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COMPARABLE PRESENTATION OF CARCASS AND MEAT QUALITY OF DIFFERENT PIG GENOTYPES USING MODERN EVALUATION METHODS**

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Abstract: In this paper quality of carcasses/carcass sides and meat from 5 different pig genotypes was comparably evaluated. Quality of carcass sides was evaluated prior to slaughtering *in vivo* (SONOMARK SM 100 M), early *post mortem* on slaughter line (FOM), by method of two points (ZP – ZWEI-PUNKT) as well as method of partial dissection on cold left carcass sides according to EU recommendations. By analysis of obtained results it can be concluded that fatteners of type E (LW x SL) x P had the highest meat yield in carcass sides (61,90; 62,40; 58,85 and 58,89%) by any other mentioned methods of evaluation compared to average meat yield in carcass sides of other investigated genotypes. Average yield of muscle tissue in carcasses of pigs of E genotype (LW x SL) x P (58,89%) established by method of partial dissection was statistically considerably higher (*p<0,05) than the average (56,06%) meat yield in carcasses of pigs of genotype D, very significantly higher (**p<0,01) than average (57,01%) meat yield in carcasses of pigs of genotype C and very highly significantly higher (***p<0,001) than average (51,30%) meat yield in carcasses of pigs of genotype A.

The quality of meat was also investigated comparably by determining its technological quality and chemical composition of MLD in investigated genotypes of pigs. Technological quality and chemical composition of MLD demonstrated significant (*p<0,05) differences in WBC and pigment content between genotypes B and C and B and E. Average values for content of ashes and share of pigment are in accordance with average values which characterize muscles of normal traits.

By analysis of obtained results we conclude that fatteners of genotype E (LW x SL) x P had the highest meat yield in carcass sides (61,90; 62,40;

58,85 and 58,89%), but quality was slightly decreased which indicates need for further improvement of meat quality.

Key words: pigs, quality of carcass/carcass sides and meat, evaluation methods.

Introduction

Quantity of produced meat is important element of production, although its precedence has for longer period been superseded. In developed countries there is agreement according to which quality of meat is of higher importance and represents competitive advantage, and quantity is one of the integral elements of the quality (Zekić *et al.* 2007).

Considering that the »quantity is one of the integral elements of quality«, in order to evaluate objectively the quality of pig carcasses, in EU countries as well as in Serbia many researches were undertaken relating to quality of carcass and meat of pigs (*Timanović* 2003*; Džinić et al.,* 2003*; Fisher et al.,* 2003*; Tomović et al.,* 2003; *Pulkråbek et al.,* 2003*; Džinić et al.,* 2004; *Bahelka et al.,* 2004; *Džinić* 2005*; Jukna and Jukna* 2005*; Zekić et al.,* 2007).

In order to increase the production volume and quality of meat, more attention is directed to determination of quality of pig carcass on live animals prior to slaughtering *in-vivo* (PIGLOG 105, SONOMARK SM 100 M), early *post mortem* on slaughter line (FOM), by method of two points (ZP – ZWEI-PUNKT) and method of partial dissection on cooled left carcass sides according to EU recommendations, and based on this method the carcasses are categorized according to standard (S E U R O P).

Considering above mentioned, objective of this paper was to present the carcass and meat quality of pigs of different genotypes by applying modern evaluation methods.

Material and methods

Evaluation of carcass quality was performed on 5 pig genotypes, one group was pure breed Swedish Landrace (SL, group A; n=20), two return mating combinations (Large White x Swedish Landrace) x Large White (F1 x LW, group B; n=19), (Large White x Swedish Landrace) x Swedish Landrace (F1 x SL, group C; n=30) and two combinations of three breed pig hybrids: (Large White x Swedish Landrace) x Duroc (LW x SL) x D, group

D; n=22 and (Large White x Swedish Landrace) x Pietrain (LW x SL) x P, group E; n=25.

On total of 116 carcasses the quality of carcass sides was determined, i.e. yield of meat in carcass sides and class (S E U R O P) on farm *in-vivo*, using SONOMARK SM 100 M (SM). Apparatus/device SM is used for determination of quality of carcasses/carcass sides, i.e. meat yield in carcasses/carcass sides on live animals on basis of so called A mode of ultrasound impulses which are presented on scale and this enables measuring *in vivo* of fat and muscle tissue thickness of pigs and directly is displayed in mm. Then, on warm right carcass sides, using FOM apparatus (*Petrović et al.,* 1996) and by method of two points (ZP-Zwei-Punkte), linear multiple regression model with two independent variables, and the defined model was verified in accordance with EU Regulations: *No 3127/94 (RMSE<2,5%)*. The model defined in Serbia by *Džinić et al.* (2004) was used. Dissection of cold (+4°C) right carcass sides was done according to method determined by *Walstra and Merkus* (1996) and classes according to S E U R O P.

