly representing small domestic producers/suppliers, decreased.

Although the overall number of producers and suppliers was high in some groups according to the origin, only few of them were delivering on the regular basis. This was especially the case of producers/suppliers from neighbouring countries (Czech Republic, Hungary, Poland). Out of 99 CZ producers/suppliers, only 12 large and 1 small were delivering regularly during the last five or four years. Similarly, out of 48 HU producers/suppliers, only 5 large and 1 small were delivering regularly during the last five or four years. While the number of producers/suppliers from Poland increased and reached 177 subjects over the studied period, only 2 large producers/suppliers were delivering on the regular basis. On the other hand, out of 14 Slovak producers/suppliers without any foreign breeding program, 9 large and 1 small producers/suppliers were delivering regularly during the last five or four years and similarly out of 22 suppliers with DK breeding program, 15 large suppliers were delivering regularly during the last five or four years.

The proportion of delivered pigs from large producers/suppliers was ranging from 89 to 92 % from a total number of delivered and classified pigs. This means the higher proportion of animals with the genotype from DK breeding programme along with CZ and SK pigs were prevailing in the deliveries of animals to slaughterhouses during the studied period.

Table 3. Distribution of carcasses according to the size of producer/supplier

Size		Class					
		S	E	U	R	O	P
Small	n	123 245	63 841	9 528	1 067	239	114
	%	62.23	32.24	4.81	0.54	0.12	0.06
Large	n	1 371 960	303 983	37 805	3 180	350	154
	%	79.88	17.70	2.20	0.19	0.02	0.01

Changes in distribution and traits

Changes in the structure of producers and suppliers of pigs (through improved genotypes, herd management, etc.) also affected the distribution of carcasses classified according to the SEUROP scale. Proportion of pig carcasses delivered by small producers/suppliers classified within S and E class was 94 %, while the proportion of these carcasses delivered by large producers/suppliers reached almost 97 % (Table 3). Higher proportion of carcasses delivered by large producers were classified to the S class. These differences suggest higher level of breeding of large suppliers compared to small ones, but it also may suggest that large producers/suppliers target their production towards higher lean meat content, while small producers/suppliers are still keeping some level of fatness.

Differences in carcass traits between small and large suppliers were statistically significant (Table 4). Smaller differences between the suppliers were observed when model also included effect of origin (Model 2), indicating that the difference was partly due to this effect. On the other hand, differences between the suppliers changed only slightly when the model with the effect of size and method (Model 3) was applied. Negligible changes in differences between suppliers were observed when carcass weight was included in the model.

Higher fat thickness was observed in carcasses from small suppliers in all classes (Table 5). Moreover, when only classes S – O were considered, the trend of increasing difference in the fat thickness between small and large producers/suppliers was observed. On the other hand, higher muscle thickness was observed in carcasses from large suppliers in all classes. Higher live weights were observed in the group of small suppliers with the decreasing difference of weights from class S to P. These findings are in agreement with Čítek *et al*. (2012), who reported that fat coverage increased with increasing live weight. This fact, however, did not explain the opposite trend of increasing differences between fat thickness of the two groups and decreasing differences between live weight. Although there was difference at only 0.86 mm in backfat thickness and difference at 3.43 kg in live weight in S class, there was difference at 4.04 mm in the backfat thickness and difference at only 0.53 kg in live weight

Table 4. Differences in carcass traits according to the size of supplier

	Trait	Small			Large		LSM difference
		R^2	LSM	SD	LSM	SD	
Model 1	CW	0.02***	96.71	0.03	90.83	0.01	***
	FT	0.03***	15.92	0.01	13.63	0.003	***
	MT	0.01***	60.32	0.02	62.24	0.01	***
	LMC	0.01***	60.20	0.01	61.86	0.003	***
	CLASS	0.02***	1.44	0.001	1.23	0.0004	***
Model 2	CW	0.03***	94.34	0.05	91.46	0.05	***
	FT	0.12***	15.73	0.01	14.49	0.01	***
	MT	0.02***	61.18	0.04	62.66	0.03	***
	LMC	0.08***	60.57	0.02	61.21	0.01	***
	CLASS	0.11***	1.43	0.002	1.33	0.002	***
Model 3	FT	0.04***	16.85	0.01	14.46	0.01	***
	MT	0.01***	59.58	0.03	61.58	0.02	***
	LMC	0.06***	58.02	0.01	59.90	0.01	***
	CLASS	0.10***	1.79	0.001	1.54	0.001	***

Model 1 – only effect of size of supplier, Model 2 – effect of size of supplier and origin, Model 3 – effect of size and method, ***$P < 0.001$, R^2 – coefficient of determination, LSM – least squares means, SD – standard deviation, CW – carcass weight, FT – fat thickness, MT – muscle thickness, LMC – lean meat content, CLASS – classification class.

