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# MEATINESS AND MEAT QUALITY IN PIGS CROSSED WITH PIETRAIN

**Đ. Senčić, Z. Antunović, Marcela Šperanda**

**Abstract**

High meatiness of carcasses of modern genotypes is closely related to the quality of meat. The Pietrain is well-known to be of extreme lean, but also to have a poorer meat quality. Piatrain boars (P) are used in terminal crossing in order to raise the level of meatiness in pig fattening. This can, unfortunately, result in the decrease of meat quality. The investigation was carried out on crossbreeds of the Large White (LW), the Swedish Landrace (SL) and the German Landrace (GL) according to the following crossing sheme: (LW x SL) x GL, (LW x SL) x P and [(LW x SL) x P] x P. Swines were fattened to about 100 kg body weight. Cross breeds with Pietrain were characterized by higher halves meatiness (55.64 and 56.50%) as a terminal breed (LW x SL) x P and [(LW x SL) x P] x P compared to cross breeds with German Landrace (LW x SL) x GL as a terminal breed (53.40%). Cross breeds with Pietrain were characterized by deterioration of meat quality with Pietrain blood share increase relative to $pH_2$ value (5.86; 5.50; 5.50), water binding capacity (8.50; 9.70; 9.80) and colour (65.50; 58.00; 55.50) in spite of being on the average within normal boundaries compared to cross breeds with German Landrace. Meat of cross breeds with Pietrain had higher protein content and lower fat content. The Pietrain crossing had favourable effect on pig halves conformation.

Key words: pig, Pietrain, meatiness, meat quality, crossbreed

*Introduction*

Aiming at improving pig carcasses meatiness and conformation boars of extreme meaty breeds and pietrans are used in final crossing. According to literature Pietrain occurs in very different crossing combinations. Thus,

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Bidanel et al. (1993) reported on Pietrain boar crossing with 12 genetic sow types having various share of Large White and Meischan gene, Ehrhardtziambor et al. (1993) on pig slaughtering properties from rotation crossing between German Landrace and Pietrain, Demo et al. (1994) on Pietrain use for terminal three breed hybrids production. Higher level of pig halves may be related to unfavourable meat quality. It is known that crossing Pietrain may bring about poorer meat quality (Pellois and Runavot 1991; Wassmuth and Glodek 1992; Živković et al. 1992; Senčić et al. 2000a and Senčić et al. 2000b). That is why this investigation aims at determining how Pietrain blood share affects pig halves meatiness level and its relation to meat quality in cross breeds.

*Material and methods*

The investigation was carried out on pig halves derived from crossbreeds between Large White (LW), Swedish Landrace (SL), German Landrace (GL) and Pietrain (P). The crossing was accomplished by the scheme: (LW x SL) x GL, (LWx SL) x P and [(LW x SL) x P] x P. Pietrain boars were stress-resistant. Fifteen pigs of each genotype were fattened until weighing 100 kg. Sex ratio was equal. The pigs were kept in the same conditions at optimal air temperature and moisture. They were fed on forage mixture containing 17% of raw proteins and 14.2 MJ ME in the first fattening period (30 –60 kg of body weight) whereas in the second period (60-100 kg of body weight) they were fed on a forage mixture with 14% of raw proteins and 12.3 MJ ME.

The pig halves were cooled at +4 °C for 24 hours followed by determination of ham circumference and MLD- area (musculus longissiumus dorsi) at $13^{th}$ and $14^{th}$ rib height.

The halves meatiness was determined directly by Weniger et al. modified method (1963). Muscle tissue of head, together with tail and legs constituted less valuable parts, was not calculated in the total muscle tissue amount.

Value of $pH_1$ in muscle tissue was determined 45 minutes post mortem and $pH_2$ 24 hours post mortem at the MLD cross section. Water fixation was determined according to Grau-Hamm (1952) and meat colour by a Gőfo device. Meat raw proteins were determined by Kjeldahl method and raw fats by Soxhlet method.

Arithmetic means ($\bar{x}$) and variability measures (s and v) of the investigated pig meatiness indicators as well as analyses variance were computed by using statistical program Stat Soft, Inc. (2001).

*Results and discussion*

Some of the pig halves basic traits of the investigated crossbreeds can be seen in Table 1.

Table 1. - BASIC INDICATORS OF MEATINESS OF PIGS CROSSBREDS
Tablica 1. - TEMELJNE ZNAČAJKE MESNATOSTI SVINJA KRIŽANACA

| Indicators – Pokazatelji | Crossbreeds – Križanci | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (LW x SL) x GL – a<br>(VJ x ŠL) x NJL - a | | | (LW x SL) x P – b<br>(VJ x ŠL) x P - b | | | [(LW x SL) x P] x P – c<br>[(VJ x ŠL) x P] x P – c | | |
| | $\bar{x}$ | s | v | $\bar{x}$ | s | v | $\bar{x}$ | s | v |
| Mass of cooled sides (kg)<br>Masa hladnih polovica (kg) | 39.10 | 2.67 | 6.83 | 39.67 | 2.85 | 7.18 | 39.50 | 2.50 | 6.33 |
| MLD surface ($cm^2$)<br>Površina MLD-a ($cm^2$) | 41.50 | 5.30 | 12.77 | 40.48 | 8.92 | 22.04 | 42.00 | 5.53 | 13.17 |
| Ham diameter (cm)<br>Opseg buta (cm) | 70.30*c | 2.55 | 3.63 | 71.20 | 2.39 | 3.36 | 72.20*i | 2.07 | 2.87 |
| Carcass meatiness(%)<br>Mesnatost polovica (%) | 53.40*c | 3.00 | 5.62 | 55.64 | 3.22 | 5.81 | 56.50*i | 3.69 | 6.53 |