Quality of cooled meat was investigated by determination of water and free fat content using reference method (1998). Content of total ashes was determined by method of stoking (1999). Water binding ability was determined according to method by *Grau and Hamm* (1953) and expressed in % of bound water, and colour of meat was determined based on absorption of water meat extract according to *Hart* (*Rede and Rahelić* 1969 a). Total pigments were determined according to method by *Horsney* (*Rede and Rahelić* 1969b). Statistical processing of data was done using computer programme *Stat. Soft. 7.1* (2007).

Results and Discussion

Average values of meat content in carcasses of investigated genotypes obtained by different methods are presented in table 1. It is obvious from results that carcass sides of pigs of genotype E are superior, regardless of the investigation method. Also it is obvious that fatteners of genotype E (LW x SL) x P had the highest meat yield in carcass sides also regardless of the method of investigation (61,90; 62,40; 58,85 and 58,89%) compared to fatteners of other investigated genotypes. Differences in average yield of meat determined by method of partial dissection between genotypes A and D were significant (*p<0,05), A and C (**p<0,01) and A and E (***p<0,001). Our data on yield of muscle tissue in carcass sides of investigated genotypes obtained by FOM and method of partial dissection are within the limits of

results obtained by *Fisher et al.* (2003), *Timanović* (2003), *Džinić et al.*(2003), *Tomović et al.*(2003), *Džinić (* 2005*)*.

Table 1. Average content of meat (%) in carcass sides determined using different methods

Genotype	Indicator	**Sono Mark**	Class	**FOM**	Class	**Dissection acc. to EU**	Class	**Two points**	Class
A	x Sd	$56,76^{AB,\ b}$ 3,53	E	$55,52^{ab,d}$ 3,00	E	$51,30^{yAB,D,b}$ 1,60	U	$55,36^{b}$ 2,02	E
B	x Sd	$58,18^{AB,ab}$ 0,67	E	$55,60^{b,cd}$ 2,73	E	$53,45^{xyB,CD,ab}$ 3,87	U	$56,38^{ab}$ 1,18	E
C	x Sd	$59,13^{AB,ab}$ 4,01	E	$60,37^{ab,cd}$ 4,58	S	$57,01^{xyAB,C,ab}$ 2,68	E	$57,95^{ab}$ 2,16	E
D	x Sd	$56,22^{B,ab}$ 3,32	E	$57,76^{ab,cd}$ 4,64	E	$56,06^{xyAB,CD,a}$ 1,73	E	$56,59^{ab}$ 1,96	E
E	x Sd	$61,90^{A,a}$ 1,22	S	$62,40^{a,c}$ 3,47	S	$58,85^{xA,CD,ab}$ 2,94	E	$58,89^{a}$ 2,11	E

a,b,c,d- significance at the level 0,05 (*p<0,05)
A,B,C,D- significance at the level 0,01 (**p<0,01)
x,y- significance at the level 0,001 (***p<0,001)

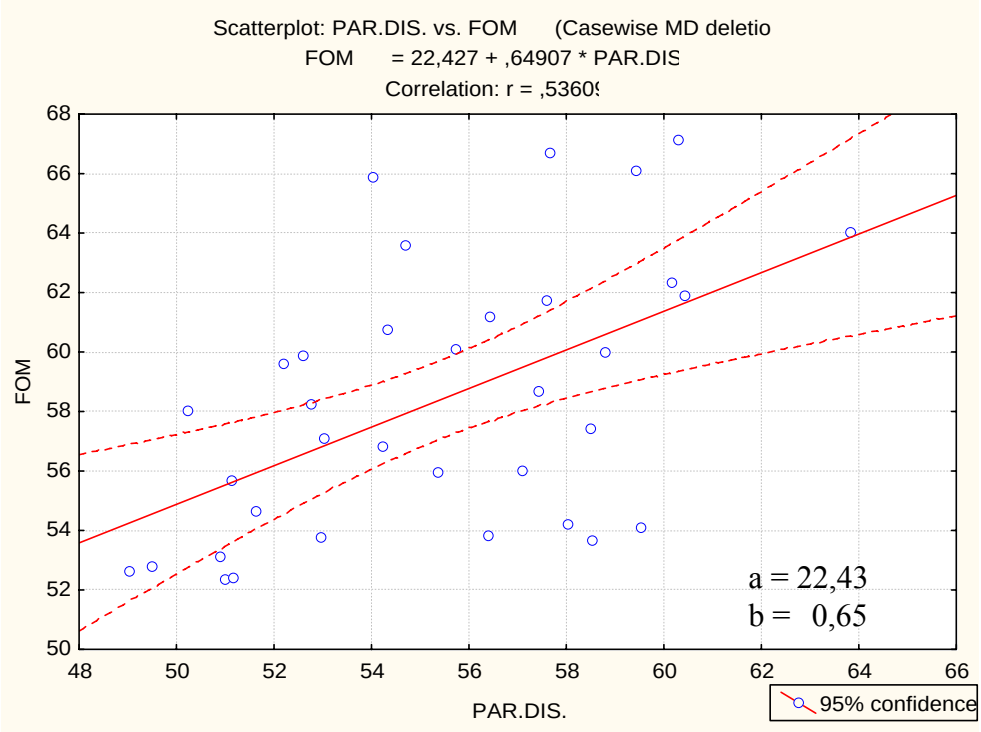
Percentage of meat in carcass sides determined using Two Point System varied from 55,36% (genotype A) to 58,89% (genotype E). Three breed hybrids with Pietrain (genotype E) had considerably higher (*p<0,05) meat yield in carcass sides compared to pure breed pigs of Swedish Landrace (genotype A).