Table 5. Comparison of traits according to the size of producer/supplier

Size	Class	FT (mm)	MT (mm)	LMC (%)	CW (kg)	LW (kg)
Small	S	13.17	63.06	62.57	92.19	116.17
	E	18.82	56.79	58.08	93.78	118.19
	U	25.69	53.77	53.32	96.51	121.62
	R	33.08	50.77	48.24	98.58	124.21
	O	41.01	46.41	42.59	97.42	122.74
	P	47.22	43.05	37.74	98.40	123.98
Large	S	12.31	63.82	63.17	89.49	112.74
	E	17.87	56.95	58.26	91.79	115.66
	U	23.44	55.52	53.39	95.13	119.86
	R	29.39	52.61	48.36	98.32	123.88
	O	36.97	48.80	43.13	96.99	122.21
	P	43.78	45.07	33.35	95.58	120.47

FT – fat thickness, MT – muscle thickness, LMC – lean meat content, CW – carcass weight, LW – live weight.

in O class. This could be explained by the fact that higher live weight may be associated also with higher proportion of belly (Vališ *et al*. 2005), which was not manifested in the loin fat thickness measured during the classification.

Differences were also observed in the development of carcass traits over the studied period (Table 6). Since the studied period was short, the trends of carcass trait development should be interpreted with caution. Only small differences were observed in changes of backfat thickness. This is consequence of fluctuating value of this trait, as shown in Figures 1 and 2. Changes in muscle thickness were more linear but different in the two groups (Table 6). Also, the improvement of lean meat content was more visible in the carcasses supplied by large producers/suppliers. On the other hand, the weight of carcasses supplied by small producers/suppliers was increasing. Stabilised trend of carcass weight in the group of large producers can be explained by requirements of slaughterhouses, which prefer homogenous group of pigs and carcasses, or by the fact that in our economic conditions better profit is achieved by production of carcasses with weight of 80 – 100 kg (Vítek *et al*., 2012). However, carcasses from pigs with live weight of 100 – 105 kg are not enough suitable for the production of retail cuts and processing. Further investigation in the retail could reveal the reasons behind the different trends in the development of carcass traits in small and large suppliers. In some cases, processors do not apply the price masks, the

Table 6. Trends in the development of carcass traits

	Small			Large		
Trait	Reg. coeff	SD	R^2	Reg. coeff	SD	R^2
FT	0.05	0.09	0.08	-0.03	0.14	0.02
MT	-0.35	0.63	0.09	0.52*	0.14	0.83
LMC	-0.02	0.15	0.004	0.15	0.07	0.59
CW	1.17	0.46	0.68	0.17	0.10	0.52

*$P < 0.05$, R^2 – coefficient of determination, SD – standard deviation, FT – fat thickness, MT – muscle thickness, LMC – lean meat content, CW – carcass weight.

paying system is, therefore, less transparent and producers do not have motivation to continuously improve the carcass traits. Some authors showed that the paying system based only on the lean meat content (especially using the classes) may lead to stagnation of breeding (Pulkrábek *et al*., 2011) or even encourage producers to deliver carcasses, which do not meet the expectations of processors and consumers (Marcoux *et al*., 2007).

From this point of view, inclusion of carcass quality traits into paying scheme could motivate farmers to improve the quality of pig meat of delivered carcasses. One of the easiest ways in this regard may be consideration of capability of