LW –Large White; SL- Swedish Landrace; P- Pietrain; GL- German Landrace
*P<0.05 **P<0.01
VJ- veliki jorkšir; ŠL-švedski landras; P- pietren; NJL- njemački landras

Uniformity of pig halves weight per genotypes enabled regular comparison of their traits. Statistically significant differences relative to cross section area of a long back muscle were not determined between genotypes. Crossbreeds with Pietrain had higher ham circumference and halves meatiness compared to cross breeds with German Landrace. However, the differences were statistically significant only compared to back- cross breeds with Pietrain. Cross breeds with Pietrain had higher share of hams, shoulders and belly-rib part and lower of chin with fat and less valuable parts compared to cross breeds with German Landrace (Tab. 2). This indicates favourable Pietrain boar effect on pig halves conformation in crossings. Živković et al. (1992) also determined Pietrain boar favourable effect on meatiness and pig halves conformation. Three breed crosses between Large White, Swedish Landrace and Pietrain had the highest ham share in halves, the largest section area of a long back muscle, most favourite meat/bones ratio in the ham meat and most muscle tissue in thighs compared to three-breed crosses with German Landrace and Swedish Landrace.

Table 2. - CONFORMATION OF PORK SIDES
Tablica 2. - KONFORMACIJA SVINJSKIH POLOVICA

| Part of pork sides<br>Dio polovice | Crossbreeds – Križanci | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (LW x SL) x GL – a<br>(VJ x ŠL) x NJL - a | | | (LW x SL) x P – b<br>(VJ x ŠL) x P – b | | | [(LW x SL) x P] x P – c<br>[(VJ x ŠL) x P] x P – c | | |
| | $\bar{x}$ | s | v | $\bar{x}$ | s | v | $\bar{x}$ | s | v |
| Ham (%)<br>But (%) | 28.54$^{*c}$ | 1.04 | 3.64 | 29.24 | 0.98 | 3.06 | 29.60$^{*a}$ | 1.05 | 3.55 |
| Back part (%)<br>Leđni dio (%) | 17.41$^{**b,c}$ | 1.25 | 7.18 | 16.25$^{**a}$ | 0.86 | 5.29 | 16.00$^{**a}$ | 0.70 | 4.37 |
| Shoulder (%)<br>Plećka (%) | 14.58$^{**c}$ | 0.50 | 3.43 | 14.25$^{**c}$ | 0.50 | 3.51 | 15.60$^{**a,b}$ | 0.60 | 3.85 |
| Neck (%)<br>Vrat (%) | 7.69 | 0.80 | 10.54 | 8.05 | 0.47 | 5.84 | 8.20 | 0.70 | 8.54 |
| Abdominal-rib part (%)<br>Trbušno-rebarni dio (%) | 17.33$^{**b,c}$ | 0.87 | 5.02 | 19.15$^{**a,*c}$ | 1.13 | 5.83 | 18.20$^{**a,*b}$ | 0.90 | 4.94 |
| Yawl and fat (%)<br>Podbradak i salo (%) | 6.06$^{**c}$ | 0.85 | 14.03 | 5.62$^{**c}$ | 0.50 | 8.90 | 5.00$^{**a,b}$ | 0.60 | 12.00 |
| Less valuable parts (%)<br>Manje vrijedni dijelovi (%) | 8.39$^{**b,c}$ | 0.68 | 8.01 | 7.44$^{**a}$ | 0.67 | 9.00 | 7.40$^{**a}$ | 0.70 | 9.46 |

LW –Large White; SL- Swedish Landrace; P- Pietrain; GL- German Landrace
*P<0.05 **P<0.01
VJ- veliki jorkišir; ŠL-švedski landras; P- pietren; NJL- njemački landras

Muscle tissue quality indicators were poorer in cross breeds with Pietrain compared to cross breeds with German Landrace (Tab. 3). The above mentioned was reflected in lower $pH_2$ value, weaker water fixation ability and less colour intensity. It indicates that Pietrain boars may deteriorate meat quality in offsprings although it can still be within normal boundiers. Pellois and Runavot (1991) revealed that muscle tissue pH values were decreasing (i.e. its quality was getting worse) along with blood share increase in Pietrain with four pig genotypes. Živković et al. (1992) reported that meat in three-breed crosses with Pietrain together with low pH was characterized by lighter colour, weaker water fixation ability as well as consistency compared to three crossbreed with German Landrace as a terminal breed and Swedish Landrace breed.

