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COMPARISON OF THE CONTENT OF LEAN MEAT IN PIGS ON FARM AND SLAUGHTER LINE

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Abstract: Measurement of lean meat on slaughter line and formation of price on the basis significantly contribute to the overall improvement of the quality and profitability of production and distribution of pork. The content of lean meat on live pigs was measured on farm using ultrasound device PIGLOG 105. While in slaughterhouse, the content of lean meat measured using Fat-O-Meater (FOM), two-point method (TP) and partial dissection. 59.30% of lean meat in vivo was estimated by the apparatus PIGLOG-105 one day before slaughter. It is 0.91% more then partial dissection and when compared to FOM and TP it is more 4.86% and 4.02%. Great deviation between PIGLOG-105 on one side and FOM and TP on other side indicated some error, and then partial dissection solved this mystery. After this study, slaughterhouse constructed new formulas for FOM in pig carcass classification. Regarding that, slaughterhouses which used FOM or similar equipment for measuring percentage of lean meat, should control results of the equipment described in this study, minimum twice a year.

Keywords: pig carcass classification, meatiness, classification methods

Introduction

Determination of lean meat content on carcass is a procedure of crucial importance in modern production of pork around the world *(Petrović et al., 2009)*. Meatiness means the percentage of meat in pig carcasses *(Ukmar et al., 2008)*. On one side, the information of lean meat content is sent to further processing or sold as fresh meat, while on the other side, feedback sent to farmers regarding the meat quality shows results in breeding and selection of pigs *(Petrović et al., 2009; Vasilev et al., 2015)*. Measurement of lean meat on slaughter line and formation of

price on the basis significantly contribute to the overall improvement of the quality and profitability of production and distribution of pork *(Petrović et al., 2009; Jovanović et al., 2009)*.

Determination of lean meat content on carcass is measured by different electronic-optical devices, such as PIGLOG 105 (produced by SFK Technology, Denmark), Fat-O-Meater (FOM) (produced by Carometec, Denmark), and other methods like „two-points method" (TP), partial dissection, total dissection and others *(Krška et al., 2002; Bahelka et al., 2005; Pulkrabek et al., 2006).* Common characteristic of all electronic-optical devices are adapted to work in unfavorable microclimate conditions, such as on the farm and in the slaughterhouse, the devices are simple to use, and trained staff are using them easily *(Mörlein et al., 2005; Vitek et al., 2012).* The content of lean meat on carcass, regardless of device type s determined on the basis of thickness of the back fat tissue (measure on different places) and thickness of *M. longissimus dorsi (Dokmanović et al., 2013)*.

The aim of this study was to investigate the content of lean meat on carcass in slaughterhouse using three different methods (FOM, TP and partial dissection) and compare to results of content of lean meat on live farm pigs (PIGLOG 105).

Material and methods

The investigation was carried out between December 2015 and June 2016, and this experiment was performed on forty finishers. Pigs originated from a commercial farm which produced 40.000 finishers per year. In this study, pigs were chosen randomly, after that pigs were adequately tagged in order to follow traceability in the chain until the end of the measurement in the slaughterhouse. The Danish line genetics was presented on the farm (Landrace x Large White x Duroc), both sex (barrows, gilts), age 6 to 7 months, and weight 80 to 120 kg. The content of lean meat on live pigs was measured on the farm using ultrasound device PIGLOG 105, while in slaughterhouse, the content of lean meat was measured using FOM, TP and partial dissection.

Fat-O-Meater (FOM)

Optical device called Fat-O-Meter (FOM) was used for determining percentage of lean meat (%) and it is produced by Carometec, Denmark. The measurement of FOM was carried out on the slaughter line, 45 minutes from the moment of stunning and bleeding of animals at the latest. FOM operation was based on placing the probe on certain points of the carcass, between 12 and 13 ribs, 7 cm laterally from the dorsal line of cutting. Thus the penetration of the optical probe through subcutaneous fatty tissue and *M. longissimus dorsi* was performed. Results were shown on display: thickness of fatty tissue, thickness of muscle tissue,

the content of lean meat on carcass (% meatiness) and quality of carcass (S, E, U, R, O or P).

Ultrasound device PIGLOG 105

PIGLOG 105 is an ultrasound device, produced by SFK Technology, Denmark, which is used to measure content of lean meat on live animals. Measurement was performed on a farm 24 to 48 hours before sending animals to slaughter. This device works on the basis of input date of age and weight of animal, while probe is put on accurately determined places of animal body. Determining thickness of the bacon in the back part, measuring was performed between the 3rd and the 4th lumbar vertebrae from the last lumbar vertebrae, 7 cm of lateral from back line. While determining thickness of the bacon in back part and deep *M. longissimus dorsi*, measurement was performed between 3rd and 4th ribs from the back, the 7 cm of lateral from back line. On the basis of the measurement value, data about percentage of lean meat on farm were generated.

Partial dissection

According this method, carcass was cut up, by anatomically precisely defined scheme,on twelve parts, but only on four parts (ham, the shoulder, back-lumbars and abdominal-ribs part) further dissection was performed on muscle tissue, fat tissue and bones. On the basis of meat in these four areas, the most importnat part, with 75% of total meat of carcass and under the lumbar muscle of the carcass, calculated % of lean meat *(Walstra and Merkus, 1996).*

Two-point method (TP)

According to Rulebook *(„Sl. List SFRJ", br. 2/85, 12/85 i 24/86)*, fat tissue on back with skin was measured on the middle back, where bacon is the thinnest and lumbar part where *M. gluteus medius* is mostly grown in bacon. Thickness of *M. longissimus dorsi* was measured as the shortest connection of the cranial end of *M. gluteus medius* with the dorsal edge of the spinal canal. Measurement was performed by a ruler. On the basis of measured values and on the tables which are an integral part of this Rulebook, data about percentage of lean meat was provided.