Table 2. Correlation coefficients between relative meat yield in carcass sides, determined by method of partial dissection and other investigated methods n=116

PARTIAL DISSECTION		
SONOMARK	**FOM**	**TWO POINTS**
0,23	0,54	0,43

Our results are in accordance with results obtained by *Zekić et al.* (2007) who established in their investigative evaluation of the carcass side quality using Two Point method average percentage of meat in carcass sides of 56,20 %, and it varied from 48,09 % (R class) to 62,61 % (S class), and according to *Pulkråbek et al.* (2003) value of average meat content was 54,36%.

Correlations between % of meat determined by partial dissection and using SM, FOM and method of Two Points are presented in table 2, and are mainly low and within limits of0,23 do 0,54.



Graph 1. Graphical presentation of regression of share of meat in carcass determined by mathematical model FOM and method of partial dissection

Y= 22,43+0,65x

Bahelka et al. (2005) established that correlations between content of meat determined by dissection and evaluated by two point method were statistically significant and negative (r=-0,84 to –0,97) which was confirmed by research of *Pulkrábek et al.* (2003). In our research, slightly higher correlation coefficient between % of meat determined by partial dissection and FOM was established - 0,54 (graph 1). Stated investigation results are not in accordance with results stated by *Timanović* (2003)**,** *Džinić et al.* (2004), *Džinić* (2005), *Brkić et al.* (2001) who obtained results justifying the

use of ultrasound apparatus PIGLOG 105, and that the most optimal measuring should be performed at the body mass of 100-120 kg. However, in our investigations, obtained correlations between meat content determined by dissection and using SM apparatus were low - 0,23.

In table 3 results relating to technological quality and chemical composition of MLD are presented. Although in absolute values difference in values obtained by study of the water content, as well as values determined for colour, these differences weren't statistically significant (P>0,05).

Table 3. Mean values of results of investigation of certain indicators of technological quality and chemical composition of MLD in investigated pig genotypes

Genotype	No.	Indicator	Chemical composition %			WBA %	Colour	Total pigments µg/100g
			Water	Fat	Ashes			
A	20	x	73,60	$1,64^{ab,cd}$	1,15	$48,27^{ab,cd}$	0,68	$28,80^{ab}$
		Sd	0,50	0,57	1,25	4,13	1,09	4,78
B	19	x	73,68	$1,65^{ab,cd}$	1,11	$53,55^{a,c}$	0,43	$29,30^{a}$
		Sd	0,88	0,74	0,02	5,38	0,07	6,28
C	30	x	73,98	$2,17^{ab,d}$	1,11	$46,68^{ab,d}$	0,28	$21,90^{b}$
		Sd	1,63	0,60	0,04	2,78	0,08	4,32
D	22	x	73,63	$2,19^{b,cd}$	1,14	$51,04^{ab,cd}$	0,33	$27,36^{ab}$
		Sd	1,26	0,63	0,05	5,95	0,11	5,00
E	25	x	74,01	$1,22^{a,c}$	1,17	$46,50^{b,cd}$	0,27	$23,66^{ab}$
		Sd	0,88	0,46	0,05	0,99	0,02	3,76

a,b,c,d – significance at the level 0,05 (*p<0,05)

Meat of pigs of three breed combination with Pietrain (LW x SL) x P (genotype E) had the lowest share of free fats, the least expressed colour and the lowest WBA, and higher share of ashes compared to results of other investigated genotypes (1,22; 0,27; 46,50 and 1,17).

In research by *Timanović* (2003)**,** *Džinić et al.* (2003), *Džinić et al.* (2004)*, Tomović et al* .(2003) and *Jukna and Jukna* (2005) obtained results for most of the traits of technological quality and chemical composition were similar to results obtained in our research.

