Possibilities for development of methods for assessment of meat productivity in skinned pigs III. Possibilities to use the results of the full dissection in skinned pig carcasses for development of methods for evaluation of meat productivity

J. Nakev[1†], Maya Ignatova[2], Teodora Popova[2], Tania Nikolova[1], Penka Marinova[2]

[1]Agricultural Institute, 9700 Shumen, Bulgaria; [2]Institute of Animal Science, 2232 Kostinbrod, Bulgaria

SUMMARY

The aim of the study was to investigate the possibilities to use the results of the full dissection of skinned pig carcasses for development of methods for evaluation of meat productivity. The information about the composition of the left half carcasses of a total of 70 pigs (♀Youna x ♂Pietrain) was used in this study. The animals were reared in the experimental farm of the Institute of Animal Science-Kostinbrod, Bulgaria and slaughtered in a certified abattoir at average live weight of 105 kg /± 2.5%/. The carcasses were skinned and their heads and feet removed.

The coefficients of phenotypic correlation between the percentage of the muscles in the skinned carcasses, and the amount of the subcutaneous fat in the individual parts were significant and negative. The dependences between the studied trait and the subcutaneous fat in the shoulder, loin and leg had the highest values, respectively - R_p = -0.807, -0.775, -0.680 (P≤0.001). High and negative were the correlations between the muscle percentage and the total amount of subcutaneous fat (R_p = -0.851, P≤0.001) and intermuscular fat in the carcass (R_p = -0.779, P≤0.001).

The most accurate equation for determination of the meat productivity, developed on one part of the carcass is the equation using the percentage of muscle in the shoulder (R^2= 0.69; SE=2.14). The model for evaluation of the carcass quality using two parts – leg and shoulder is more accurate (R^2= 0.86; SE=1.75) when compared to the models using full dissection of the separate parts and the amount of the intermuscular fats, but its accuracy is lower in comparison to the model using the total amount of subcutaneous fat as a variable (R^2= 0.90; SE=1.48).

Keywords: pigs, dissection, models for prediction of meat quality

† Corresponding author: jivko_nakev@abv.bg

INTRODUCTION

The content of lean meat in the pig carcasses is a main criterion for determination of the prices in pigs in the European Union. The evaluation is done through approved methods for classification, developed using the statistical analysis of the results from the measurements of one or more anatomical parts of the carcass.

During the 1980s, methods for prediction of lean meat percentage have been developed based on the results of full or partial dissection (Desmoulin et al. 1980; Noveay and Pommeret 1980; Branscheid et al., 1987). Later this problem was investigated by other scientists (Engel and Walstra, 1991; Branscheid et al., 1990, Daumas et al., 1998, Métayer and Daumas, 1998). The results of the research of Čandek-Potokar and Kovač (2004) and Pulkrábek et al., (2006) proved the efficiency of the evaluation of the carcass based on lean meat percentage and reported that this might considerably contribute to the overall improvement of meat production. On the other hand, Marcoux et al., (2007) found low level of correlation between the market price of the carcass and the prediction value of the lean meat percentage measured by various devices. The authors concluded that the lean meat content cannot be used to determine the market price. According to Savescu and Laba (2016), the accuracy of the work of the system is fundamental for the fair system of payment to the pig breeders.

The efficacy of the models is based on dissection analyses of carcasses in a certain geographic area for a certain period of time. With improvement of the pig lines and the hybridization schemes, constant updating of the methods applied is necessary to ensure maximum accuracy.

The aim of the study was to investigate the possibilities to use the results of the full dissection of skinned pig carcasses for development of methods for evaluation of meat productivity.

MATERIAL AND METHODS

For determination of the slaughter characteristics and morphological components of the carcass and its individual parts in skinned pigs we used the information of the composition of the left half carcasses of 70 pigs (♀Youna x ♂Pietrain), reared in the experimental farm of the Institute of Animal – Kostinbrod, Bulgaria. The animals were slaughtered in a certified abattoir, at a distance of 5 km from the Institute on the day of the transportation. The average live weight at slaughter was 105 kg /± 2.5%/. The carcasses were skinned, without head and feet.

After 24 h of storage at + 4◦C, left carcass halves were divided into cuts according to the DLG method (Scheper and Scholze, 1985). After recording of the weight, each cut was subjected to further dissection and the weights of muscle, intermuscular fat, subcutaneous fat and bones were determined.

The prediction equations were developed according to the method of Causeur et al., (2003) using the MINITAB 17 software package.