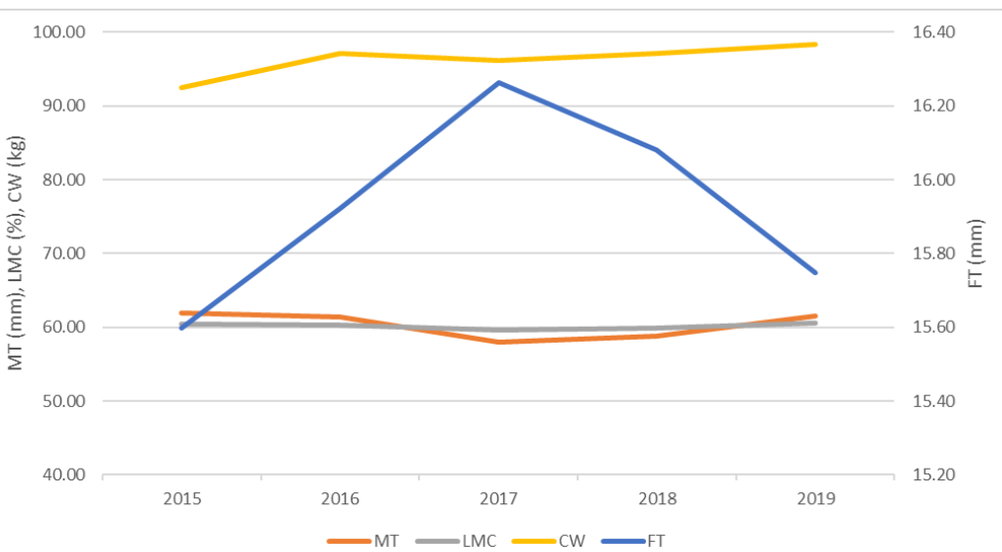

Figure 1. Development of traits in the studied period – small producers/suppliers

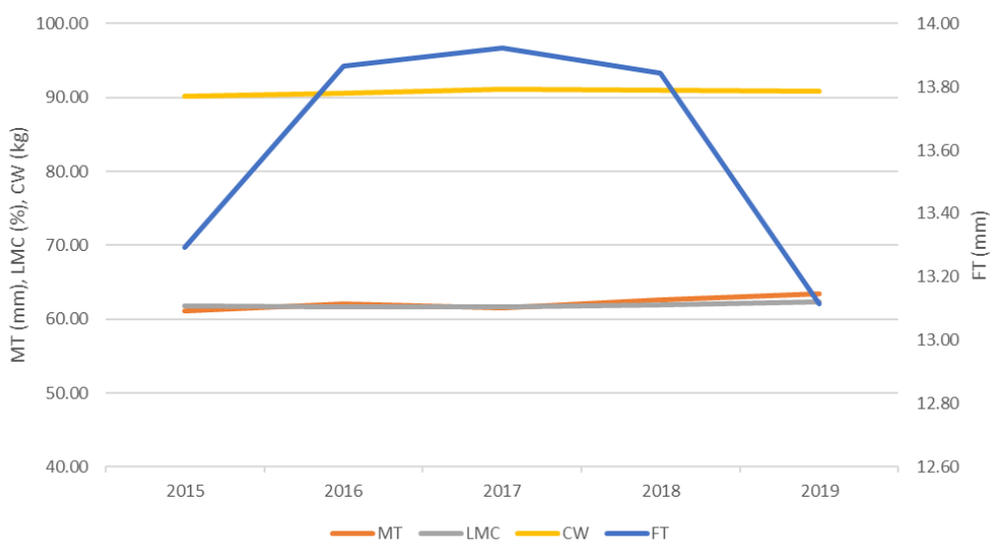

Figure 2. Development of traits in the studied period – large producers/suppliers

recently used apparatus Fat-O-Meater to measure the reflectance of meat and, thus, predict occurrence of PSE meat. Although, there is a more accurate method for determining the PSE meat (measurement of pH after 45 minutes), when this procedure could provide easier and faster (pre)sorting of pig carcasses. In fact, fatteners coming from crossings, where the terminal sires with high lean meat content (especially Pietrain) are used, are highly susceptible to stress conditions before and during the slaughter. This may lead to higher incidence of PSE (pale, soft, exudative) meat with lower consumer quality. Estimation of meat quality at the slaughterhouse, therefore, may improve the quality of retail cuts and final meat products.

CONCLUSION

Present study showed that there are not only differences in carcasses coming from small and large producers/suppliers but also in the trends of their changes. Actual differences were observed especially in backfat thickness and live weight of animals. When comparing the trends, differences were observed in muscle thickness and live weight. These differences may result from different management of breeding including the genotype of fatteners, but also may be the result of different requirements that producers/suppliers are trying to meet. Different distributions of carcasses according to the size of the producer/supplier may suggest that this fact should be considered in the preparing of the authorisation trial. However, small producers/suppliers do not deliver the animals regularly, therefore, selecting pigs on this basis would be limited and could complicate the trial.

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