Pietrain crossbreeds had higher raw protein content and lower meat raw fat content compared to crossbreeds with German Landrace. Meat fat content was within optimal value limits regarding meat taste.

Table 3. - QUALITY OF MUSCLE TISSUE
Tablica 3. - KVALITETA MIŠIĆNOG TKIVA

| Indicators - Pokazatelji | Crossbreeds – Križanci | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (LW x SL) x GL – a<br>(VJ x ŠL) x NJL - a | | | (LW x SL) x P – b<br>(VJ x ŠL) x P – b | | | [(LW x SL) x P] x P – c<br>[(VJ x ŠL) x P] x P - c | | |
| | $\bar{x}$ | s | v | $\bar{x}$ | s | v | $\bar{x}$ | s | v |
| $pH_1$ | 6,20 | 0.28 | 4.52 | 6.30 | 0.15 | 2.38 | 6,25 | 0.20 | 3.20 |
| $pH_2$ | $5.86^{**b,c}$ | 0.30 | 5.20 | $5.50^{**a}$ | 0.10 | 1.82 | $5.50^{**a}$ | 0.15 | 2.73 |
| Water binding capacitiy ($cm^2$)<br>Sposobnost vezanja vode ($cm^2$) | $8.50^{*b,c}$ | 1.50 | 12.50 | $9.70^{*a}$ | 1.20 | 12.37 | $9.80^{*a}$ | 1.30 | 13.26 |
| Colour (Göfo)<br>Boja (Göfo) | $65.50^{**b,c}$ | 3.50 | 5.34 | $58.00^{**a,*c}$ | 2.40 | 4.13 | $55.50^{**a,*b}$ | 3.20 | 5.76 |
| Raw protein (%)<br>Sirovi protein (%) | $21.30^{*b**c}$ | 0.90 | 4.22 | $22.00^{*a}$ | 0.92 | 4.18 | $22.50^{*a}$ | 0.96 | 4.27 |
| Raw fat (%)<br>Sirova mast (%) | $3.15^{*b**c}$ | 0.40 | 12.70 | $2.80^{*a}$ | 0.45 | 16.07 | $2.50^{*a}$ | 0.45 | 18.00 |

LW –Large White; SL- Swedish Landrace; P- Pietrain; GL- German Landrace
*P<0.05 **P<0.01
VJ- veliki jorkišir; ŠL-švedski landras; P- pietren; NJL- njemački landras

## *Conclusion*

Cross breeds with Pietrain were characterized by higher halves meatiness (55.64 and 56.50% ) as a terminal breed (LW x SL) x P and [(LW x SL) x P] x P compared to crossbreeds with German Landrace (LW x SL) x GL as a terminal breed (53.40%). Crossbreeds with Pietrain were characterized by deterioration of meat quality with Pietrain blood share increase relative to $pH_2$ value (5.86; 5.50; 5.50), water fixation ability (8.50; 9.70; 9.80) and colour (65.50; 58.00; 55.50) in spite of being on the average within normal boundaries compared to cross breeds with German Landrace. Crossbreeds with Pietrain meat had higher protein content and lower fat content. The Pietrain cross-breeds had favourable effect on pig halves conformation.

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## MESNATOST I KVALITETA MESA U SVINJA KRIŽANACA S PIETRENOM

### Sažetak

Visoka mesnatost polovica svinja suvremenih genotipova povezana je sa slabijom kvalitetom mesa. Svinje pietren pasmine poznate su po ekstremno visokoj mesnatosti, ali i po slabijoj kvaliteti mesa. Nerastovi pietren pasmine koriste se u završnom (terminalnom) križanju za podizanje razine mesnatosti svinja namijenjenih tovu. Problem pri tome može biti slabljenje kvalitete mesa. Istraživanje je provedeno na svinjama križancima velikog jorkšira, švedskog landrasa i njemačkog landrasa (VJ x Š) x NJL, na križancima između velikog jorkšira, švedskog landrasa i pietrena (VJ x ŠL) x P i na povratnim križancima s pietrenom and [(VJ x ŠL) x P] x P. Tov svinja trajao je do 100 kg tjelesne mase. Križanci s pietrenom kao terminalnom pasminom (VJ x SL) x P i [(VJ x SL) x P] x P imali su veću mesnatost polovica (55,64 i 56,50%) u odnosu na križance s njemačkim landrasom (VJ x SL) x NJL kao terminalnom pasminom (53,40%). U odnosu na križance s njemačkim landrasom u križanaca s pietrenom slabila je kvaliteta mesa s porastom udjela krvi pietrena s obzirom na $pH_2$ vrijednost (5,86; 5,50; 5,50), sposobnost vezanja vode (8,50; 9,70; 9,80) i boju (65,50; 58,00; 55,50) iako je ona u prosjeku bila u granicama normalnog. Križanje s pietrenom povoljno je djelovalo na konformaciju svinjskih polovica.

Ključne riječi: svinja, pietren, mesnatost, kvaliteta mesa, križanci

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