RESULTS AND DISCUSSION

The coefficients of phenotypic correlation (Table 1) between the amount of lean meat and of subcutaneous fat in the separate parts were low and not significant. The dependences between the percentage of muscles and subcutaneous fat in the shoulder, loin and leg were respectively - R_p = -0.807, -0.775, -0.680 (P≤0.001). Negative, at high levels were the correlations between the muscle percentage and the total amount of subcutaneous (R_p = -0.851, P≤0.001) and intermuscular fat (R_p = -0.779, P≤0.001) in the carcass. Knecht and Duziński (2016) examined 140 pig carcasses of the most widely spread lines in Poland and found higher Pearson correlation between the muscle amount and subcutaneous fat (with skin) in the loin and leg.

Table 1. Phenotypic correlation coefficients between the muscle amount and percentage and the content of subcutaneous and intermuscular fat

Traits		Lean meat, kg		Muscle, %	
		R_p	Sr	R_p	Sr
Subcutaneous fat, kg,	Total	0.055	0.12	-0.851 ***	0.06
	Leg	0.231	0.11	-0.680 ***	0.08
	Loin	-0.097	0.12	-0.775 ***	0.07
	Shoulder	-0.074	0.12	-0.807 ***	0.07
	Belly	0.084	0.12	-0.649 ***	0.09
	Neck	-0.242	0.11	-0.313 **	0.11
	Ventral part of belly	0.010	0.12	-0.518 ***	0.10
	Front shank	0.082	0.12	-0.198	0.11
	Hind shank	0.299	0.11	-0.416 ***	0.11
Intermuscular fat, total, kg		-0,197	0.12	-0.779 ***	0.07

Significance: *- P≤0.05; **- P≤0.01; *** - P≤0.001

In view of the correlation value, the best accuracy was found in the model predicting the lean meat percentage in the carcass using the results of the dissection in the shoulder (R^2= 0.69; SE=2.14), presented in Table 2. We consider that this might be due to the participation of Pietrain as sire, as well as the way the carcass was presented. According to Desmoulin et al. (1980) the most accurate equation, developed on one part of the carcass in scalded pigs is the one using the muscle proportion in the loin parts. Higher precision was found when using the percentage of the muscle in two parts-loin and leg.

In Europe, pork is most often sold fresh or cooled, and the most popular cuts are leg and loin (Verbeke et al. 2010). According to Knech and

Duziński (2016) they form more than 35% of the total weight in scalded carcasses. The results in this study show that these two parts form 45.20 % of the weight of the carcass, as reported in the first part of this article, but included as individual prediction traits, they determine the lean meat percentage in the carcass respectively R^2= 0.69 (SE= 2.55) for the model using the lean meat in the leg and R^2= 0.65 (SE=2.71) for the one using the same trait in the loin.

Table 2. Models for prediction of quality in skinned pig carcasses

Prediction models	Mult, R	R^2	SE
1. LM = 79.305 – 1.1611 × subcutaneous fat, Total, %	0.95	0.90	1.48
2. LM = 77.83 – 2.003 × intermuscular fat, Total, %	0.70	0.49	3.27
3. LM =74.30 – 0.8529 × subcutaneous fat, Leg, %	0.83	0.69	2.55
4. LM = 73.14 – 0.6750 × subcutaneous fat, Loin, %	0.81	0.65	2.71
5. LM = 76.456 – 0.8945 × subcutaneous fat, Shoulder, %	0.88	0.78	2.14
6. LM =70.26 – 0.4961 × subcutaneous fat, Belly %	0.60	0.36	3.66
7. LM =69.01 – 0.856 × subcutaneous fat, Neck %	0.54	0.30	3.84
8. LM =77.705 – 0.4115 × subcutaneous fat, Leg, %- 0.6006 × subcutaneous fat, Shoulder, %	0.93	0.86	1.75

According to Duzinski et al. (2015) the quality of the belly part of the carcass is influenced by many factors. The results of our study showed that the lean meat proportion in this part determines R^2= 0.36 (SE=3.66).

The model for determination of the carcass quality using the leg and shoulder showed higher accuracy (R^2= 0.86; SE=1.75) when compared to the models using the full dissection in the individual parts and the amount of intermuscular fat. However, its accuracy is lower in comparison to the model using the total amount of the subcutaneous fat as variable. In a similar study, Lisiak, et al. (2015) found the regression coefficients for the main parts of the carcass as follows: - 0.92 for the leg, 0.87 for the loin, 0.87 for the shoulder, and 0.74 for the belly of the carcass.