Correlation coefficients between % of meat determined by method of partial dissection and some indicators of technological quality and chemical composition of meat of investigated genotypes are presented in table 4 and are mainly low. Only the correlation coefficient determined between

percentage of meat and content of colour in meat from pigs of genotype E was established to be higher - 0,78.

Table 4. Correlation coefficients (r) between % of meat in carcass sides (dissection) and some indicators of technological quality and chemical composition of MLD in investigated pig genotypes

Genotype	Water	Fat	Ashes	WBA	Colour	Total pigments
A	-0,12	-0,24	-0,47	-0,50	-0,55	0,47
B	0,51	0,08	-0,28	0,21	-0,44	-0,27
C	0,37	-0,29	0,17	0,08	-0,20	-0,40
D	-0,20	0,64	0,37	-0,19	0,26	0,37
E	-0,24	0,17	0,03	-0,46	0,78	-0,65

Conclusion

Based on results of comparative study of the quality of carcass sides and meat of 5 pig genotypes, *in vivo* (SM), on slaughter line (FOM), by method of two points (ZP), on cold carcass sides (partial dissection), as well as comparative investigation of the technological quality and chemical composition of MLD of investigated genotypes, the following can be concluded:

Fatteners of genotype E (LW x SL) x P had the highest yield of meat in carcasses/carcass sides (61,90; 62,40; 58,85 and 58,89%) regardless of the evaluation method used compared to average yield of meat in carcass sides of other investigated genotypes.

Average meat yield in carcass sides of pigs of genotype E (LW x SL) x P (58,89%) established by use of method of partial dissection was statistically considerably higher (*$p<0,05$) than average (56,06%) meat yield in carcass sides of pigs of genotype D, very significantly higher (**$p<0,01$) than average (57,01%) meat yield in carcass sides of pigs of genotype C and very highly significantly higher (* **$p<0,001$) than average (51,30%) meat yield in carcass sides of pigs of genotype A.

Established regression equation resulted in better evaluations for pigs with meat content of 55,52 % and more, with correlation coefficient (0,78) between relative meat yield in carcass sides determined by method of partial dissection and FOM. Therefore, this method is suitable for evaluation of

carcass side quality on slaughter line, and for future progress in pig production it will be necessary to introduce the evaluation of carcass side quality on slaughter line and in this way satisfy criteria set by EU.
Technological quality and chemical composition of MLD exhibited significant (*p<0,05) differences in regard to WBA and pigment content between genotypes B and C and B and E.

UPOREDNI PRIKAZ KVALITETA SVINJSKIH TRUPOVA PRIMENOM NEKIH SAVREMENIH METODA OCENE

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Rezime

U radu je izvršeno komparativno ocenjivanje kvaliteta trupova/polutki i mesa 5 različitih genotipova svinja.

Kvalitet polutki ocenjen je na živim životinjama pre klanja in-vivo SONOMARK SM 100 M), rano post mortem na liniji klanja (FOM), metodom dve tačke (ZP – ZWEI-PUNKT) kao i metodom parcijalne disekcije na ohladjenim levim polutkama po preporuci EU. Analizom dobijenih rezultata može se zaključiti da su tovljenici genotipa E (VJ x ŠL) x P imali najveći prinos mesa u polutkama (61,90; 62,40; 58,85 i 58,89%) pri korišćenju bilo koje od navedenih metoda ocene u poredjenju sa prosečnim prinosom mesa u polutkama svinja ostalih ispitivanih genotipova. Prosečan prinos mišićnog tkiva u trupovima svinja genotipa E (VJ x ŠL) x P (58,89%) ustanovljen primenom metode parcijalne disekcije statistički značajno veći (*p<0,05) od prosečnog (56,06%) prinosa mesa u trupovima svinja genotipa D, vrlo značajno veći (**p<0,01) od prosečnog (57,01%) prinosa mesa u trupovima svinja genotipa C i vrlo visoko značajno veći (* **p<0,001) od prosečnog (51,30%) prinosa mesa u trupovima svinja genotipa A.

Ispitan je komparativno i kvalitet mesa odredjivanjem tehnološkog kvaliteta i hemijskog sastava MLD-a ispitivanih genotipova svinja Tehnološki kvalitet i hemijski sastav mesa MLD-a ispolio je značajne (*p<0,05) razlike u SVV i sadržaju pigmenata izmedju genotipova B i C i B i E. Prosečne vrednosti za sadržaj pepela i udeo pigmenata odgovara

prosečnim vrednostima koje karakteriše mišiće normalnih svojstava.

Analizom dobijenih rezultata zaključujemo da su tovljenici genotipa E (VJ x ŠL) x P imali najveći prinos mesa u polutkama (61,90; 62,40; 58,85 i58,89%), no nešto umanjenog kvaliteta, što iziskuje dalji rad na poboljšanju kvaliteta mesa.

Ključne reči: svinje, kvalitet trupa/polutki i mesa, metode ocene

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