Statistical analyses

The results were analyzed statistically, taking into consideration arithmetic means, standard deviations, coefficients of variation, and coefficients of simple correlation. Furthermore, the basic ANOVA model was performed using the LSD procedure. Also, results were analyzed by Pearson's correlation coefficient between methods used in the trial.

Results and Discussion

Forty years ago, some countries used the sonographic apparatus for carcass quality evaluation *(Miles and Fursey, 1974)*, while in Serbia there is still Rulebook on the Quality of Slaughtered Pigs and Pork Meat Categorization *(Sl. list SFRJ, 2/85)*. Even though in Serbia the grading of pig carcasses was not obligatorily performed based on the SEUROP system, slaughterhouses which measure the content of lean meat, use this classification. The carcasses are graded according to the content of lean meat and carcass weight. Farmers often did not believe the results of percentage of lean meat from slaughterhouse, especially when they received payments for live pigs, based on results from slaughter line. These results show how farmers can control percentage of lean meat on farms and compare with results from slaughterhouse. The content of lean meat is presented in Table 1, for each methods measure.

Table 1. Summary Statistics of lean meat content

	Count	*Average %*	*Standard deviation*	*Coeff. of variation %*	*Minimum %*	*Maximum %*	*Range*
PIGLOG-105	40	59.30	2.53205	4.26990	53.3	63.5	10.2
FOM	40	54.43	2.84827	5.23219	49.2	61.6	12.4
TP	40	55.28	4.48007	8.10469	42.1	60.8	18.7
Partial dissection	40	58.39	3.06825	5.25519	48.4	64.6	16.2
Total	160	56.85	3.87089	6.80895	42.1	64.6	22.5

By using the apparatus PIGLOG-105, 59.30% of lean meat in vivo was estimated one day before slaughter. It is 0.91% more then partial dissection and when compared to FOM and TP it is more 4.86% and 4.02%.

Table 2. The content of lean meat gained by various methods (Multiple Range Tests (95,0 percent LSD))

Contrast	*Sig.*	*Difference*	*+/- Limits*
PIGLOG-105% - FOM%	*	4.862	1.46507
PIGLOG-105% - TP %	*	4.022	1.46507
PIGLOG-105% - Partial dissection%		0.915	1.46507
FOM% - TP %		-0.840	1.46507
FOM% - Partial dissection%	*	-3.947	1.46507
TP% - Partial dissection%	*	-3.107	1.46507

Results of the content of lean meat that were measured using PIGLOG-105 were similar to results from partial dissection, and that shows the validity and reliability of this method *(Krška et al., 2002)*. Great deviation between PIGLOG-105 on one side and FOM and TP on other side indicated some error, and then partial dissection solved this mystery. In Table 2, there are results representing content of lean meat gained by various methods. Between PIGLOG-105 - partial dissection and FOM - TP were not significantly different, while between other methods there was a significant difference.

Table 3. The content of lean meat gained by various methods (Pearson's correlation coefficient)

	PIGLOG-105	FOM	Partial dissection	TP
PIGLOG-105	1			
FOM	0.618**	1		
Partial dissection	0.741**	0.562**	1	
TP	0.650**	0.623**	0.721**	1

** Correlation is significant at the level $p<0.01$ (2-tailed).

Differences in the content of lean meat gained by various methods is shown in Table 3. Among all methods treated by Pearson's correlation coefficient, PIGLOG-105, FOM, Partial dissection and TP, were significantly different.

Calibration of the fatometer was necessary and more reliability of staff who measure values for TP (*Bak et al., 2003*). Regardless of the method for measuring the content of lean meat before and after slaughter, results have to be the same, as it has already been described in previous research (*Borzuta, 1999; Ostrowski et al. 2000).*

Conclusion

After this study, slaughterhouse constructed new formulas for FOM in pig carcass classification. Regarding that, slaughterhouses, which used FOM or similar equipment for measuring percentage of lean meat, should control results of these equipment as described in this study, minimum twice a year. On the other hand, farmers should get feedback from slaughterhouse about the quality of their pigs, improve genetics, diet, conditions of keeping pigs, and check percentage of lean meat on farm, in order to avoid possible litigation and court case.

Poređenje mesnatosti svinja na farmi i liniji klanja

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Rezime

Merenje mesnatosti na liniji klanja i formiranje cene na osnovu mesnatosti doprinosi unapređenju kvaliteta i profitabilnosti proizvodnje i distribucije svinjskog mesa. Mesnatost kod živih svinja je merena na farmi korišćenjem ultrazvučnog aparata PIGLOG 105. U klanici, mesnatost je merena korišćenjem FOM, metode dve tačke i parcijalnom disekcijom. Kod živih svinja je izmerena mesnatost 59.30% jedan dan pre klanja. To je 0.91% veća vrednost nego što je dobijena parcijalnom disekcijom i 4.86% i 4.02% veća u poređenju sa FOM i metodom dve tačke. Velika razlika između vrednosti izmerenih PIGLOG-105 sa jedne strane i FOM i metodom dve tačke sa druge strane je ukazivala na neku grešku pri merenju i onda je parcijalna disekcija rešila ovu misteriju. Nakon ovog istraživanja, klanica je konstruisala novu formulu za FoM. Prema tome, klanice koje koriste FOM ili sličnu opremu za merenje mesnatosti treba da kontrolišu te uređaje kao što je opisano u ovom istraživanju, najmanje dva puta godišnje.

Ključne reči: klasifikacija polutki svinja, mesnatost, metode za klasifikaciju

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