Since the introduction of the SEUROP system, it has been constantly improving. Despite the numerous studies, Pulkrábek et al. (2012) carried out comparative analysis of the official methods for classification and found the following values for the lead meat percentage: full dissection (56.25%), partial dissection (56.46%) and reference method (59.02%). According to Lisiak et al. (2015), the technological value of the main carcass parts determines their further utilization, so that the search for new factors, measurements and parameters, concerning the carcass and meat processing has practical consequences and is necessary and important.

Conclusions

Significant negative phenotypic correlation coefficients were determined between the muscle percentage and the amount of the subcutaneous fat in the individual parts of the skinned pig carcasses, as the highest their values were for the shoulder, loin and leg. The correlations between the muscle percent and the total amount of the subcutaneous and intermuscular fat in the carcass were high and negative as well.

The most accurate equation for determination of the meat productivity in skinned pig carcasses, developed on one part of the carcass, was is the equation using the muscle percentage in the shoulder. On the other hand, the model using two carcass parts (leg and shoulder) appeared to be more accurate, compared to the models using the full dissection of the separate parts and the amount of the intermuscular fats, however its accuracy was lower in comparison to the model using the total amount of subcutaneous fat.

References

Branscheid W., Komender P., Oster A., Sack E., Fewson D., 1987. Utersuchungen über die Eignung einzelner Slachtkörpermesse und Messstellenkombinationen für die Klassifizierung von Schweinehälften nach dem Muskelfleischanteil. Züchtungskunde, 59, 258–267.

Čandek-Potokar, M., Kovač, Š., M., 2004. Slovenian experience in pig carcass classification according to SEUROP during the year 1996 to 2004. J. Central Eur. Agric. 5 (4), 323-330.

Causeur, D., Daumas, D., Dhorne, Th., Dobrowolski, A., Engel, B., Font-I-Furnols, M., Hojsgaard, S., 2003. Statistical handbook for assessing pig grading methods. Growth Project GRD 1-1999-10914 "EUPIGCLASS" WP 2 Task 3 report, draft 4.0, September 18.

Daumas, G., D. Causeur, T. Dhorne, E. Schollhamer, 1998. The new pig carcass grading methods in France. In: Proc. 44-th ICOMST-Barcelona (Spain) C-64.

Desmoulin, B., Chalier, R., Pommeret, P., 1980. La dissection compléte ou partielle des carcasses de porcs; signification des réferences CEE. In: 12 émes jounées de la recherche porcine en France, 1980. Paris, France Ministry of Agriculture, 1980, 117-125.

Duzinski, K., Knecht, D., Lisiak, D., and Janiszewski, P., 2015. Factors affecting tissues composition of pork belly. Animal, 9, 1897–1903.

Engel B., Walstra P., 1991. A simple method to increase precision or reduce expense in regression experiments to predict the proportion of lean meat of carcasses. Anim. Prod., 53, 353–359.

Knecht, D., Duziński, K. 2016. The effect of sex, carcass mass, back fat thickness and lean meat content on pork ham and loin characteristics. Arch. Anim. Breed., 59, 51-57.

Lisiak, D., Duzinski, K., Borzuta, K., Janiszewski, P., Knecht, D., 2015. A new simple method for estimating the pork carcass mass of primal cuts and lean meat content of the carcass, Anim. Prod. Sci., 55, 1044–1050.

Marcoux, M., Pomar, C., Faucitano, L., Brodeur, C., 2007. The relationship between different pork carcass lean yield definitions and the market carcass value. Meat Sci., 75, 94–102.

Métayer, A., Daumas, G., 1998. Estimation, par découpe, de la teneur en viande maigre des carcasses de porcs. Journées Rech. Porcine en France, 30, 7-11.

Noveay, J., Pommeret, P., 1980. Appréciation subjective du développement musculaire; interet pour l'estimation du pourcentage de muscle des carcasses de porcs. Techni - Porc, 3, 7-11.

Pulkrábek, J. Pavlík, J., Vališ, L., Vítek, M., 2006. Pig carcass quality in relation to carcass lean meat proportion Czech J. Anim. Sci., 51, (1), 18–23.

Pulkrábek J., David L., Vítek M., Vališ L., 2012. The comparison of EU reference methods for the prediction of lean meat contents in pig carcasses. Res. In Pig Breeding, 6, (1) 40-44.

Savescu, R., Laba, M., 2016. Multivariate regression analysis applied to the calibration of equipment used in pig meat classification in Romania. Meat Sci., 116, 16–25.

Verbeke, W., Pérez-Cueto, F. J., Barcellos, M. D. D., Krystallis, A., Grunert, K. G., 2010. European citizen and consumer attitudes and preferences regarding beef and pork. Meat Sci., 84, 284–292, 2010.